

AUDIO

THE EQUIPMENT AUTHORITY

JULY 1996

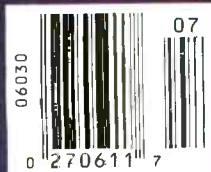
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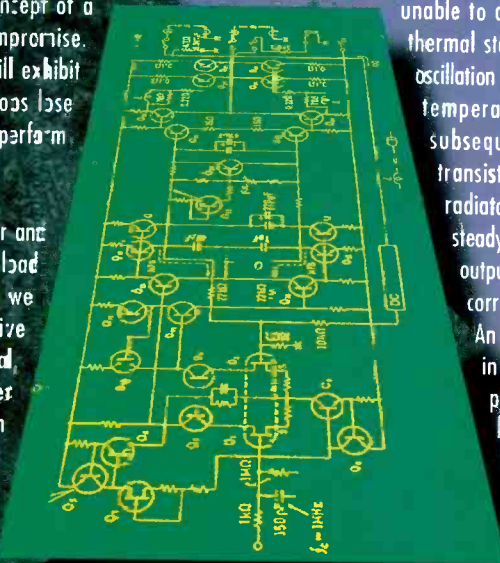


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Practically all amplifiers, regardless of price, employ a design technique called Negative Feedback (NFB) to ensure wide bandwidth, stable operation and generally low distortion. NFE amplifiers handle back-EMF reactance from the load by introducing a canceling signal at the input. Great stuff. Downside, however, is that the benefits of NFB are at the expense of lower open-loop gain. In other words, if an amplifier is based on the concept of NFB, it is based on the concept of a correcting mechanism that introduces compromise. The result? For starters, a NFB amplifier will exhibit higher IM distortion. In addition, NFE amps lose control at maximum power conditions, and perform particularly poorly near clipping. Bad deal.

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way, we can add two levels of current boosters to the emitter followers. Quite revolutionary. Thus we achieve lower output Z, and since an inverted configuration is used, we entirely avoid the collector current nonlinearities of regular Darlington's. That was the easy part.

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The **Realities** of Audio Transformer & Capacitor Design


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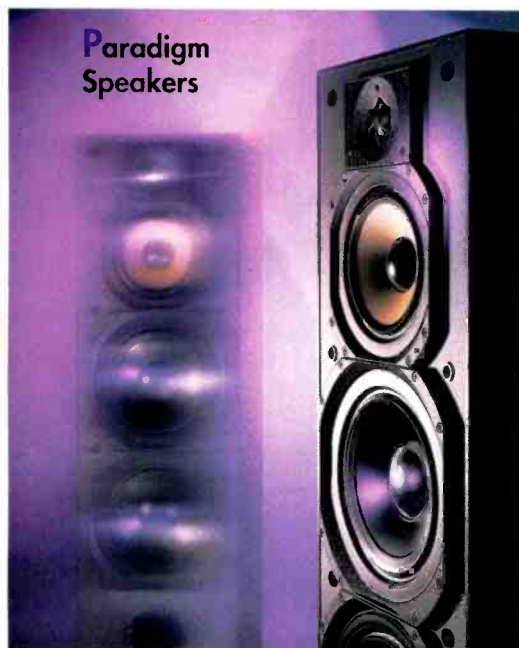
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THE EQUIPMENT AUTHORITY



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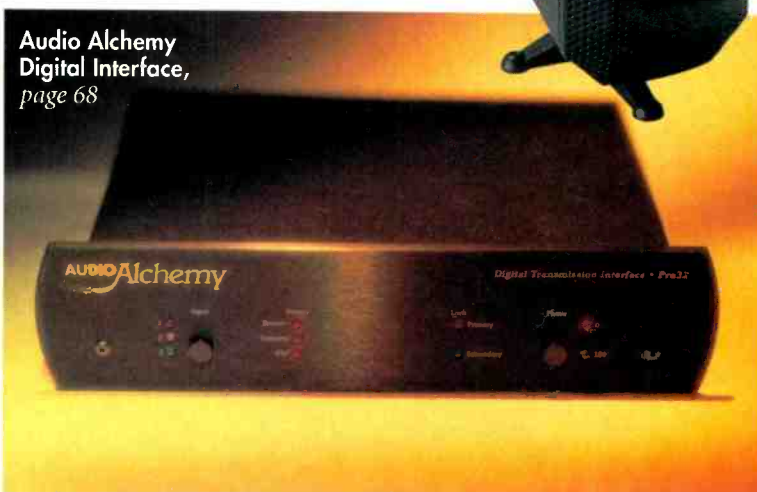
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We couldn't have said it better ourselves.

— excerpts from *Audio Magazine*, by Anthony H. Cordesman

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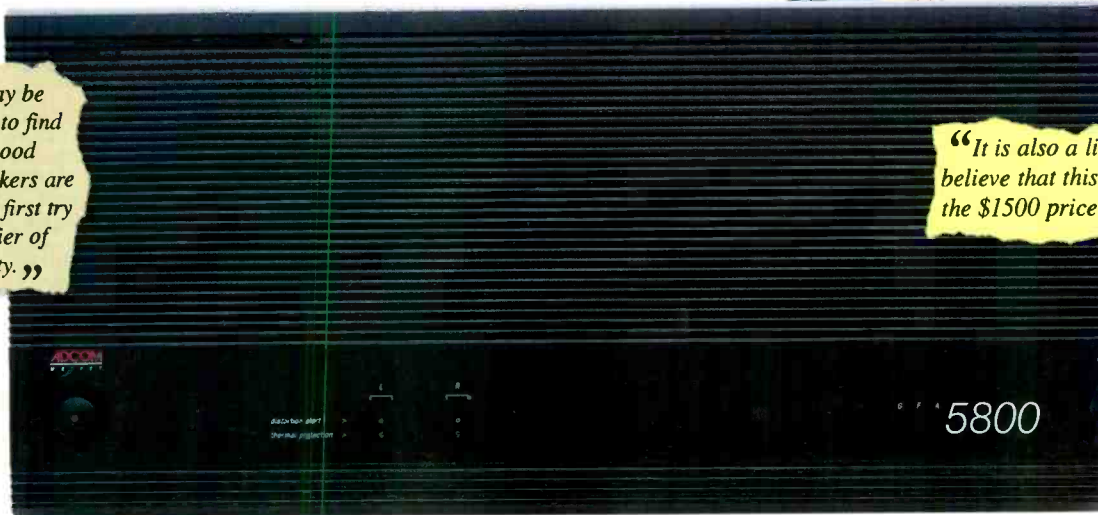
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A few weeks ago, when it was still rather damp and chilly here in New York, I had the pleasure of visiting sunny Gainesville, Florida, home of the University of Florida, the Gators, and Virtual Listening Systems. VLS is a division of Tucker-Davis Technologies—named for its founders, Tim Tucker and Damian Davis, who met in the engineering program at the university. Chances are you've never heard of either of these companies. Although VLS is in the consumer audio business, its first product will not hit the market until around the time you receive this issue, and TDT specializes in providing high-performance instrumentation for hearing researchers.

It's the research connection that led to the founding of Virtual Listening Systems. I often hear it said (or see it written) that the human hearing process is poorly understood, but that's too strong; it's more accurate to say that there's still a lot to learn. The fact is, however, that auditory research has been an active discipline for many years, and though there's plenty of distance left to go, a great deal is known about how we hear. VLS's first product, called Auri, applies some of that knowledge to reproduce Dolby Pro Logic surround over headphones.

As with some other products in the growing field of "3D" audio, the Auri technology, which VLS calls Toltec processing, is based partly on application of head-related transfer functions, or HRTFs. This is the way the head and outer ears (pinnae) alter the frequency responses of sounds arriving from different directions. In other words, if a sound source is moved around your head, the response of the sound reaching your eardrums will change accordingly, even though the response of the source itself hasn't. Everyone is intimately, if unconsciously, familiar with his own HRTFs and uses that information, together with timing and intensity differences between the ears, to localize sounds. HRTFs are particularly important in establishing the elevation of a sound source and whether it is in front or in back of us. So if you can use HRTFs to generate directionally appropriate response changes, you can significantly enhance the spatial realism of reproduced sound.

The main problem (apart from the complexity of the necessary processing) has been that HRTFs are a very personal thing. Change the size or shape of the ear, and the HRTFs will change as well. So what works for me can easily be completely wrong, and thus quite confusing, for you. In the past, that's meant that the processing had to be watered down and based on some sort of "average" model, which significantly dilutes the effect, or customized to the individual. As I learned, customized processing can be incredibly convincing. But I also learned that it involves sitting rigidly for a long time in an anechoic chamber, with microphones stuffed in your ears, while a small speaker, spitting noise, is moved from point to point around your head. Obviously, that's not practical for a consumer audio product.

VLS's solution has been to develop a database of HRTFs for a large number of people and isolate the most significant characteristics. Tucker and Davis say that an Auri user will be able to take a short listening test, built into the processor, that will select an HRTF set that is a close approximation to his own. We won't know how well that actually works until we've had a chance to review a production unit (soon, I expect), but I had a lot of fun down in Gainesville hearing things processed according to my own HRTFs.

Apart from the effect itself, possibly the most amazing thing about the Auri is its price, which is supposed to come in at less than \$400. That buys you a Motorola DSP chip for Pro Logic and Toltec processing, two channels of A/D and D/A conversion, a headphone amplifier, a remote control, and a digital wireless transmission system for getting the audio from your preamp, receiver, or whatever to the handset that contains almost everything else. The wireless technology all by itself is quite impressive and could spawn a line of products. Yet it was developed just to make the Auri more convenient to use! This could turn out to be a very interesting company.



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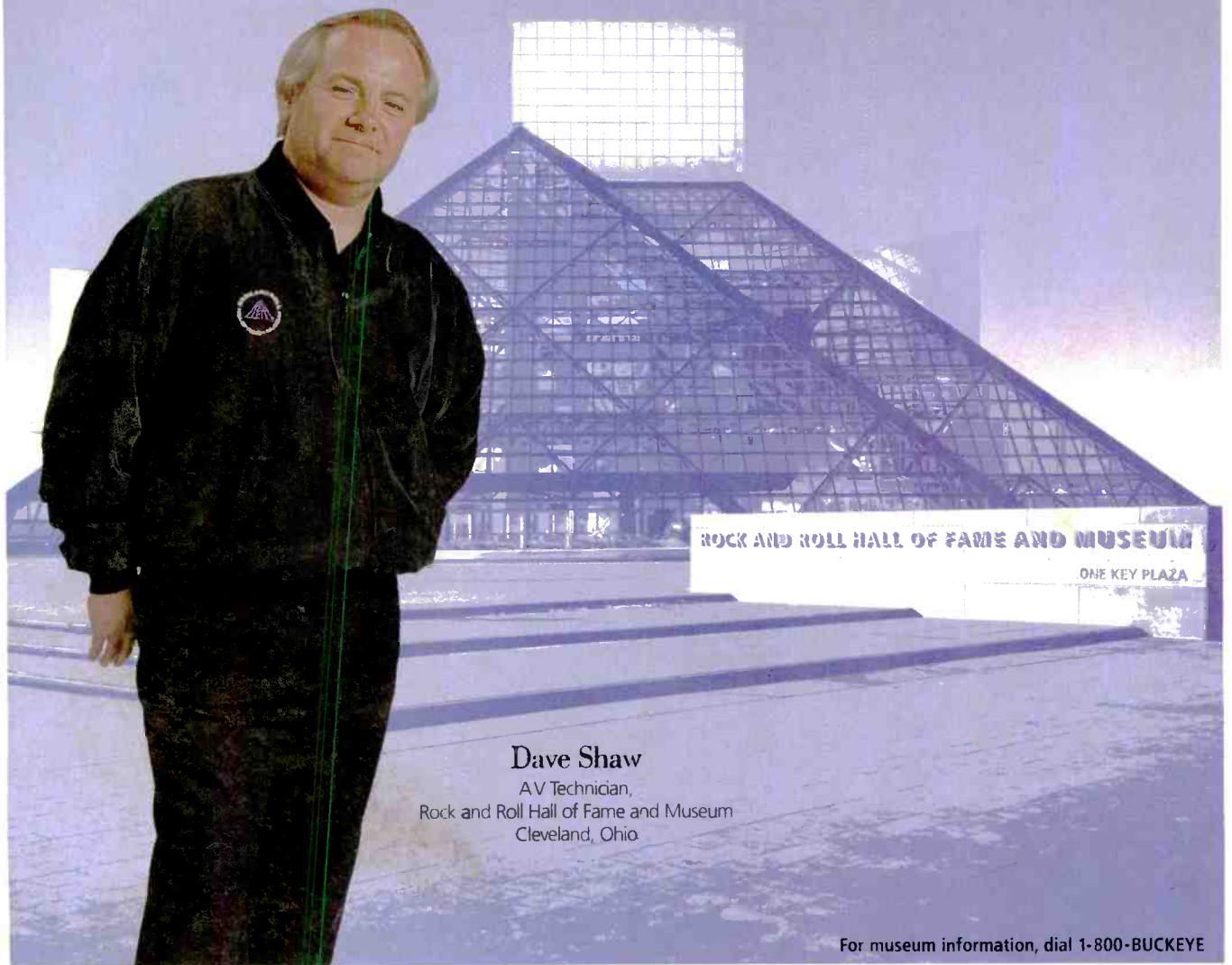
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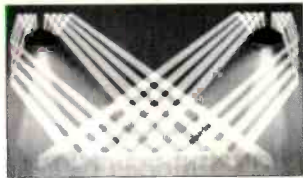
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Fostle Fuels Fire

Dear Editor:

A fundamental flaw underlies both Michael Riggs's comments in "Fast Fore-Word" and D. W. Fostle's analysis in "Digital Deliverance" in the April issue. That flaw is a total lack of any kind of direct A/B/C comparison of the audible accuracy of HDCD A/D and D/A conversion versus that of any other process of A/D and D/A conversion—using a high-quality analog input source, such as a mike feed or first-generation analog master tape, as a reference. Unless the analog input source is available as a reference, declaring that one digital recording sounds better than another is pointless, as it may simply have colorations preferred by the listener.

The science and art of audio engineering deal with sound, and the only way sound can ultimately be judged (or heard!) is by listening. This is not to say subjectivism is the sole means to advance the state of audio technology; an enormous amount of technical effort must be spent in identifying and quantifying mechanisms of distortion before they can be corrected. That type of effort was a constant during the almost 10 years it took to develop the HDCD process. However, even if a device or system measures extremely well, it can still audibly alter the input source because of distortion mechanisms not quantified by the tests employed. Thus, the final criterion of quality in an audio reproduction system must be how much it alters, by subtraction or addition, the signal fed into it, as determined by controlled listening comparisons.

Some of the greatest appreciation of the accuracy of the HDCD process has come from such top professional recording engineers as Bob Ludwig of Gateway Mastering and Denny Purcell of Georgetown Masters. These engineers have built careers on the acuity of their hearing. Unlike almost all reviewers and writers in the audio press, they make direct A/B comparisons—analogue source versus digital output—on a daily basis. They know the limitations of today's digital audio technology because they are intimately familiar with the analog source.

Purcell has said that "HDCD sounds closer to the analog source even when played back undecoded, period." Ludwig has stated that HDCD conversion is the most accurate he has heard and that it has "greater harmonic integrity than any other digital recording system."

It is important to note that measurements, while seeming to be completely "objective," are sometimes nothing of the sort. Of equal importance to what is measured is what is not measured. It is also essential that measured results be correctly understood within a proper context. In evaluating the HDCD process, Fostle unfortunately reaches many erroneous conclusions, resulting from inadequate measurements and errors in analysis and interpretation.

One of the confused conclusions Fostle draws about the HDCD process is that when HDCD recordings are played back undecoded, they sound "wetter," with longer reverberation tails than standard 16-bit digital recordings, and therefore less accurate. The unstated and incorrect assumption underlying this conclusion is that standard 16-bit digital playback is accurate in its portrayal of low-level information and thus can serve as a reference. Recording industry professionals know from long experience that 16-bit digital recordings lose low-level timbral and ambient information compared to the analog source. If, at the option of the recording engineer, an HDCD recording is made using low-level range extension, then that recording played back undecoded will have more low-level information than a standard 16-bit recording. However, when an HDCD recording is played on the 95% of today's CD players that lose low-level resolution, its additional low-level information will yield sound closer to that of the analog source. Decoded HDCD playback, which uses D/A converters whose resolution is greater than 16 bits, is even more accurate and, with the best HDCD playback equipment, is nearly indistinguishable from the analog source.

Many of Fostle's other observations regarding the HDCD process are extremely misleading because of his lack of scientific

method. Without any kind of analog source as a reference, he concludes that HDCD D/A converters have "an inclination toward the mellow." His stated reference is an Apogee DA-1000 D/A converter that can be demonstrated by A/B comparison to have a "glisten" or "edge" not present in the analog source, even if an HDCD processor is used for A/D conversion.

Fostle further states that HDCD has a "signature" sound that is not accurate, implying that it has been tailored to sound rich and distant, in supposed imitation of an "analog" sound. As evidence for this conclusion, he mentions a comparison of standard Sony 1630 versus HDCD transfers of the same analog recording of "Moon-glow," claiming that the HDCD version violates convention by presenting the trumpet far to the rear of the other horns while the standard version does not. When Keith Johnson, the recording engineer for the "Moonglow" session, was shown this comment, he was flabbergasted. "Convention" or no, the trumpet was recorded fully 15 feet from the microphones and well to the rear of the other horns. The HDCD recording simply preserves that spatial information; the standard recording does not.

Fostle also chose to present the spectrum of the noise floor at the beginning of an HDCD track (decoding not specified) on a Reference Recordings sampler versus that of a dithered 20-bit A/D converter with no input signal. What is the point? As Fostle well knows, the graph of the HDCD noise floor only shows the noise contribution of multiple microphones in a live acoustic space; it tells nothing about the noise level of the HDCD A/D converter. Despite Fostle's later disclaimers, the inclusion of this graph is misleading at best.

Another disturbing aspect of Fostle's analysis is his seeming confusion of analog noise level, which he expresses in equivalent numbers of bits, with resolution. It is well known that an analog signal can contain audible information many decibels below its noise floor. If that signal undergoes A/D conversion through a system that has sufficient resolution, then the information in the sub-noise floor will be preserved and can be reproduced.

Although a complete discussion of Fostle's conclusions isn't possible here, one further observation needs to be made. To

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The Sensible Sound

Issue Number 54

SPRING 1995

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adequately measure the performance of a Model One HDCD processor, Pacific Microsonics uses over \$100,000 worth of test equipment, including the best available 24-bit digital generator/FFTs, digital storage oscilloscopes, and spectrum analyzers. Custom-built signal-interface devices are used, and elaborate test procedures resulting from years of research are precisely followed. Unless a similar level of sophistication and thoroughness is applied to measuring the performance of a digital audio system, little-known but audibly critical distortions, such as complex signal intermodulation products, will be overlooked. This could result in mistaken conclusions that do not correlate with listening tests.

Pacific Microsonics has submitted the précis of a paper on the HDCD process to the Audio Engineering Society in time to be presented at its November 1996 convention. That paper should effectively answer any remaining technical questions concerning the HDCD process.

In the meantime, both Riggs and Fostle are cordially invited to attend controlled, blind, A/B/C listening tests of the Model One HDCD processor compared to any other A/D converters, D/A converters, or processors, with all digital outputs compared to the analog input source. This will demonstrate the unprecedented sonic accuracy of the HDCD process.

Michael D. Ritter
President, Pacific Microsonics
Berkeley, Cal.

Author's Reply: Mr. Ritter and I talked after my article in the April issue was published. One salient topic was the measured treble rolloff on an HDCD demonstration disc (Reference Recordings RR-905CD). As reported in the article, the two HDCD cuts showed treble deficits of as much as 3 dB at 9 kHz relative to the non-HDCD versions. He did not contest that fact. Months earlier, at the October 1995 Audio Engineering Society Convention, Ritter, with Keith Johnson present, played for me those same two HDCD cuts and asked if I heard any differences in comparison to the conventional masters. I said I did. These differences, he assured me, were the result of the HDCD process. But after the article was published, Ritter told me he didn't know about the rolloffs, nor did he know how they oc-

curred. This would seem to imply either that he doesn't hear the loss in treble energy or, alternatively, that it is an intended effect of the HDCD process. Now Ritter writes that the HDCD version of "Moonglow" is superior in its presentation, to the point that Keith Johnson was "flabbergasted" by my comments. Yet it's one of the cuts that exhibits the high-frequency rolloff. Treble energy is a key determinant of sonic perspective and spatiality. Go figure.

Ritter also claims that HDCD reduces distortion. But when asked what kind of distortion and by how much, he refused to answer. When I first spoke to him in July 1993, he was promising a technical paper on HDCD. He is still promising, three years later. While claiming extensive measurement capabilities, Pacific Microsonics releases no meaningful technical data about HDCD. And in criticizing my technical analysis of the process, Ritter misconstrues one of the graphs. Figure 5, on page 30 of the April issue, shows noise spectra of an HDCD cut on the Reference Recordings sampler and of the output of a Meridian 618 processor in its "flat dither" mode, fed by a Lexicon 20/20 A/D converter with no input. Thus, the lower curve in the graph represents the noise spectrum of the output of a good 20-bit A/D converter dithered down to 16 bits in conventional fashion, which raises it a few dB above the theoretical minimum noise for 16-bit PCM. The noise in the HDCD recording is a *minimum* of 15 dB higher across the entire audio band and thus sets the fundamental resolution limit. (As pointed out in both the April article and, more extensively, my article on noise-shaping in the March issue, such discrepancy is very much the rule in commercial recordings of all kinds, not an exception.) No claim is made that this represents the noise floor of the HDCD converter, however, and I think that's quite clear in the article. The noise performance of the process itself is addressed more directly by Figs. 14 and 15 on page 34 of the April issue.

As before, I encourage readers to order the *TestMasters* CD produced in cooperation with *Audio* (call 800/505-6140). For less than 10 bucks, you can compare HDCD to other processes and make up your own mind about them. What you'll hear is what was there. No celebrity endorsements, though.—D. W. Fostle

Is Fostle a Bit Off?

Dear Editor:

D. W. Fostle's two-part series ("19 Bits in a 16-Bit Sack," March; "Digital Deliverance," April) was informative and presented some important points of view. Permit me to present the other side of one coin that Mr. Fostle chose not to flip.

Regarding HDCD, I agree with Fostle that its developers have been less than forthcoming about how the system works, and I also agree that HDCD's improvements generally have been exaggerated by the high-end press. Reportedly, Pacific Microsonics will be delivering a much-needed white paper to clear up the confusion at an upcoming AES convention.

However, I feel that Fostle's comments on the "warm" sound of the HDCD decoder chip reveal some of his own listening biases and that he did not look deep enough into the issue. He said, "Whereas the NPC filter had a certain 'glisten' or 'edge' when presenting choral voices and strings, this effect was absent when the Pacific Microsonics chip was installed." The jury is definitely out on which of these two chips presents an accurate tonal balance, but I tend to side with the PM chip at this time: Its internal DSP design implements a superior oversampling filter, and its warmer sonic character cannot be attributed to frequency response errors or lack of monotonicity when reproducing standard (non-HDCD) material. The chip measures very well when tested with the industry-standard CBS CD-1 disc. The PM chip uses far more coefficients and longer internal word length in its calculations than the NPC, and it has lower clock jitter (which also contributes to a warmer sound). Additionally, the NPC uses a deleterious type of noise-shaping (without dither) in an attempt to reduce its long internal word length before feeding the D/A converter.

My listening tests have revealed time and again that, all other things being equal, digital recordings using longer word lengths sound warmer (as well as more spacious, dynamic, ambient, and natural) than those using shorter words. This is why we engineers universally prefer the sound of our 20- and 24-bit masters to their 16-bit derivatives. This, despite Fostle's assertion that very few venues have low enough noise level to "warrant" 20-bit recording. What he

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neglected to take into account was the well-known principle of noise masking (and unmasking). Even an analog tape sounds better when converted through a 20-bit system; you can still hear ambience and decay 10 dB, to perhaps 30 dB, below the noise level of a good analog tape!

Digital-audio mastering engineers have the opportunity to perform some unusual experiments and demonstrate sonic differences that Fostle may not have had the opportunity to experience. I can hear the superiority of calculating to 24-bit word length versus 20-bit word length every day that I master. Everyone "knows" that since the least significant bit of a 20-bit word is 120 dB down (relative to 0 dBFS), 20 bits should be enough for us. And since the least significant bit of a 24-bit word is 144 dB down, it must be far below the threshold of importance. But you can prove the importance of those four bits by the following simple test, which can be performed in a high-quality digital audio workstation: Take a 20-bit (or 16-bit) digital audio signal (music), and turn it into a 24-bit signal by dropping or raising the gain an insignificant amount, perhaps 0.1 dB. (This calculation generates infinite word length, but round the result to 24 bits.) Next, redither the 24-bit result with two different processes. First, use a good 24-to-16-bit dithering process on the music (e.g., UV-22 or Meridian). Then try redithering while ignoring the lower four bits—i.e., perform a 20-to-16 process.

The redithering process that accounts for all 24 bits always sounds warmer than a 20-to-16 process. In other words, truncating the lower four bits of a 24-bit word creates subtle audible granulation and loss of ambience; there is meaningful information in those lower four bits. When you remove that information, you hear a kind of additional bite, "glisten," or "edge" to the sound, very similar to the differences Fostle heard between the two filters. Therefore, based on my knowledge of how they handle word lengths in their internal calculations, I have to conclude that the more accurate digital filter is probably the one that sounds warmer.

It would not be difficult to create an experiment that conclusively proves which filter is the more musically accurate. (I would be happy to participate in this experiment

and provide any necessary digital audio equipment.) I suggest taking a 24-bit digital audio signal, attenuating it 40 dB or so in the digital domain, and feeding it to a Mark Levinson D/A converter (which can be fitted with either chip). By amplifying the result (in the analog domain), you'll be able to tell which chip reveals more ambience and decay and has less quantization noise (distortion).

The winner of this listening test should be quite clear. If the winner is the Pacific Microsonics chip, then I suggest Fostle preferred the sound of the NPC chip because it has an artificial "bite" rather than the demonstrably more "natural" sound (improved ambience, space, and so on) of the PM chip.

Bob Katz
Recording and Mastering Engineer
Digital Domain
New York, N.Y.

Author's Reply: My comments about the sound of the Pacific Microsonics PMD-100 filter were not, as Mr. Katz seems to think, judgmental. I described what was heard, while twice suggesting that readers audition the devices for themselves. On the other hand, he seems to assume that the "glisten" was not part of the recording and thus that the PMD-100 presentation was correct, even though he wasn't there.

He also seems to misunderstand what I've said about 20-bit recording. I never wrote that wide-word recordings do not sound better than 16-bit recordings. I did point out that processes for converting 20-bit masters to the 16-bit CD medium are severely limited by the noise of real-world systems and that nothing approaching 20-bit noise performance is delivered into our homes.

Through most of his letter, Katz bases his points on his own extrapolations. It's important to note, however, that I can find no study affirming his statement that listeners can hear "10 dB, to perhaps 30 dB" into the noise. In fact, standard work on masking suggests this is false, as does Demonstration 2 on the Acoustical Society of America's *Auditory Demonstrations* CD (Philips 1126-061). Even if it were true, practical use of any ability to hear 30 dB into the noise would require listening with peak levels above the threshold of pain. And that's not

even accounting for real-world hearing thresholds. One large study found a threshold rise of 19.2 dB SPL at 4 kHz between the ages of 20 and 40 for American men. By age 50, the mean threshold had climbed another 9 dB, to an absolute level of 33.3 dB SPL. If you are an average 50-year-old man, and assuming Katz is correct, hearing 30 dB into the noise requires listening with the noise at 63 dB SPL or so. Put a 15-bit (90-dB) S/N on top of that, and the peak level turns out to be 153 dB SPL. A 40-year-old needs only 144 dB SPL. Hmmmm.—*D.W.F.*

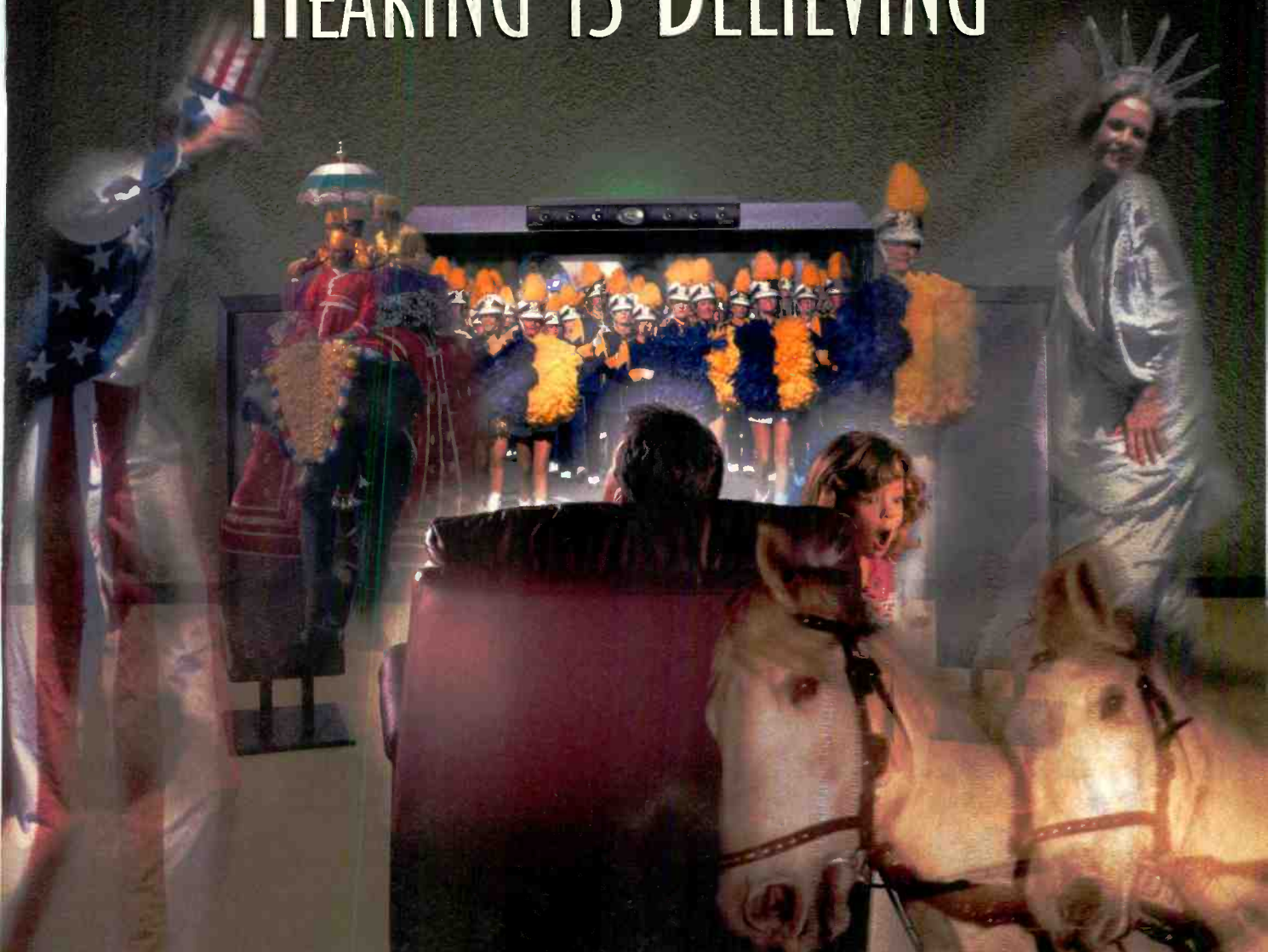
Editor's Note: The concept of "listening into the noise" is a little bit tricky and, I think, often misunderstood. Essentially, it refers to our ability to hear tones or other narrow-band sounds at levels below the aggregate level of a wideband noise source. To take a simplified example, if you were to play white noise with a total level of 50 dB SPL over the audio band, you might be able to hear, say, a 500-Hz tone at 40 dB SPL, which is 10 dB below the level of the noise. The reason, however, is that the level of the noise energy near 500 Hz would not only be lower than that of the *total* noise energy but also lower than the level of the tone, so the noise wouldn't completely mask the tone. Masking is a narrow-band phenomenon.

Let's translate that more specifically into the realm of digital audio. The aggregate noise of conventional 16-bit PCM is at about -96 dB relative to full scale (0 dBFS). Performing a spectral analysis of that noise with a high-resolution FFT will yield an essentially flat spectrum across the audio band at about -130 dB. Nothing has changed; it's the sum of the noise across all those frequencies that comes to the routinely cited -96 dB. Could you hear a tone at -100 dB? Possibly, if you have good hearing, and very likely if you were to amplify both the noise and the tone substantially to get them well above the basic threshold of hearing. Could you hear a tone at -131 dB? No, because that would be below the spectral noise floor.

This fact bears on the significance of the elevated noise spectra shown for many recordings in "19 Bits in a 16-Bit Sack" (March) and "Digital Deliverance" (April). No signal that falls below the recording's spectral noise floor will be audible. Consequently, the noise floor of the recording

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medium itself will become a factor in signal masking only if it is above the noise floor of the input or approaches it closely enough to raise the combined noise floor by a perceptible amount.

Also, I notice that people sometimes refer to "hearing into the noise" in ways that suggest the phenomenon is peculiar to analog signals. The same thing happens with properly dithered digital signals.—M.R.

Covering Vinyl

Dear Editor:

The April issue's "Jazz & Blues" section included a review of Terry Evans's CD, *Puttin' It Down*, released by AudioQuest. Why wasn't there any mention that an LP version is also available?

Today's tenuous vinyl "renaissance" includes state-of-the-art reissues of classical recordings and rock music as well as new rock/pop releases (from Bruce Springsteen, Green Day, et al.). These LPs are as much an improvement in quality and sound reproduction from previous LPs as present CDs are compared to the early atrocious-sounding ones. Mass-readership audio magazines, such as *Stereo Review* and *Audio*, typically have not reviewed new vinyl albums.

Vinyl album sales were prematurely killed off in the United States, starting in the mid-'80s, as part of the marketing strategy for CD—something that did not happen in Europe. Is the recent vinyl renaissance likewise to be killed off, this time by mainstream audio magazines deliberately ignoring an alternative format?

Already, Reference Recordings and AudioQuest have stopped general release of their recordings on vinyl, the former citing a total absence of reviews of its classical and jazz vinyl releases by audio magazines. *Audio* is doing readers a disservice—those readers, that is, who have not been duped into believing that CDs provide the only legitimate listening experience.

Michael T. Klewin
Lawrenceville, N.J.

Editor's Reply: In the case of *Puttin' It Down*, we didn't know an LP version was available. And most labels send us only the CD version of a release for review, even if a vinyl edition is also available. Reviews should be relevant to any release format with respect to musical content, and

though CD and vinyl releases would tend to sound somewhat different, they should be close enough in most cases for many of the comments on sonic character to apply substantially to the LP as well as the CD.

I don't think the theory that the LP was purposely killed off holds much water, by the way. Sales of LPs had already started to decline before the Compact Disc was introduced. Nonetheless, record labels didn't show much enthusiasm for CD in the beginning, and it was some time before the new discs stopped being a curiosity in record shops. Stocking policies of record stores pretty much followed the demand curves, which meant that eventually most didn't want to bother with LPs anymore. They may have overshot the market a bit when they dumped vinyl altogether, but I see no reason to think any grand marketing conspiracy was involved.—M.R.

Rolling Your Own Can Be a Drag

Dear Editor:

The remarks about designing one's own loudspeaker ("Fast Fore-Word," May) reminded me of an experience I had that should serve as fair warning to anyone so inclined.

It was 1966, and I hadn't yet quit my daytime engineering job to go into the audio business full-time. Discos were just opening up, and I wanted to bring high-fidelity techniques into the commercial sound field. For some reason, no one was doing it. At around the same time, I was beginning to write equipment reviews, mostly of loudspeakers and phono cartridges, for *Audio*. So I thought I knew something about speakers.

One day I came across a pair of terrific-sounding electrostatic tweeters and began playing around with them, together with some cone midranges and very large cone woofers. Eventually I came up with a tri-amplified loudspeaker system that sounded pretty good to me. All of my audiophile friends who auditioned the thing loved it. Then I invited two acquaintances, who were expert speaker designers in their own right, to audition the system. (I have omitted their names for their protection.) The demonstration consisted of playing two of these hybrids, which were placed in corners behind an acoustically transparent curtain in my basement. The experts were so im-

pressed that, at first, one of them wanted to pay me for the design so that he could market it. When I told him that it was just from playing around and that I had gotten lucky, he raved about how great the thing sounded and encouraged me to do something with it commercially. The other expert said the system sounded as good as anything he'd heard to date. I thanked them for their encouragement.

A few weeks later, I got a job to build a disco sound system in a small Manhattan club. Since I wanted hi-fi sound and not public address, I decided to use eight Acoustic Research AR-3a speakers, which were, at the time, considered to be good, compact, full-range hi-fi systems. They were to be powered by four McIntosh MC-275 amplifiers, so each speaker system would have its own 75-watt amplification channel. The eight speakers were to be installed around the dance floor, near the ceiling. This was before subwoofers and tweeter arrays, mind you.

Before installing the speakers at the site, I thought it might be interesting to compare them with my home-brewed concoction that everyone had liked so much. I placed the AR speakers behind the curtain, next to my own systems. The ARs were in two four-speaker arrays, each with two speakers on top and two on the bottom. I used pink noise and a sound-level meter to adjust the amplifiers so that the ARs and my own speakers would sound equally loud. Even when I played them quietly, the ARs blew my systems away! Shortly afterward, I dismantled my own speakers, and no one heard them again.

Before designing loudspeakers, one needs to know that it's much more of a science than one might suspect, and good science requires proper knowledge and tools (plus, an anechoic chamber helps). Our egos often interfere; we tend to think that our ears are as good as, if not better than, somebody else's. But before your friends inspire you to go to the trouble of designing and building your own speakers, consider just going out and buying them. Then you can spend the time you've saved listening to good music. I've since taken my own advice and have never regretted it.

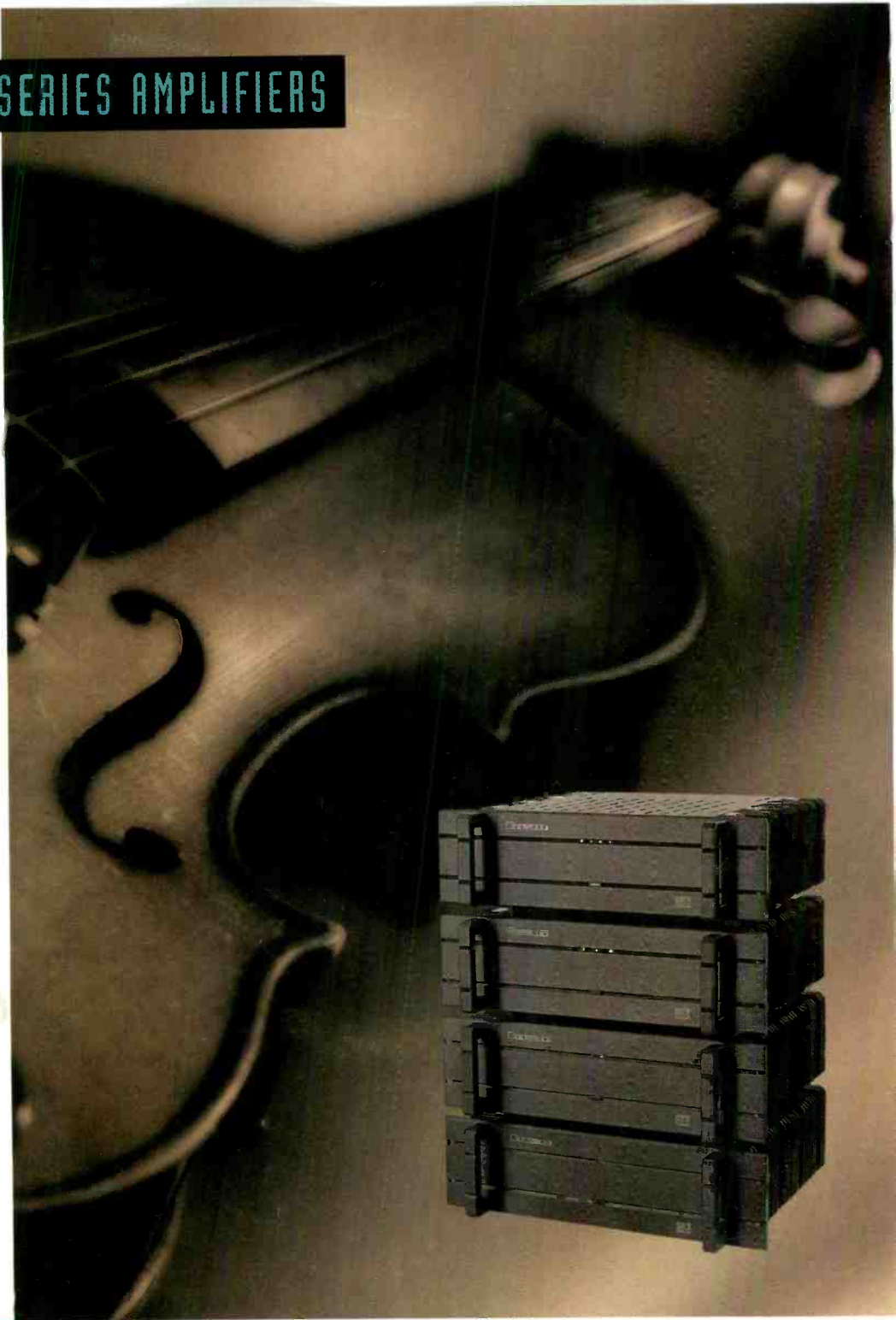
Al Rosner
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other rooms are muted, with local muting status indicated on each IntelliPad in the house. Once a source is selected, the IntelliPad's buttons control such functions as play, volume, next station, and track number. Programming information can be copied from one IntelliPad to another

and can be stored on a PC disk. Price: \$350.
For literature, circle No. 100

ROCKFORD FOSGATE DAMPING COMPOUND

NoiseKiller Yellow is a vibration-damping adhesive for subwoofer enclosures. Rockford Fosgate says enclosures made of 3/8-inch panels sandwiched together by this substance will sound better than those built of single 3/4-inch MDF panels. NoiseKiller Blue, another formulation, is designed to be sprayed or brushed onto



the inside surfaces of car doors, trunk lids, or other vibrating panels, to reduce resonances. Prices: NoiseKiller Yellow, \$65 per liter; NoiseKiller Blue, \$55 per liter; spray gun for NoiseKiller Blue, \$35.
For literature, circle No. 102



Wright Mono Amp

Delivering 80 watts, the monaural 120M amplifier uses only point-to-point wiring, with no circuit boards. It uses EL34 output tubes; 5881/6L6WGC tubes can be substituted, reducing output to 45 watts. All service adjustments are on the top surface, and there are separate, choke-filtered power supplies for the low-level input tube and for the output tubes. Price: \$1,280 each.
For literature, call 541/343-1413

Marchand Electronic Crossover



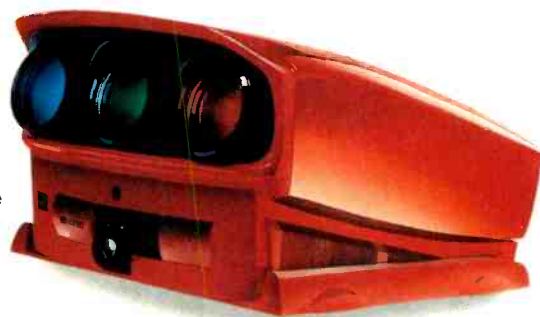
The XM26's electronic crossover network uses four 12AX7 tubes in each stereo channel; a switch allows its bass to be summed for use with a single subwoofer. Interchangeable modules set the crossover frequencies (20 Hz to 5 kHz) and slopes.

The XM26 is normally configured for fourth-order (24-dB/octave) slopes and a constant-voltage, Linkwitz-Riley alignment, but first-, second-, and third-order modules are available. Price: \$1,499.
For literature, circle No. 101

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The Vision One can project high-resolution video (or computer) images onto screens measuring 90 to 300 inches diagonally. A Scheimpflug-type lens adjustment prevents keystone when the projector is above or below the screen; manual and computer-controlled active adjustments are said to correct astigmatism

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These Mini-Mags are the smallest speakers that Magnepan makes — they even have the great quasi-ribbon tweeter/mid-range. Their size may be small but their sound is BIG.

In preparation for this review, I listened to a number of speakers in the price range. (And remember, with ordinary box speakers you have to figure another one or two hundred dollars for stands. The MMG's are, of course, floor standing and thus require no stinking stands.) I have yet to hear any other competitive speakers that sound as real, or as natural as the Mini-Mags. In order to grab your attention in a dealer show room, the box speakers have a boosted bass and exaggerated highs. Take one of these boxes home and see how long it takes you to tire of boomy one note bass and ear splitting treble.

Let's face it, there are few - very few - good \$500 speakers out there. Most of them will make Bonnie Raitt sound like Lyle Lovett, and they will not have the definition and imagery, breadth or depth of sound stage that a planar speaker can give you. On the MMG's, a Steinway will sound like a Steinway and not like that old spinet in your uncle's basement.

Buy these! They are one of the true bargains in audio. And then in three or four months when you've become as hooked on planar sound as I am, truck 'em on down to your Magneplanar dealer and trade 'em in (remember that 100% trade-in allowance) on some bigger and better Maggies.

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WHAT'S NEW



DENON A/V TUNER/PREAMP

Designed to handle all major types of surround encoding without the use of an external processor, the AVP-8000 tuner/preamp has Dolby Digital AC-3, Home THX, and Dolby Pro Logic processing built in. All surround processing is digital, using 20-bit A/D converters for analog sources. Surround modes and parameters can be stored individually for each of the analog and digital

inputs. The tuner section has full RDS facilities, including search by program type and a 64-character display. Multisource outputs enable you to feed separate program material to another room. The supplied remote can operate components from Denon or other manufacturers. Price: \$3,500. For literature, circle No. 104



SOTA Record-Cleaning Machine

Some of SOTA's turntables use vacuum systems to clamp records in place; the LPC-1 record cleaner uses one to slurp cleaning fluid from a record's surface. The fluid is applied semi-automatically from a dispensing system with a replaceable bottle, and a soft-bristled brush is provided for manual scrubbing.

The tank for waste fluid holds 32 ounces, so it won't need frequent emptying, and a visible level indicator enables you to see when it should be emptied. For easy storage between uses, the unit measures 19 inches wide, 14½ inches deep, and 8½ inches high, and it has a detachable power cord. Price: \$595. For literature, circle No. 106

Shure Phono Cartridge



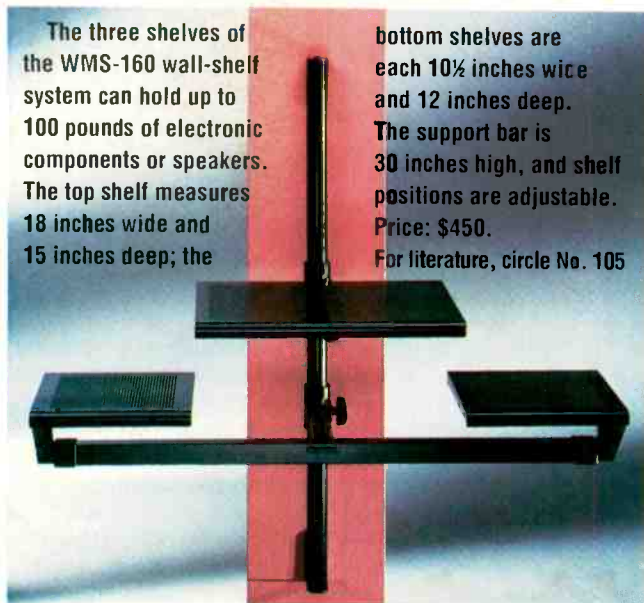
Shure's latest top-of-the-line moving-magnet cartridge, the M111E, sports a Dynamic Stabilizer shock absorber (which doubles as an anti-static groove brush) and the company's Side Guard stylus-protection system.

The user-replaceable stylus is a biradial diamond, 0.2 x 0.7 mil. Recommended tracking force is 0.75 to 1.5 grams, and rated frequency range is 20 Hz to 20 kHz. Price: \$99.95. For literature, circle No. 107

BELL'OGGETTI

The three shelves of the WMS-160 wall-shelf system can hold up to 100 pounds of electronic components or speakers. The top shelf measures 18 inches wide and 15 inches deep; the

bottom shelves are each 10½ inches wide and 12 inches deep. The support bar is 30 inches high, and shelf positions are adjustable. Price: \$450. For literature, circle No. 105



WALL SHELVES

Marantz Mono Amplifier

An all-tube, Class-A, push-pull mono power amp, the T-1 develops 50 watts continuous power, 75 watts peak. No negative feedback is used, and all stages are coupled by transformers. All tubes (other than the rectifiers) are directly heated triodes; the first two stages use 300B tubes, more often used in output circuits, while another triode, the 845, is used for



output. All wiring is point to point, with ceramic sockets for the tubes. Only balanced input is provided. Price: \$25,000 each. For literature, circle No. 108

WHAT'S NEW



Soundwave Speaker

Slope a speaker's baffle, and you cut down on its internal standing waves; slope all four sides, and you eliminate those waves, ending up with the pyramidal shape of the

Metronome. Each cabinet houses a long-excursion, 6½-inch woofer and a 1-inch tweeter with a polymer and fabric dome. Frequency range is rated as 65 Hz to 20 kHz, sensitivity is 88 dB SPL for 1 watt at 1 meter, and peak power handling is

150 watts. The cabinets, which measure 10 inches on a side and 13 inches high, are available in black or white. Price: \$550 per pair. For literature, circle No. 109

MB Quart Surround Speaker

Surround speakers are not supposed to make their presence obvious, either sonically or (MB Quart feels) visually. So the Domain Balcony Surround is designed to look more like a wall sconce than a speaker. Two ½-inch titanium-dome tweeters are used at the sides, and a 4-inch woofer fires from the top. The system covers the range from 100 Hz to 22 kHz



and is available in black or white, with paintable grilles. Price: \$399 per pair. For literature, circle No. 110

phantom sound outdoor speaker



Although redwood is not a common finish for speaker cabinets, Phantom Sound decided to use it on its PSOD outdoor speaker because it weathers well. A two-way system, the PSOD has a down-firing 6½-inch woofer with a polymer cone and rubber surround plus two tweeters on opposite sides of the enclosure. Connections are via a weatherproof, quick-disconnect plug. Claimed frequency range is 60 Hz to 14 kHz, and sensitivity is 89 dB. Price: \$400 per pair. For literature, circle No. 112

ATLANTIC TECHNOLOGY HOME THX SPEAKERS

a number of unusual touches mark the System 350 Home THX speakers. The 353 C center speaker is tiltable, for mounting above or below a TV screen, and its tweeter and midrange drivers are in a D'Appolito-style vertical array, for proper dispersion. The triangular 354 SR surround speakers can be mounted on the optional stands shown or on a shelf or wall. The 351 LR speakers,

for the main channels, can also be wall-, shelf-, or stand-mounted, and they have the same drivers as the center speaker, to match its sound. Completing the system are two 352 PBM powered subwoofers, each housing a 12-inch driver and a 200-watt amp. Prices: Seven-piece system, \$3,546; 353 C, \$549; 354 SR, \$499 per pair (stands, \$169 per pair); 351 LR, \$899 per pair (stands, \$199 per pair); 352 PBM, \$1,599 per pair. For literature, circle No. 113

M&K SOUND SURROUND SPEAKER



Miller & Kreisel calls the SS-150 a tripole, since it combines dipole radiation from its left and right sides with direct radiation from its front. The design is said to combine the diffuseness of dipoles with the immediacy and imaging of direct radiators. Either dipole or tripole mode can be selected by the user. The system has 3¼-inch drivers on the sides and a 5¼-inch woofer plus a 1-inch soft-dome tweeter in the front. Price: \$995 per pair. For literature, circle No. 111



Conversion Confusion

Q *If I understood it right, an article I read said that the A/D converter in a CD player converts the info on the CD to digital. I thought that the info on the CD was already digital.—Name withheld*

A The information recorded on a CD is, indeed, digital. An A/D converter turns analog signals into digital before they're recorded on a CD, so a CD player doesn't have an A/D converter. It does have a D/A converter, to turn the digital signals back to analog during playback. In all likelihood, the writer wrote the opposite of what he meant (every writer does, once in a while), and the editor failed to catch the error (every editor does, once in a while).

Audio Mode Selector on VHS Hi-Fi VCRs

Q *Some VHS Hi-Fi VCRs have an audio mode selector. This switch usually enables one to select the Hi-Fi stereo channels or the linear track (which is usually mono). If I set this switch to mono and record a stereo program, will it be recorded stereophonically on the Hi-Fi track? Will it be in mono on the Hi-Fi track? Or will that track simply be blank?—Steven Matthews, Louisville, Ky.*

A The audio mode selector affects only the VCR's output; it has no effect on the input and recording process. Therefore, a stereo program will be recorded in stereo on the Hi-Fi tracks regardless of this switch's setting. However, if the switch is set to mono, you will hear only the linear mono track until you set the switch back to stereo again. Those few VCRs that were designed to record stereophonic linear tracks may be an exception to this.

Another Way To Avoid CD Damage

In the February 1996 "Audioclinic," David A. Taylor stated that he sometimes cannot play CDs that had once played perfectly. You suggested that his problem might be dirt on the disc or on his CD player's optics. I suspect that the problem could be the technique he uses when removing a CD from its case. What

I do is press down on the hub of the case with my index finger while removing the CD with my other fingers and a thumb. This reduces some of the case's grip on the CD, which lessens the bending stress applied to the disc during removal. Theoretically, the disc's aluminum layer is less likely to be damaged this way. I have no data to back up this theory, but I have used the technique successfully for many years.—Bill Eccles, Omaha, Nebr.

Replacing the Amp in a Powered Subwoofer

Q *Is there a way to replace the amplifier in a powered subwoofer with a more powerful amp?—Timothy T. Anzalone, Streamwood, Ill.*

A Before replacing a powered subwoofer's amp with something more powerful, check with the subwoofer's manufacturer to see how much power the driver can handle; it may be designed to handle only the power its original amp provides. Further, the original amp may have incorporated the crossover or some of the subwoofer's controls, in which case you'll need to provide substitutes. Even if you can get around those potential problems, you may not be able to find a more powerful amp that fits the space provided. If you don't insist on your new amp's being built into the cabinet, you can use an external amp. Just remember to remove the original amp and connect the wires that formerly came from the old amp's output to the output terminals on the new amp.

Mysterious Music

Q *My system includes a CD transport and an outboard D/A converter. I don't know how I stumbled on this, but I found that, with the D/A off but the phono volume turned way up, I can hear music very faintly being played in the transport. I tried changing interconnects, but the situation did not change. Could this music be coming in via the power line? I didn't try filtering the line.—Name withheld*

A Is the music you hear on a CD that's currently playing? And does your CD

player have analog as well as digital outputs? If it does, and if those outputs are connected to an input on your preamp (or the preamp section of your amp or receiver), your mystery signal might be getting into your system via leakage in the source selector. (This is more likely to happen with a CD player than with other sources, because CD players have higher output voltages.) If this is the case, disconnecting the cable carrying this signal should cure the problem.

Or are you hearing music coming from the transport itself? If so, and if it's from a CD that's playing, then something in the transport is causing it. If it's unrelated to the current CD, your transport may be picking up and demodulating a radio transmission (more likely AM than FM); grounding the transport might cure this. Radio-frequency energy from a local AM or FM station could also be getting into the sensitive phono circuitry of your system, and it could indeed be entering the system via the power line.

If your mystery music is audible only when there's no other signal and you have the volume turned up fully, there is no need to go to extremes in order to eliminate it. I wouldn't worry about interference you can't hear under real listening conditions, though I would be concerned about interference you can hear under realistic but extreme conditions.

Power-Line Filters

Q *My system sounds poor, and I've been told that's because of RF signals in my power line. I am considering buying a power-line filter/conditioner to clean this up. On the other hand, a salesman told me that the odds are only 50-50 that using the filter will solve this problem.—Benjamin Chiaro, New York, N.Y.*

A Whereas some sound systems are virtually impervious to RF and other electromagnetic interference that may be in the power line, other systems are very sus-

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@delphi.com. All letters are answered. In the event that your letter is chosen by Mr. Giovanelli to appear in Audioclinic, please indicate if your name or address should be withheld. Please enclose a stamped, self-addressed envelope.

ceptible to it. If RF is getting into your sound system via the power line, it is certainly possible that the filter/conditioner will remove it. But a lot of the interference that finds its way into a sound system comes via other routes. If this is the case, the filter won't do anything for you. Since it's hard to know whether the filter will help you, see if a dealer will let you try one overnight. By the way, there are many other possible reasons for your system's unsatisfactory sound.

Speaker-Impedance Limits

Q *If my receiver calls for loudspeakers whose impedance is no lower than 8 ohms, is there any way I can use a 4- or 6-ohm speaker? What will happen if I try this?*—Name withheld

A If the owner's manual for a power amplifier or a receiver says that 8 ohms is the lowest impedance that should be connected to it, the safe bet is to follow those instructions. Many that carry such a warning do so primarily to make UL happy and will work fine with lower-impedance speakers. Unfortunately, there's usually no way to find out other than by trying it.

Here's the scoop. The lower the impedance of the speaker load, the more current will be drawn from your receiver's output transistors. Raising current flow heats up the output stage. Too much heat will make these transistors fail, usually causing the failure of other components. This will require a costly repair. If parts are no longer available for your receiver, you may even have to replace it.

These problems usually occur only if you run your receiver close to its maximum power output. You can't tell exactly when you're doing that, but a high volume-control setting or distorted sound should serve as a warning sign. So unless you plan to use your receiver only for background listening, you'll probably want to make sure that any speakers you use that have low impedance also have high sensitivity, so you can get adequate volume without overdriving your receiver.

If you have your heart set on a loudspeaker whose impedance is, say, 4 ohms, you should seriously consider replacing your amplifier or receiver with one that is specified to work with such loudspeakers. If your budget won't permit that, keep things

as they are and enjoy the sound produced by your present system.

Setting Tone Controls

Q *Is there any general rule determining which bass- and treble-control settings are best? If not, how can I find out which are the right settings?*—Daniel Hileman, Oak Ridge, Tenn.

A There is no one perfect setting for tone controls; you must experiment. But it helps to know what they are for. Bass and treble controls have several purposes. They help you deal, crudely, with frequency imbalances in your audio system or your room's acoustics. They're more helpful in compensating for frequency imbalances in individual recordings, and they can help you adjust the tone of even well-balanced recordings until they sound more to your liking. If your system lacks a loudness-compensation control, adding a bit of bass when you turn the volume down will make the softened music sound more natural and not so thin.

Try listening to a variety of recordings with your tone controls switched out or turned to their "flat" positions (usually, pointing straight up), until you're familiar with how your system sounds without them. Then turn the bass and treble controls, one at a time, all the way up and all the way down, to hear what they can do. After that, experiment with subtle increases in bass and treble. (If you have to use your tone controls' extreme positions to get good sound, there's usually something wrong.)

The more expensive the equipment, the less likely it is to have tone controls. That's because many audiophiles feel that these controls introduce unacceptable distortion levels and phase shifts. I do use them, however, because I think the good they can do when I need them far outweighs any potential ill effects.

Matching Main and Center Speaker Sensitivity

Q *What happens if the sensitivity of my main front loudspeakers is 5 dB greater than the sensitivity of my center speaker?*—Name withheld

A It isn't too important that the sensitivities of the main and center speakers in a home theater system be matched. Just as a balance control takes care of imbalance between the left and right channels,

your system's center-channel level control should take care of the difference—assuming, that is, that your system's center level control has enough range to eliminate this imbalance. However, if these speakers are mismatched to such a degree in sensitivity, they're probably mismatched in other ways and will sound different: Voices and other sounds, for example, may change tone unrealistically as they move between the center and flanking speakers.

Headphone Impedance and Tape Deck Meters

Q *My cassette deck has no headphone jack, so I've connected my headphones (which have their own volume control) to its line output jacks. When I connect the 'phones to the deck, the reading on the deck's meter is a lot lower than when my deck is feeding my receiver. And the higher I turn the headphones' volume control, the lower the reading becomes. Can I damage the 'phones or the deck by connecting things this way?*—Kao Saeteurn, Visalia, Cal.

A Because your meter is connected, directly or indirectly, to your deck's line output, anything that drops the voltage at the output jacks will lower the meter reading. Adding a high-impedance load, such as the input of a receiver or amplifier, does not drop this voltage appreciably. But your headphones have a much lower impedance (probably on the order of 8 to 35 ohms, as opposed to several thousand ohms), so they do drop this voltage. The impedance of your headphones varies with the setting of their volume control; raising the volume lowers the impedance.

No damage is likely to occur to the headphones or to the deck, though it can occur if your deck has a direct-coupled output circuit. When such circuits are loaded too heavily, they can overheat. This can, if continued, damage the equipment.

With such a large impedance mismatch between your 'phones and your recorder's output jacks, you're probably not getting enough level when you listen to the deck through headphones. A far better arrangement is to connect the headphones to your receiver's headphone jack, if it has one. You could also use audio transformers to match your headphones' impedance to that of your deck's output or try to find headphones that have higher impedance. **A**

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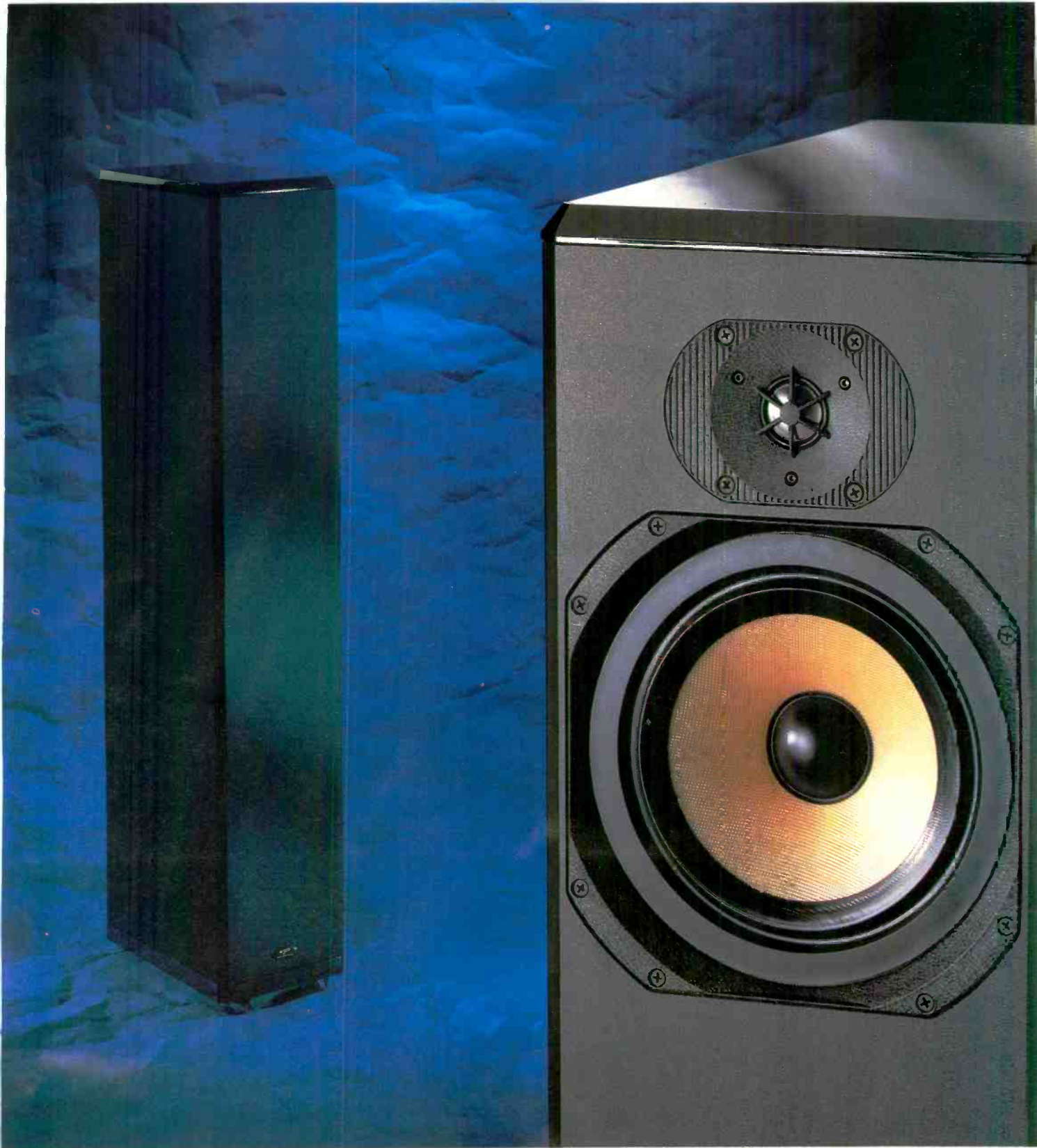
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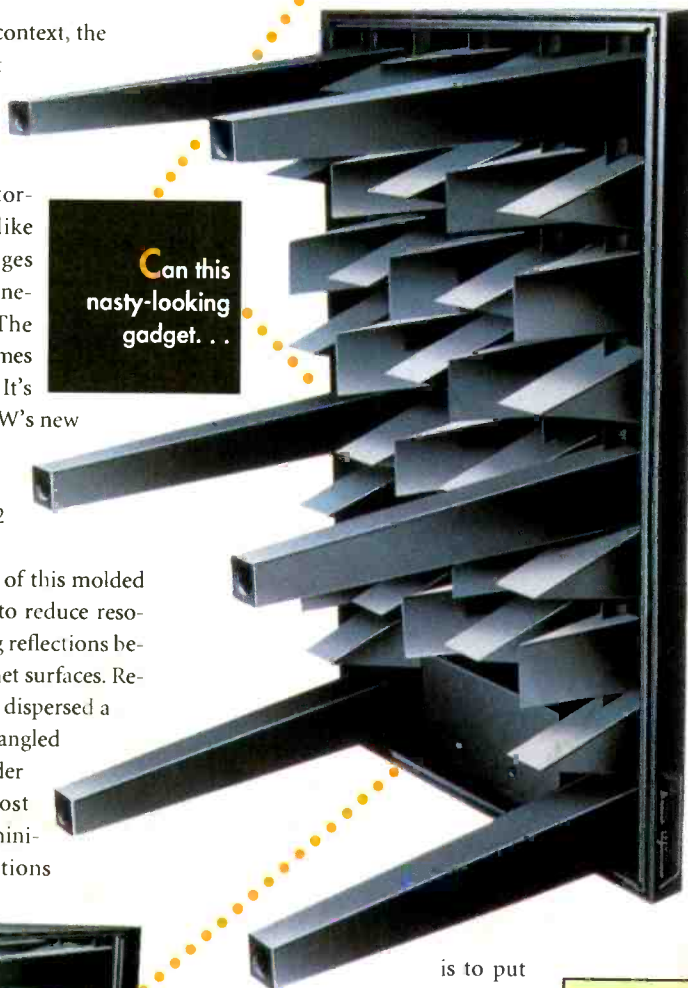
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TORTURE TRACK FOR RESONANCE

Taken out of context, the spiky gadget shown here looks like an implement of torture or, perhaps, like the system of wedges that helps deaden anechoic chambers. The second purpose comes closer to the truth: It's the back wall of B&W's new Prism enclosure, making its debut in the Model DM302 speaker.

The angled facets of this molded panel are intended to reduce resonances by dispersing reflections between internal cabinet surfaces. Reflections are further dispersed a bit by the cabinet's angled front corners, an older technique. The most traditional way of minimizing these reflections



Can this nasty-looking gadget...



is to put absorbent wadding into the cabinet. According to B&W, however, putting sufficient wadding into a small cabinet also deadens bass.

The rectangular projections from the molded panel fight resonance yet another way. They tie the front to the back of the cabinet, clamping it rigidly together in order to fight mechanical vibration.

...help produce better sound?

ANCHORED TO THE COUCH

Foreign words are often difficult to spell, perhaps most so when the foreign language involved is English. And home theater is beginning to catch on all around the world. So I was not surprised when I saw an Italian ad for "Home Theater" equipment. Yet on second thought, it made sense: What better to tether us to our homes and couches?

BLASTED DIFFICULTIES

Now that I've added multimedia to my own computer, I find that John Woram's caveats on possible problems ("Adding Multimedia to Your PC," November 1995) didn't tell the half of it. But I have learned a few lessons that are worth passing on.

First, if following the instructions doesn't work, make sure you've followed them correctly—then check to make sure they aren't wrong. Although I had followed the directions faithfully (something I don't always manage), the instructions for my Creative Labs CD-ROM drive turned out to be, besides clear and complete, wrong in two places. Once I figured that problem out, the drive worked just fine in my PC.

Second, the simpler your computer system, the easier your sound-card installation is likely to be. In my system (which has three serial ports, two bidirectional parallel ports, a bus mouse, and a SCSI card, among other complications), the installation was far from easy.

code, however, did not reveal the entire truth. As Tom Jung of dmp Records pointed out in our February 1992 issue, even a DDD disc may have been processed in the analog domain between the recording, mixing, and mastering stages noted by the code, passing through D/A and A/D conversions each time. As Jung put it, each conversion "takes a little bit away from the purity of sound you hear when you listen to the finished CD at home."

Just as Jung's article went to press, SPARS dropped the code. "The SPARS code no

Third, try on-line resources as a primary source of help, but don't rely too much on them. Both Creative Labs and Reveal



have forums on CompuServe, but Creative Labs' forum was swamped; it took weeks to get even simple answers. Reveal's forum was more helpful, so I downloaded new software from there.

Fourth, if all else fails, be prepared to spend a lot of long-distance telephone time. It took several hours on the phone with a sequence of helpful Sound-Blaster technicians to work through all my software problems; since the board still didn't work, the last technician concluded that it had a bad

chip. (Many such products have these problems on occasion.) I took the dead board back to the store and tried installing a Reveal card. That, too, took some long-distance time, but only about 1½ hours.

Now I'll soon be able to experiment with multimedia music—once I make up for the time lost getting my sound card up and running.

longer fairly reflects the complexity of the technology," said the Society's then chairman, Pete Caldwell.

But about a year ago, the SPARS board unanimously voted to recommend the code's reintroduction, and most CDs now car-

ry it. The SPARS code no longer poses a marketing problem to record companies, because there are more DDD recordings around for those audiophiles who want them. And AAD and ADD recordings have come back into vogue. As Shirley Kaye, executive director of SPARS, told me, "When it was discontinued, analog was not in such great favor. That's no longer true."

HARD TIMES FOR RECORD STORES?

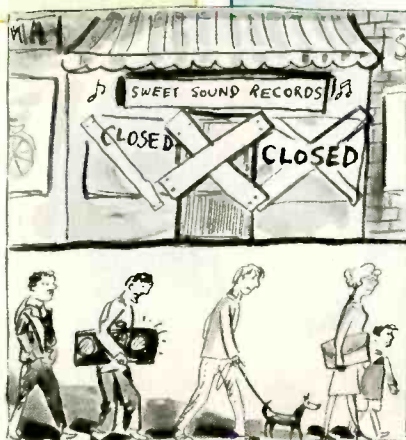
Does your local record store seem a bit less crowded lately? For that matter, is it still there? According to a recent article by Jeffrey A. Trachtenberg and Eben Shapiro in *The Wall Street Journal*, more than 300 record stores closed last year, and 500 or more are expected to close this year.

One reason so many stores are closing is that too many have opened. Scenting a boom that never came, record retailers overexpanded during the early '90s, opening more than 1,200 stores in the past three years alone.

Another reason, *The Journal* says, is that it has become much easier to buy CDs without leaving home. It's now possible to sample as well as order music over the phone or via the Internet, and to order discs from record clubs. (On the other hand, the Bose Express Music catalog service is no more.)

The record companies have also had trouble coming up with new music and artists who excite buyers into buying more. And when there are fewer fast-selling albums, record stores have less patience for slow-selling types of music, no

matter how steadily that music sells. This will probably mean slimmer pickings for buyers of older music, including classical, jazz, folk, and "vintage titles, such as Van Morrison's *Moondance* or Bob Dylan's *Blood on the Tracks*," according to *The Wall Street Journal's* report.



Illustrations: Beata Szpuru

DO THE DVD BACKPEDAL



Have you heard the latest buzz? DVD's gonna be a *flop*. You heard me right: The next-generation, \$20, CD-sized digital disc, the one with up to 25-times the data storage capacity and the ability to deliver full-length movies in laserdisc-quality video with Dolby Digital AC-3 surround sound (not to mention its application as a computer storage medium with up to 17 gigabytes of uncompressed data capacity), is going to be a *failure* in the marketplace.

Do I buy into this latest buzz? Hell, no! I think DVD's going to be a big success. No, I'm just doin' the latest dance that all the groovy technology-beat writers have been doin' lately, the DVD Backpedal.

It goes like this: First you put your hands on your hips and shout, "DVD's gonna be *huge*, y'all, woop, woop!" Then you spin around and do some Michael Jackson-style *backwards moonwalking*. To complete the dance, you scream out, "DVD's *dead*, y'all, woop, woop!"

If Don Cornelius himself does not come over and declare you the funkiest technology prognosticator on this week's "Soul Train," that's only because John Dvorak beat you to it. In his "Inside Track" column in *PC Magazine's* March 26th issue, Dvorak declares that the current CD-R format "is going to be

leapfrogged soon by DVD," and he predicts a "mad rush" this fall on DVD players. In all, Dvorak devotes half his column to rightly trumpeting DVD as "the floppy disk drive of the 21st century."

But just four weeks later, in his April 23rd column, Dvorak says, "DVD will be a dud." Why the sudden change of heart? Because, he explains, everyone *else* was predicting DVD's success, too. And when he read those predictions in other magazines, it smacked to him of boosterism. So what's a hep insider do? Why, the DVD Backpedal, of course. Gotta stay contrarian, y'all, woop, woop!

Even ultra-hep *Wired* (for which I'm a sometime contributor) is turning on DVD. In the April issue's "Hype List," where expiration dates are basically stamped on new technologies, section editor Steve Steinberg declares that DVD will have a four-month lifespan because it "offers only an incremental improvement over today's storage technology." Of course! I keep forgetting about those *other* 17-gigabyte storage formats. Silly me.

When DVD was first announced early last year, it seemed like every consumer electronics journalist agreed that the proposed format was going to be the biggest industry success

**DVD WILL SUCCEED
BECAUSE IT
IS A LEAPFROG
OVER CD, CD-ROM,
VHS, AND LASERDISC.**

since the Digital Satellite System (DSS). And in the year-plus since, the two rival manufacturing camps resolved their differences, agreed

on a unified format, and got down to planning a summer '96 launch. Give 'em a few months to work out the details, and we'll all get our new toys before Hanukkah.

But instead of waiting for DVD with the rest of us, we get the DVD Backpedal. When pressed for actual reasons for concern, the backpedalers have come up with three: First, people don't care about

Illustration: Scott Menchin

The DC-1 Digital Controller: Total System Control.



The simple, clean lines of the DC-1 house a programmable A/V switcher with multi-channel digital crossovers, eight D/A converters, and legendary Lexicon DSP for music and film sound. Its stunning sound quality is matched only by its remarkable ease of use. Over 25 years of digital audio research and development have created a new

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The ergonomic remote control makes operating the DC-1 as easy and enjoyable as listening to it.

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COLORADO:

Recycled Audio/Stereo Image, Boulder	303 449 0153
Thul Electronics, Avon	970 949 4638

CONNECTICUT:

Tweeter Etc., Avon	203 677 6060
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KANSAS:

Kief's Gramophone, Lawrence	913 842 0191
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MASSACHUSETTS:

Tweeter Etc., Boston	617 262 5215
Tweeter Etc., Framingham	508 879 1500
Tweeter Etc., Burlington	617 273 2200

MICHIGAN:

Classical Jazz A/V, Holland	616 393 9099
Stereo Showcase, Grand Rapids	616 942 8920
The Sound Room, Traverse City	616 947 4710
Gramophone Co., Birmingham	810 540 2440

MINNESOTA:

Ambient Systems, Bloomington	612 922 5276
Robert Paul TV, St Paul	612 489 8025

NORTH CAROLINA:

Sound Systems, Fayetteville	910 868 1111
Sound Systems, Charlotte	704 568 3333
Sound Systems, Greensboro	910 273 5577
Musicians Workshop, Asheville	704 252 1249

NEW JERSEY:

Sight & Sound Audio, Bernardsville	908 766 7888
Film & Music, Little Falls	201 256 1122
Angel Audio Tech., Palisades Park	201 313 5551
Harvey Electronic, Paramus	201 652 2882

NEW YORK:

Harvey Electronic, New York	212 575 5000
Harvey Electronic, Westbury	516 334 3443
Audio Classics, Walton	607 865 7200
Audio Video Center, New York	212 226 1815
Clark Music, Syracuse	315 446 7020

NEVADA:

Best Home Theaters, Las Vegas	702 365 6882
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PENNSYLVANIA:

Stereo Trading Outlet, Jenkintown	215 886 1650
Tonex, Coudersport	814 274 0567

SOUTH CAROLINA:

Read Brothers Stereo, Charleston	803 723 7276
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TENNESSEE:

Underground Sound, Memphis	901 272 1410
Audio Video Envir., Madison	615 868 7710

TEXAS:

The Home Theater Store, Dallas	214 404 9500
Videoland, Houston	713 952 5700

VIRGINIA:

Home Media, Midlothian	804 379 0900
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WASHINGTON:

Magnolia HiFi, Bellvue	206 747 0851
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WISCONSIN:

Sound Seller, Marinette	715 735 9002
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higher-quality home entertainment; second, people aren't willing to spend \$500 on a new entertainment box; third, computer users don't need higher-capacity storage than the 680-megabyte CD-ROM.

I've got just three things to say to that nonsense: ha, DSS, and hahaha! If there's one lesson we can learn from the recent boom in home theater, it's that people definitely *do* care about quality when it comes to home entertainment. It's higher quality, and the idea of owning a private movie theater, that have driven sales of big-screen TVs and surround-sound audio gear to record levels.

And the unprecedented success of DSS chokes the old argument that consumers aren't willing to pony up serious dough for a newer, better black box. An entry-level DSS system costs around \$600 on the street, and monthly programming fees can hit \$70 and up if you want all the premium movie channels. That's no small chunk of change, but nearly 2 million DSS systems have been sold since its launch less than two years ago.

The Compact Disc's decade-long crawl to prominence was the old model for new-format adoption, but I think DSS is a much more relevant model by which to gauge consumer commitment to a new technology. In the 13 years since CD's launch, the PC revolution has dramatically increased consumers' comfort level with new technology and sped up the time it takes to adopt a new format. The rapid success of DSS in my opinion, is a better reflection of today's market and what people will go for when a truly better carrot is dangled in front of their eyes.

If nothing else, computer data storage will guarantee DVD's success. The idea that you can store 17 gigabytes of uncompressed data on a \$20, 5-inch disc sets even hardcore PC nuts' mouths a'foaming. That's enough storage capacity to fit the names of all the women that Julio Iglesias, Willie Nelson, Fabio, Wilt Chamberlain, Warren Beatty, Charlie Sheen, and I have loved on a single DVD-ROM with room to spare. Even though data storage formats seem to be

doubling their capacity and halving their price every 15 minutes, it's unlikely that we'll see anything to rival DVD-ROM for years to come. And by that time, we'll have rewritable DVD-R drives in our PCs, just in time for Windows NT-M (code name, Dorothy—say it twice in a little girl's voice, and you'll get it).

Aww, what am I arguing this for? None of these backpedalers believes his own B.S. about this. It's all a matter of wet feet. The truth is, DVD is going to be a big success, if a few promises are kept: The discs will be priced at \$20 or less; the first players will come in at \$499; and I get my player and discs before the other reviewers get theirs.

If the hardware and software folks keep the promises they made in the beginning,

**THE SUCCESS OF DSS
CHOKES THE ARGUMENT
THAT PEOPLE
WON'T PAY FOR NEWER
AND BETTER EQUIPMENT.**

then DVD will become the new worldwide standard for audio, video, and computer data storage. Break any of these promises (especially that last one), and DVD's success is less certain. Based on my

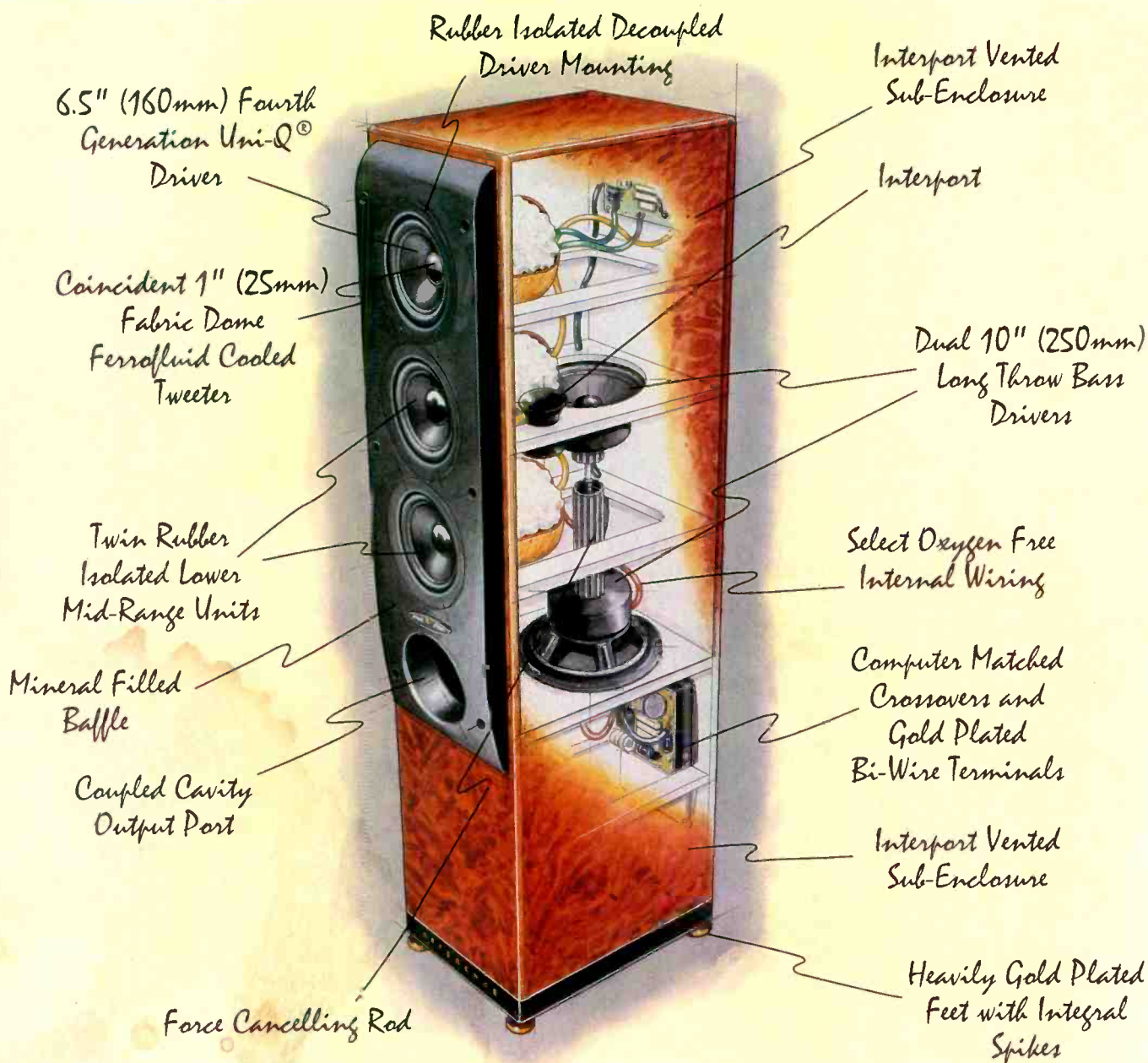
talks with high-ups in both the hardware and software camps, however, I am confident that they will be kept.

So why the turnaround on DVD in the press after all the hype following the format's announcement? Because some technology writers are more concerned about not being seen as backing a loser than they are about standing by their original opinion. In other words, better to be seen as a flip-flopper than as a booster of a dud. And as DVD is proving, the longer it takes for a new technology to finally come to market after the initial hype, the more flip-flopping we see.

The fact of the matter is, none of this backpedaling will really matter in terms of DVD's success or failure. The format will succeed because, as John Dvorak said in his earlier column, it is a leapfrog over CD, CD-ROM, VHS, and laserdisc. And because after 13 years of the 680-megabyte audio-only CD, it's time for the next-generation 5-inch universal digital disc. I'm just as confident of DVD's eventual success today as I was when it was announced in January '95, and I look forward to the DVD era with great anticipation. **A**

KEF REFERENCE SERIES MODEL FOUR

The Inside Story



Look inside the new KEF Reference Series Model Four and you'll understand why it has been hailed as one of the finest loudspeakers in the world. You'll find brilliantly innovative design and advanced features found on no other speaker. No wonder it has met with such critical acclaim.

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The experience of sound



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Trespassers will be cooked, vibrated, humidified, dropped and reduced to the point of whimpering "Mommy" to our sound.



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After the headunits are shaken like they're out of their minds, operated in 95 percent humidity, subjected to temperatures from -40 to 176 degrees and dropped from nail-biting heights, they're able to arm wrestle your car and win.

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Assembled with high-quality components by bare hands, these amplifiers have a built-in crossover and come dressed in purple.

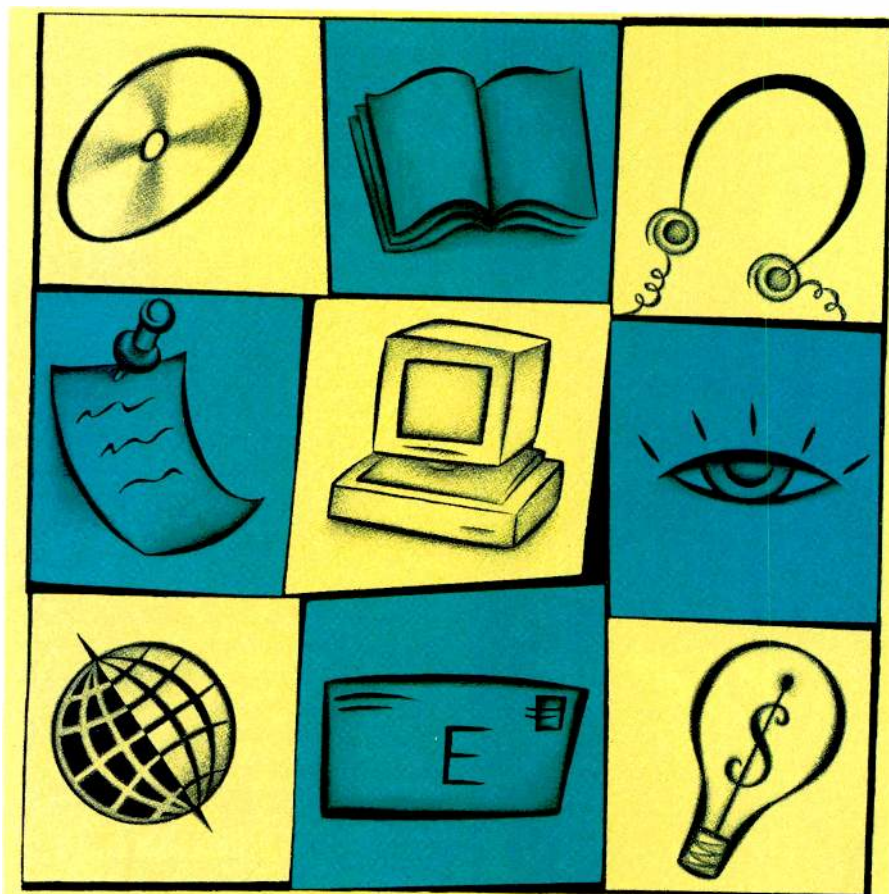


Depending on the speaker's frequency demands, Ringle™ Composite cones contain the perfect tailor-blended mix of maximum-performance materials in order to be both rigid and light.



PREMIER

http:// caughtinthewww.com



Living in the country—hell, living in *another* country—can lead one to feel detached from the audio mainstream. You know the motivation: It's the insatiable, nerdish, hobbyist need to feel that one is plugged into the scene. True, Great Britain has the finest postal system in the world (even my old man, a retired U.S. postal worker and union honcho, admitted as much to me). But news is news is news, and a lot can happen between one Consumer Electronics Show and another. So for me, it's God Bless the Internet.

It's safe to assume that a large number of you are wired, because hi-

fi guys gravitate quite naturally to personal computers and, by extension, to PC (and Mac) communication. And as any audio manufacturer will tell you, today's computer geeks are to the post-1984 world what audiophiles were to the previous era. So you're likely hitting the addresses that keep your passion aflame between issues of *Audio*. Believe me, the Internet is bursting at the seams with hi-fi-related home pages and bulletin boards, and they're not all just extensions of print magazines or manufacturers' public-relations departments.

Admittedly, there is a lot of that going on, but at least it's useful. Au-

dioweb is the site for tastes of a half-dozen or so specialist publications, such as *Glass Audio*, along with subscription information and shots of their latest covers. Many magazines have their own dedicated home pages, and nearly all have e-mail addresses so you can hassle editors and authors directly. (See "Cyberspace Addresses" for *Audio* and other sites mentioned here.)

One of the boldest efforts in the Web is what must certainly be the world's first Internet-only hi-fi magazine. *CYBERFi*, which has been around for more than a year, does its best to act like a normal print hi-fi mag. The contents range from show reports to news to equipment reviews, most of it written by its editor, veteran U.K. hi-fi journalist Jonathan Kettle. Publishing frequency has changed from weekly to a more sedate monthly, but the pages still seem fresh. And *CYBERFi* reports that it's getting more than 30,000 "hits" per month, with the numbers increasing. This has no doubt been helped along by deserved acclaim in one of the U.K.'s leading computer magazines, which judged *CYBERFi* to be one of the slickest sites on the Web. With all due respect to Kettle, however, *CYBERFi* has developed a one-man feel. In a recent issue, for example, he was the author of 15 out of 16 topics under the heading of "Opinion." But the site is always

worth a visit: The layout is gorgeous, the color photos are Netscape-friendly, and it's a remarkably swift way to gather news of the "Roksan sold to Verity Group" variety. If you're looking for a Net mag with somewhat wider scope, check out *E-Town*, which covers video and other categories of consumer electronics as well as audio.

Many of you will probably find the Internet useful for its manufacturers' pages. This saved my hide just last month. I was up against a deadline, working into the wee hours on a Friday night/Saturday morning (Oy! Working on Shabbos!), and needed some basic facts about a Marantz CD player. Looking for a laugh, I called

Illustration: Rob Blackard

up Yahoo! and typed "Marantz" in the "Search" box. To my relief, good ol' Philips Europe had set up a Web site for Marantz (Europe); sure enough, the CD player in question, the hot-rodded CD-63, was at the top of the list. A few mouse-clicks later, I had all the information I needed. It was clear and useful, too, which is what I've now come to expect of companies large enough to assign someone other than the resident mouse potato to set up their home pages.

This leads me to the obvious: The major hardware manufacturers and record companies all have amazing Web sites. (Many now include these addresses in their ads.) What was more fun, and what led to this month's column, was the path I took in the wake of my 11th-hour salvation by Marantz. I just picked company names at random, played around with Yahoo!, and got the following:

Snell: Snell hides out at a nonobvious, inscrutably computerese address, but it's as good as any for design and completeness. Among the hotkey topics the day I browsed were product categories (in-wall, home theater, etc.) and links to "The Laserdisc Division" and the THX home page. Fascinated though I was, an awareness of my phone bill kept me from hitting the hypertext "Audition our loudspeakers on line?" And I was just kidding when I once suggested a virtual CES where all exhibitors would merely supply the press with .WAV files!

Madrigal: Everything you ever wanted to know about Mark Levinson and Proceed hardware can be found in Madrigal Audio Laboratories' rather stylish pages. Elegant and informative, the main page opened with a few full-color shots of magazine covers, including one from an Italian journal that declared the Levinson No. 333 amplifier "Product of the Year."

Mobile Fidelity Sound Lab: Along with Monster Cable (which itself has a page on the Web), MoFi is one of the companies that knows marketing inside out. The MoFi pages offer a company history, a message from the boss (Herb Belkin), news of future album releases, and even "reprints" of magazine articles (if that's what you call articles appearing on the Net after they've been published in a magazine). I was amused to see an article of mine there.

Dolby Laboratories: Want to know the latest in the AC-3 campaign? Connect with

the Dolby Labs site, and you'll have access to such treasures as a full listing of all the laserdisc titles released with Dolby Digital AC-3 tracks as well as those about to appear. I stopped counting at 50, smiled to note that my latest purchase (Sam Peckinpah's *The Wild Bunch*) was present and accounted for, and wished I'd waited another

Linngo and even contemplated entering the personal computer field), this Scottish manufacturer has a superb site. Linn can proudly boast a hit rate of about 12,000 per month, most impressive for a specialist audio brand. Every imaginable category was posted (including Linn Records), as were article reprints, information on how to find a local retailer, and more.

And that's just an hour's worth of surfing the Net for hardware. If it's arguments you want, both CompuServe and America Online have forums under "Consumer Electronics," with enough topics to keep you in front of your computer for hours on end. And *Stereo Review* maintains an AOL forum containing a number of very active message boards plus articles and reviews from current and past issues. Because I'm new to AOL, I've only dipped into their groups once or twice. Something a little more familiar to me is the result of entering "ceaudio" in CompuServe's "Go" box. The topics cover every hardware category, and a lot of brands have their own categories, but the big fun is under "Community Square" and "Audio Issues/BAS." This is where you'll sometimes find Editor Michael Riggs explaining *Audio's* policies to readers, both grunted and disgruntled.

Once you start looking into the music scene, you're beyond hope. A friend just handed me a couple of floppy disks with files he'd downloaded from the Net, including a Burt Bacharach discography, a Chess Records catalog, a directory of acts that appeared on the Ed Sullivan Show, an interview with Big Star, a list of all the songs that The Beatles played but never recorded, a comprehensive list of Byrds bootlegs, findings from Buddy Holly's autopsy, and the story of the withdrawn John Lennon *Roots* LP. And that's just scratching the surface. A Roy Wood and The Move home page? You got it. A list of Hollies cover versions? A mere mouse-click away. The whereabouts of The Incredible String band? Yours for the asking.

And it's never gonna end.

But if you want a jolt of good old-fashioned hi-fi hobbyist insanity, do yourself a favor by contacting Sound Practices and telling them that you want to join their forum. In case you thought the single-ended triode/horn loudspeaker revival was a myth, think again!

CYBERSPACE ADDRESSES

Audio Magazine "Audioclinic"

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Audio Magazine editors

audiomag@aol.com

Audioweb

http://www.audioweb.com

CompuServe Audio Forum

go ceaudio

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http://www.virtual-publishing.com/cyberfi

Dolby Laboratories

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DTS

http://www.dtstech.com

E-Town

http://www.e-town.com

Linn

http://www.linn.co.uk/linn

Madrigal Audio Laboratories

http://www.madrigal.com

Marantz (Europe)

http://www.philips.com/marantz

Mobile Fidelity Sound Lab

http://www.mofi.com

Monster Cable

http://www.monstercable.com

Snell

http://www.primenet.com/mainpage

Sound Practices

sound@mail.tpoint.net

Stereo Review

America Online, keyword "Stereo Review"

month instead of buying three titles on the list without Dolby Digital tracks. DTS, one of Dolby Labs' main rivals in the movie industry, has a neat page, too. It was absolutely rich with information about forthcoming films produced with DTS soundtracks, but it was less willing than Dolby to let me print out the list.

Linn: Ever computer-literate (the company once wrote a computer language called

episode upside

do
UM

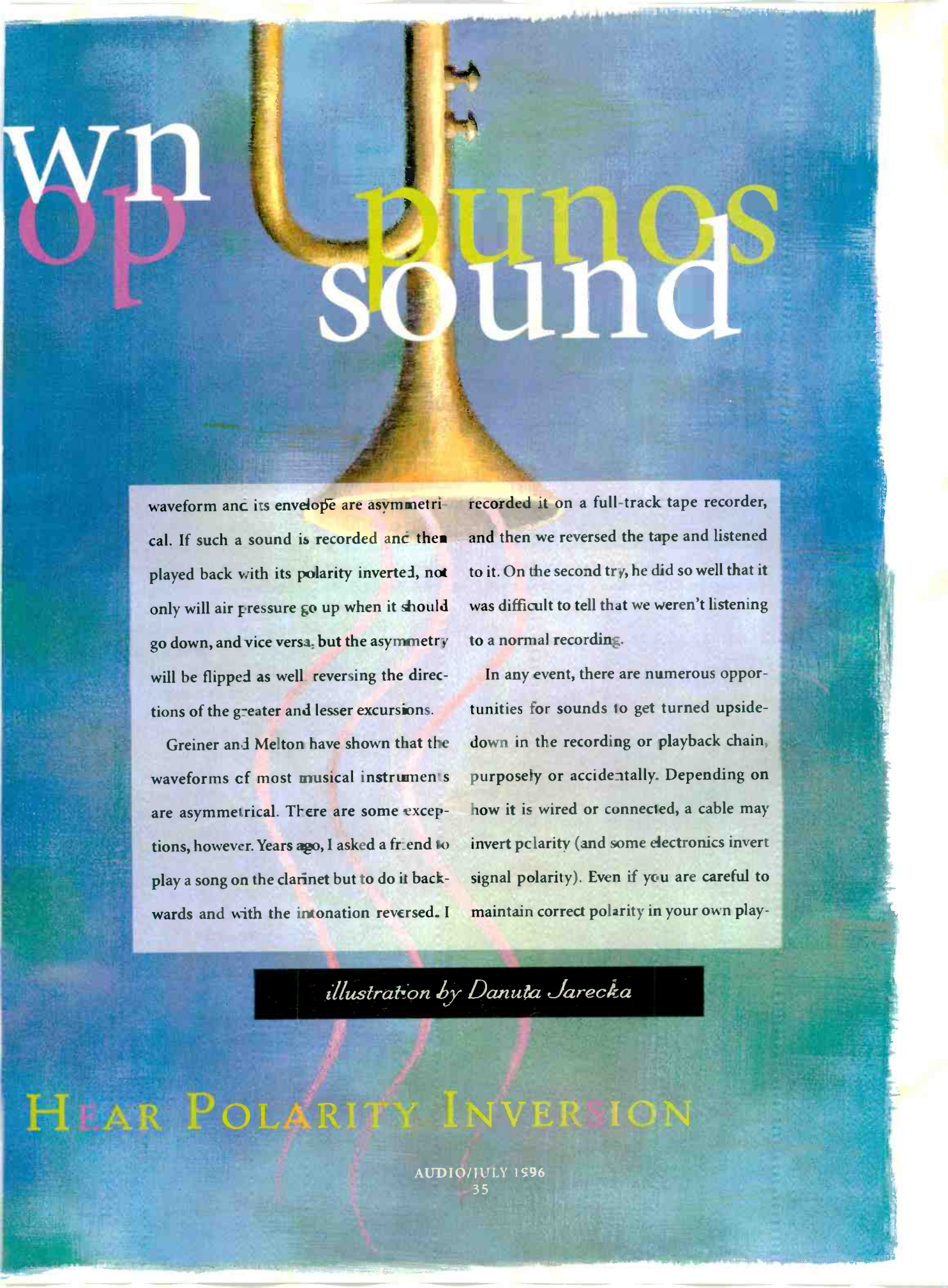
by Edward M. Long

in the beginning, there was only natural sound. It might have been loud or soft, high or low, but it was never upside-down. Then came recording, and the trouble started. Without meaning to do it, we now had a way to turn sound upside-down. If you have never heard of the argument about whether absolute polarity (or absolute-phase) inversion is important or not, you might ask me, "What on earth are you talking about? How can you describe sound as being upside-down?"

Sound causes a variation in air pressure above and below the median (or normal) barometric air pressure. When sounds reach our ears, our eardrums move in with an increase in air pressure and out with a decrease in air pressure. Most acoustically generated sounds—such as speech, brass instruments, plucked instruments, drum rim shots, and so forth—are asymmetrical, especially at their onset; they cause air pressure to vary up and down in an unequal manner. Figure 1, for example, shows the onset of a trumpet tone; it is clear that the

FIND OUT WHETHER YOU CAN





When op punos sound

waveform and its envelope are asymmetrical. If such a sound is recorded and then played back with its polarity inverted, not only will air pressure go up when it should go down, and vice versa, but the asymmetry will be flipped as well, reversing the directions of the greater and lesser excursions.

Greiner and Melton have shown that the waveforms of most musical instruments are asymmetrical. There are some exceptions, however. Years ago, I asked a friend to play a song on the clarinet but to do it backwards and with the intonation reversed. I

recorded it on a full-track tape recorder, and then we reversed the tape and listened to it. On the second try, he did so well that it was difficult to tell that we weren't listening to a normal recording.

In any event, there are numerous opportunities for sounds to get turned upside-down in the recording or playback chain, purposely or accidentally. Depending on how it is wired or connected, a cable may invert polarity (and some electronics invert signal polarity). Even if you are careful to maintain correct polarity in your own play-

illustration by Danuta Jarecka

HEAR POLARITY INVERSION

AUDIO/JULY 1996

35

back system, you have no way of knowing the polarities of the signals on recordings you buy.

Whether it is important to maintain the correct polarity is not my concern here. To some people, the question is moot, but I think that everyone should have a chance to check it out for himself. I am reminded of a study done many years ago by a major electronics company to determine the bandwidth necessary for "high-fidelity" sound reproduction. The conclusion was that 5 kHz was adequate, which seems laughable today. The point is that as audio recording and reproducing equipment improve, people can often hear things they couldn't hear before. I believe that is probably true for polarity inversion. I am one of those people who can hear the difference in the polarity of sound, yet I have listened to loudspeakers and earphones that did things to waveforms that made it impossible for me to determine the correct absolute polarity. I have also found that hearing polarity inversion is something that can be learned, so even if you build one of the polarity switches described here and don't hear a difference right away, don't give up.

A POLARITY SWITCH FOR EARPHONES

The easiest way to determine whether you can hear polarity reversal is by using earphones. The reason I suggest that you

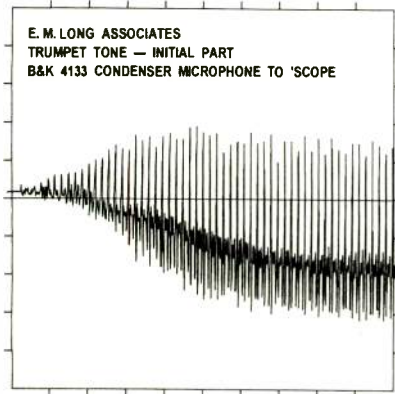


FIG. 1—ONSET OF A TRUMPET TONE. NOTE THE ASYMMETRY OF THE WAVEFORM AND ITS ENVELOPE.

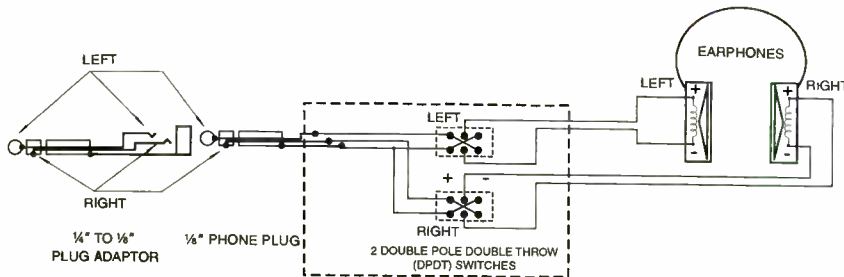


FIG. 2—SCHEMATIC FOR AN EARPHONE-POLARITY SWITCH.



should use earphones rather than loudspeakers for this experiment is that the characteristics of some loudspeakers and room acoustics can make hearing the effects very difficult. Even if you do most of your listening with loudspeakers, it still makes sense to use earphones when you are just trying to determine if you can hear a change in acoustical polarity.

Unless your preamp has a polarity switch, you will have to make your own. For earphones, which use a three-circuit plug, that means the earphone cable must be modified. The problem is that the common (negative) wire from each earphone element is connected to the sleeve of the plug, so you can't reverse polarity unless you cut the cable and wire a switch between the plug and the 'phones. Most of the earphones that I have tested for *Audio* will enable you to hear polarity reversal, but since you might have qualms about cutting the cord to your earphones just to do this experiment, especially if they are expensive, I looked around for some that are relatively inexpensive yet good enough for the purpose.

I came up with Sony's MDR-E565—small, in-the-ear 'phones that are good enough for me to hear the effects of polarity inversion on certain program material. They come with a 1/8-inch stereo mini-plug and a 1/4-inch adaptor and cost only \$29.95. They are also reasonably easy to modify. These "earbuds" have very good frequency response, with excellent high-frequency extension; the bass response is just adequate, lacking the powerful sound of more expensive earphones, but I must admit that I was pleasantly surprised by their overall performance. They are very sensitive and provide a very high output from a number of sources. This is because of their low impedance; I made a quick check with an

ohmmeter and measured 17.5 ohms on the left side and 18.0 ohms on the right. They are wired with positive polarity, but they do ring somewhat because of delayed response above the audio band. The transducer elements fit comfortably in my ears, and I could wear them for long periods without feeling any discomfort. Although each earpiece is marked for left or right, you will not have to



look each time you put them on because the left channel has a shorter lead than the right—a nice touch.

Figure 2 is a schematic of the modification. It is very hard to find four-pole double-throw switches, so I used two Radio Shack No. 275-407 sub-mini double-pole double-throw (DPDT) slide switches. I mounted them into a cassette case. You can use any small case, but a cassette case has some advantages, at least for this experiment: Such cases are readily available at record stores, they are easy to drill and file, they fit your hand, and they have enough room to store the phone-plug adaptor supplied with the MDR-E565 earbuds.

I drilled a hole in the top of the body of the case and then filed a $\frac{1}{2} \times \frac{3}{16}$ -inch opening for the two switches. I also drilled a $\frac{1}{8}$ -inch hole at each end of the cassette case to allow the earphone cable to enter and exit. I picked the No. 275-407 switches because, when they are mounted close together, the two slide levers can be moved together easily with a thumb or finger. If you wish, you can use mini toggle switches (such as Radio Shack No. 275-614 or 275-663), but they are more expensive, are harder to move, and make a click that might be distracting.

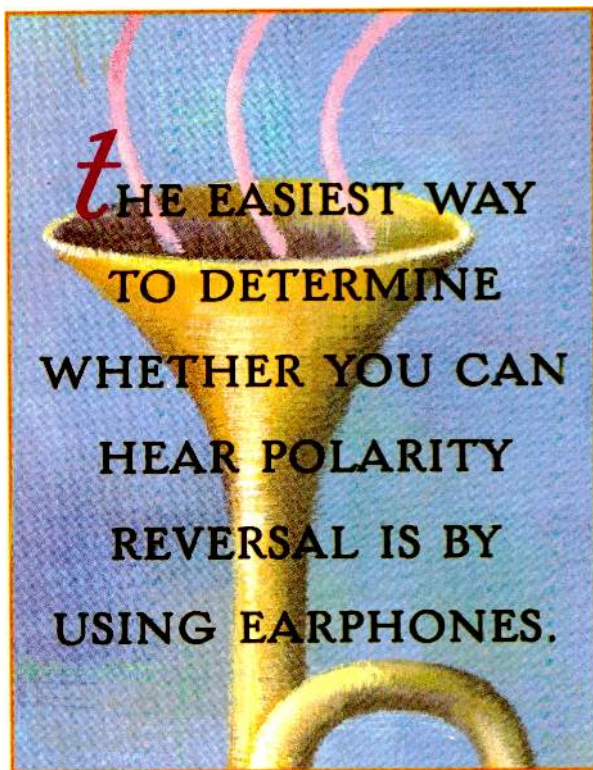
After I drilled and filed the openings in the cassette case, I checked the switch opening to make certain that it was large enough to allow the full travel of the switch levers. I glued the two switches together (with Scotch Brand Super Strength Adhesive) and then glued them against the inside of the case, with the levers sticking out of the opening. The switches come with tiny screws, but I decided to avoid the problem of locating and drilling holes for them in the case.

Cutting the earphone cable and soldering it to the switches requires some care. The Sony MDR-E565 earbuds have a very flexible cable jacket that is slightly oversized relative to the four very fine litz wires inside. I used a razor blade to cut the outside jacket and pulled it back to expose 2 inches of the wiring within. There are two copper-colored wires for the

common ground, a green wire (left), and a red wire (right). I determined which common went to which channel by stripping the insulation from each of the wires, scraping them carefully with the razor blade, and cutting just one of the two copper-colored wires. I then put on the earphones and touched the ends of a 1.5-volt battery to the cut common wire and the green or red wire. If you hear a click in the left ear when you connect the cut common wire and the green wire, they go together as a pair; if the click is in the right ear when you connect the *red* wire and the common wire, then *they* go together as a pair.

After I determined which colored wire went with the cut common wire, I cut the colored wire to the same length for connection to the switch. I then cut both the other common and its matching colored wire at a slightly different point from the first pair so that I could keep track of which pairs went together. I slipped the ends of the wires through the holes at the ends of the case, leaving enough slack to make soldering them to the switch easy. Next, I tied a slip knot in each cable, inside the box, to act as a strain relief so that the cable could not be pulled back through the hole. I soldered the crisscrossed wires (shown in Fig. 2) to the switches, using insulation tubing on one of them. (You can use insulated tape on both wires if you don't have slip-on insulation tubing.) I then wired the earphone part of the cable to the switches' center

lugs and the cable's plug end to the lugs at the ends of the switches. That's it! Follow this procedure, and you will be ready to try to hear the effects of polarity reversal through your earphones.



LISTENING FOR POLARITY REVERSAL

Over the years, the effects of reversing acoustical polarity have been described in different ways. Some people say that they perceive the effect as a subtle change in pitch, with correct polarity having slightly higher pitch than inverted polarity. Many people can hear this effect over a single loudspeaker reproducing a mono source, such as a human voice. In stereo, many people hear a more solid and defined soundstage when polarity is correct. If the stereo program features a vocal, most

A POLARITY TESTER'S LISTENING LIBRARY

Live microphone into a tape recorder. Ask someone to read something while you listen and switch polarity. You can record the voice for later tests, but the best quality will be while listening to the original microphone sound.

Announcer's voice on AM radio. Tune in a clear AM station, and listen to a live announcer's voice. Listen for the sound of hard consonants (Ts, Ps, etc.).

My Disc: *The Sheffield/A2TB Test Disc* (Sheffield Lab 10045), track 23, polarity test signal. This is a sequence of clicks, three positive and one negative. The sound should be "tick, tick, tick, tuck." If it sounds like "tuck, tuck, tuck, tick," the polarity of something in your system is reversed.

Cooustic Test CD (Sheffield Lab 10040), track 10, polarity test signal. This is the same test described above.

The All-Star Percussion Ensemble (MMG MCD-10007), various tracks. Robert Hohner Percussion Ensemble, *Lift Off* (dmp CD-498), track 4, "La Bamba." The percussion should be bright and clear, the soundstage stable and precise.

Steve Miller Band, *Wide River* (Polydor 314-519-441), track 6, "Like a Horse and Rider." The snare drum should sound bright and real, not muffled. The voice should be clear and articulate.

Prokofiev, *Lieutenant Kijé Suite for Orchestra* (RCA Gold Seal 60176), track 8. The trumpet should sound clear and bright.

Copland, *Billy the Kid* (Mercury Living Presence 434301), track 13, "Gun Battle." Listen for realistic, bright brass and sharp percussive transients.

Margie Gibson, *Say It with Music* (Sheffield Lab 10036). Gibson's voice should be clear, articulate, and forward.

One Night in Vienna (Windham Hill WD-1060), track 1, "Wishing Well." The percussive sounds should be clear, bright, and articulate.

Sheffield Drum and Track Disc (Sheffield Lab 11420), track 6. The cymbals should sound bright. The snare drum should have a clear, sharp sound, with good attack.



people will say that the voice is more forward and distinct when the polarity is correct.

The best source for testing your ability to hear the effects of polarity reversal is a live microphone feed. Have someone speak into a microphone that is connected to your recorder while you switch polarity back and forth, listening for a difference. The quality of the microphone can affect the results, so try to use a good one. (If you do this experiment later with loudspeakers, you will need a long microphone cable to allow the mike to be in a different room from the speakers so that the sound won't feed back and howl.)

Another good program source for this purpose is AM radio. Of necessity, AM broadcast limiters are designed in such a way that they maintain signal asymmetry. If you listen carefully to an announcer's voice, you should be able to hear a difference when you switch from positive to negative polarity. One switch position will make the announcer's voice sound more natural than the other, especially with certain hard consonants (Ts, Ps, and so forth).

Recordings, especially those that contain prominent brass or percussion, should also enable you to hear the effects of polarity reversal. I have listed a few suggested CDs in "A Polarity Tester's Listening Library."

If you can hear the effect of polarity inversion on some program material with earphones, then you will probably want to experiment with your loudspeakers. There are several things you can do to make the process easier. If you can, move your loudspeakers so that they are about 3 feet apart and away from any walls or objects that could produce acoustical reflections. Sit between the loudspeakers and as close to them as practical. Play some program material (pink noise from an off-tuned FM station or a test CD is excellent for this purpose) and move your head up and down while listening for any major changes in spectral balance. Try to keep your head in the spot that provides the smoothest sound with the least coloration; this will be the best position to listen for the effects of acoustical polarity.

SPEAKER-POLARITY SWITCHES

If you listen to a single loudspeaker, you can change polarity with a simple DPDT switch connected between your amplifier output and the speaker. If you use two speakers, you must be able to switch both of them simultaneously; this will require two DPDT switches or some other, more sophisticated system for reversing polarity.

...punes sound



Figure 3 is a schematic of a simple loudspeaker-polarity switch. This switch can be placed between your amps and speakers. If you have an external speaker selector that connects the negative wires for all the speakers together, as most of them do, you will have to put the switch after it.

I used a Radio Shack No. 274-623 eight-position pushbutton terminal for my loudspeaker-polarity switch; it will easily accept even very heavy cable. It has a diagram on the back of the package that will help you to cut the correct opening in the switchbox before you mount the terminal. I selected Radio Shack No. 275-652 flat-lever toggle switches, which are rated at 6 amperes, but any heavy-duty DPDT switches will work. The terminals and switches can be mounted on a Radio Shack No. 270-224 or 270-232 box. (These boxes are also large enough for the relay-type polarity switch discussed below.)

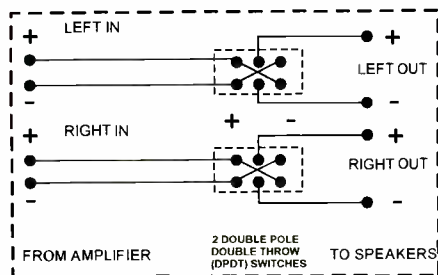


FIG. 3—
SCHEMATIC FOR
A STEREO
SPEAKER-POLARITY
SWITCH.

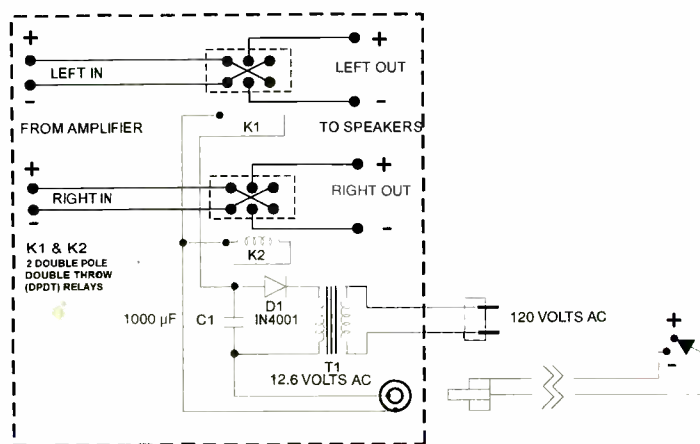


FIG. 4—SCHEMATIC FOR A RELAY-OPERATED
SPEAKER-POLARITY SWITCH ACTUATED BY A REMOTE
PUSHBUTTON.

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Since the distance between the terminals and the switch is very short, you can use 18- or even 20-gauge wire. Mount the switches close together so that you can flip them simultaneously with your thumb and fingers. If you glue a bar between them, this will be even easier.

If you determine that you can hear the effects of polarity inversion and that it is important to you to be able to set your loudspeakers to the correct polarity for each recording, you should probably build a loudspeaker-polarity switchbox that uses relays and a remote pushbutton so you don't have to leave your listening position. A schematic for a relay-type speaker-polarity switch, using two Radio Shack No. 275-218 relays, is shown in Fig. 4. The remote pushbutton can be mounted on a small box that you can hold in your hand. I used a Radio Shack No. 275-1565 push-on/push-off switch in a 2 x 1 x 1-inch case.

I hope that I have provided the incentive for you to experiment and discover for yourself whether you can hear the effects of acoustical polarity reversal. Remember that it is a learning experience; you might not hear the effects right away. Also remember that the quality of the program material and your earphones and loudspeakers, as well as your acoustical environment, can affect the results. I also hope that the guidelines that I have provided will make it easier for you to decide whether you are willing to accept upside-down sound. A

ARNIE *To Inf* NUDELL

A handful of now-legendary speaker designers (Rudy Bozak, Paul Klipsch, James B. Lansing, and others) did much to fuel the high-fidelity boom that occurred in this country immediately after World War II. In the 1950s, a second wave of talented designers (perhaps best exemplified by Henry Kloss and Edgar Villchur, who together founded Acoustic Research) rolled into the industry. Arnie Nudell is one of the most prominent speaker-designing entrepreneurs of the third wave. Not only has he been enormously successful, but he has

helped carve out an industry segment that churns with both passion and controversy: high-end audio.

Born in 1937 and raised in Los Angeles, Nudell was a dissertation away from his doctorate in nuclear physics at UCLA when he was sidetracked by a new scientific development. At precisely the time when the laser was discovered at Hughes Research Lab, Nudell held a summer job there. "I was so fascinated with this new field that I decided to stop my graduate work," he recalls.

For about five years in the mid-1960s, Nudell ran the laser lab at Litton Industries, where he did basic research and applied it by tying a pulse laser into an inertial navigation system. The marriage of these two elements resulted in a laser range-finder that helped American fighter pilots (notably those of the F-4D aircraft) bomb targets accurately on the first pass.

But two longstanding passions, music and hi-fi, continued to play a key part in Nudell's life. From an early age, he spent considerable time experimenting with new loudspeaker designs. Eventually, one that he devised with a Litton colleague who shared his interest in music reproduction sounded just the right note, which led to the founding of Infinity Systems in 1968.

In 1989, after 21 years at the helm of the company he had guided into the ranks of America's top three speaker companies, Nudell left Infinity. He is now president of Genesis Technologies, the Colorado-based firm he founded in 1992 with Paul McGowan (the "P" in PS Audio), and he recently designed a line of speakers for Eosone, a new company whose products are being sold through the Best Buy chain.

D.L.

GENESIS TECHNOLOGIES V (LEFT) AND I

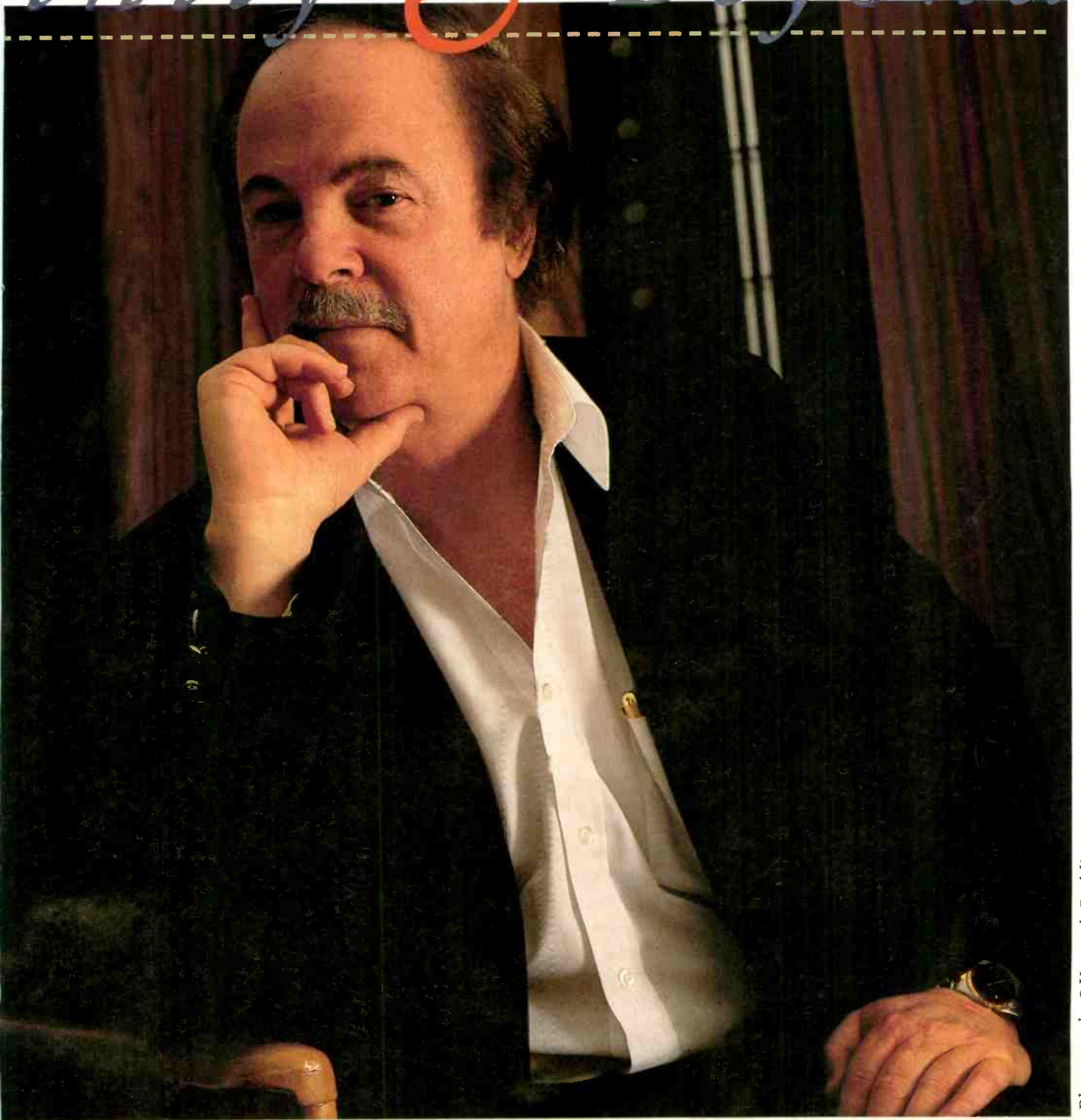


The thing I look for most in designing a loudspeaker is harmonic

THE AUDIO INTERVIEW

by David Lander

inity & Beyond



Photograph: © Kenneth Redding

integrity. Without it, many of the other elements are impossible.



INFINITY
SERVO-STATIK 1A
SPEAKER SYSTEM

When did music become an integral part of your life?

When I was a little kid. I started playing the clarinet when I was about 6 years old, and I played semiprofessionally for a while. I played in the California All-Youth Symphony, and at one point I was considering going into music, although I wanted to be a conductor. But I rejected that idea at a very young age because, to be the conductor that I wanted to be, I'd have to have had perfect pitch, and I didn't.

I was first exposed to opera by my parents and their friends when I was about 8 or 9. They figured they were going to put me through one night of torture so that I would at least get exposed to it. So I went, and much to their surprise, I was the one who made them get all the opera tickets from then on. When they didn't go, I went myself. Those were the days when the San Francisco Opera was coming down to Los Angeles, so I saw really good stuff.

I understand that you also began designing speakers early on.

I started designing loudspeakers at 9 or 10. Through college I designed all kinds of

loudspeakers. I spent hundreds and hundreds of hours in the anechoic chamber at UCLA and closed it down at 1 o'clock in the morning. I just stayed up all night and did measurements.

When I was at the laser lab at Litton, I got together with an electronics guy, John Ulrick, who was designing servo systems for inertial navigation. He was a hi-fi junkie just like me and also loved music. We created a speaker using electrostatic panels and a servo woofer system. We didn't think a full-range electrostatic could portray an orchestra very well. But with an electrostatic from about 100 Hz, and a servo woofer system that matched the electrostatic's speed and distortion characteristics, we thought we would have something.

There was no such hybrid in those days, was there?

No. There were no servo systems either. There had been *writings* about theoretical servo systems that could be done this way or that way, and we came up with our own way. We made them much better subsequently, but we found that, indeed, there was a huge improvement over any existing bass system. The servo system's enclosure was about 20 inches per side, and it had an 18-inch woofer in it. We compared it with a four-thirds Klipschorn, a speaker 1½ times the size of a normal Klipschorn that I had made myself, also using an 18-inch woofer. In our judgment, the new system was far better. The four-thirds Klipschorn had previously been my reference, so we realized we had opened up a whole new area of bass reproduction.

And new pricing territory. Your first speaker system, the Servo Statik, sold for about \$2,000, which made it the most expensive loudspeaker of its day. It actually cost 30% or 40% more than the next most expensive model. What did people in a world that

hadn't known such a thing expect from a speaker that cost so much?

First, that the loudspeaker had to perform in a totally different and better way than anything before it. Second, that the speaker's fit and finish had to be in a league with the finest furniture. And that's what we tried to achieve with the Servo Statik. We found that it sounded so radically different from other speakers that when people came in for a demonstration, it only took about five minutes for a sale. The money would just be plunked down.

Did this surprise you?

Yes, of course it surprised me.

These people weren't buying the Servo Statik for prestige?

They were not. The market has changed in that regard. A lot of expensive, very good-looking loudspeakers today sell because of prestige.

With the introduction of the IRS in 1978, you pushed Infinity's top price up to \$20,000 per pair. At the same time, you were pushing at the bottom of the pricing envelope; the least expensive Infinity model cost about \$200 a pair. Did any other speaker company attempt working at both ends of the price spectrum?

I don't think so. We were pushing in both directions. We tried to take the state-of-the-art technology we had developed for the top end as low as we could. Take the IRS, for example. We developed the EMIT tweeter and the EMIM midrange, and we were the first to develop and use polypropylene in the United States. All of those things were originally done for the IRS, and all were brought down to much less expensive speakers.

Did Infinity build its own drivers?

We designed all of our drivers. We built some, but many we had built elsewhere.

In developing the Servo Statik, how rigorously did you apply the lessons you learned during all those nights in the anechoic chamber? How stringent were you about measurements?

The Servo Statik was one of the first speakers CBS Labs tested for *High Fidelity Magazine*. It measured ± 2 dB from 20 to 20,000 Hz. As long as that magazine used CBS Labs, nothing even came close. You've got

It's taken us a long time, but we've finally perfected the servo bass

Arnie Nudell

to get the physics right. Then you spend a long time making it sound like music. The question is, what measurements are we talking about? And what correlation do those measurements have with performance? We still can't answer the latter question, although we do understand it better now. We have many more measurements, and we have much better measurement techniques. All these help us a great deal in getting the design process started. But with regard to the final making of music, you throw the test instruments away and just listen.

Some people would argue that the ear is variable and can be imprecise at times, because of our moods or factors that we don't understand.

My ear is precise. Not that it doesn't vary with mood or whatever, but there's a constancy to my hearing that most people don't have. I hear an orchestra in my head; I can hear a whole symphony orchestra and know exactly what those instruments sound like. And I know that if a loudspeaker sounds similar to what I hear in my head, then I'm getting close. That is invariant.

Is there never a time when something sounds different from day to day?

I never say never.

How much of your time is spent on the art—the listening—versus the science of design?

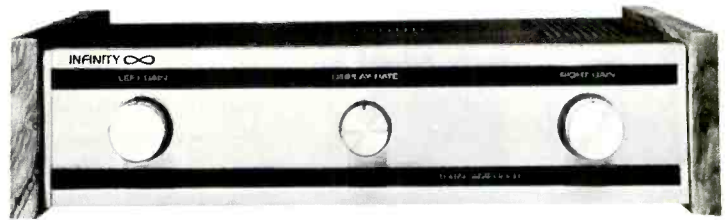
Most of my time is spent trying to get that loudspeaker in front of me, which has passed all this prerequisite scientific experimentation, to sound like music. And this takes a lot of time and patience. I can hear in my head what it should sound like, but then what do I do to the loudspeaker? What is the next step to make it sound like what I hear in my head? When I find out what that is, it could be a month later, or it could be six months.

The first several changes you make may fail to solve a problem.

That is correct. After all these years of designing loudspeakers, however, I have a much better idea of what adjustment bends the sound in a particular way or moves it more the way I want.

In what areas do you find adjustments tend to be effective?

After you've tended to what kind of drivers to use and their materials, as well as the cabinet and its geometry, the final thing is, of course, the crossover network. One of my philosophies is that all the drivers must be electrically in phase, never out of phase, and you need very fancy crossover networks



INFINITY SWITCHING AMPLIFIER

to ensure this. And then there's the crossover components: There are very, very excellent inductors that have wonderful characteristics across the entire audio band, and there are others that have lousy characteristics. You have to be selective. At Genesis Technologies, we've designed and have made for us our own kind of capacitor. Most capacitors are featherweight, whereas ours weigh fractions of a pound because of the materials that we use. So if you talk about all these adjustments, you have to mention kinds of components, quality of components, and the kinds of crossover slopes available to you—or that you have to make up. We use very, very extensive computer modeling to help us in this quest.

If I asked you for a single key that would unlock your design philosophy, would I be leading you to oversimplify?

I think it's an oversimplification, but if I had to distill it down to one thing, I guess what I look for most in designing a loudspeaker is harmonic integrity. Because without that, many of the other elements are impossible. Without harmonic integrity, it is very, very difficult to make a recorded instrument sound like a real instrument in space.

Infinity went beyond manufacturing loudspeakers during your tenure. You had some interesting products in other component categories.

All the people at Infinity were audio freaks, and we were interested in every aspect of audio. As a consequence, long before there was such a thing as a hybrid circuit, we developed one for the world's first commercial Class-D switching amplifier. FETs had

never been dreamed of for use in preamplifiers in those days, yet we made one. And we made other electronic products.

You had the Black Widow tonearm.

With the Black Widow, I think we came up with a way to solve a problem no one else had solved. There were these big, thick, heavy tonearms, but the compliance of cartridges at that time was getting higher and higher. The big, heavy tonearm did not match the higher-compliance cartridge, so we came up with a tapered carbon-fiber arm that had very low mass and very low friction. You could put a high-compliance cartridge in our arm, and it would sound like a totally different cartridge. You know, one year we sold more separate tonearms than anybody else in the world.



EOSONE RSA100 SATELLITES

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Arnie Nudell



EOSONE RSF1000

What were your goals in starting Genesis Technologies?

One reason I left Infinity was that it had grown so huge. Many of my goals certainly had been met, but in the process of running such a gigantic company, I had less and less time to do the thing I loved most, designing high-end products. It became very frustrating. Genesis Technologies is not going to be another Infinity; it's not going to be so large. We're going to concentrate on the very highest end of audio and the farthest reaches of what can be done, whether it be in speakers or anything else. We now have the Digital Lens, which took us two years to perfect. It's an electronic digital interface that goes between a CD player and a D/A converter. It does two things. First, by using a memory buffer, it stores each digital word and clocks it out very precisely to eliminate jitter. Second, dither is added to create a 20-bit word, thereby triggering the 20-bit format in the D/A converter.

Did any startling new discovery help spawn Genesis Technologies?

It was really a continuation of my thinking for many years, even when I was working at Litton: Perfecting all kinds of new materials for loudspeakers and perfecting servo systems. Remember, we started that a long time ago. Genesis has servo amplifiers that go with most of our loudspeakers. It's taken us a long time, but we've finally perfected the servo bass system to where it's the best bass system in the world, bar none. We've come up with new ribbon technology. It not only has much lower distortion than previous designs, but we've also increased the dynamic range of ribbon and planar loudspeakers. And we've come up with some interesting new crossover components, such as the capacitors I mentioned earlier.

What were your design goals with Eosone?

To take the technology that really works in high-end audio and try to bring that technology down to a point where it can be utilized in a less expensive product.

All Eosone speakers are dipoles. This is probably the first time any lower-priced consumer speaker has been dipolar. One of the main advantages is that a dipole interacts with the room in a much more favorable way. It has a cardioid pattern from front to back, the back radiation being out of phase with the front, and the first side-wall reflection is essentially zero. It allows you to hear, in a much better way, the character of the recording as opposed to sound bounced around the room, initially a lot, and then distorted by the room. In addition, since a dipole radiates sound to the rear, delayed maybe 30 milliseconds, the old problem of one sweet spot really doesn't exist. Music and audio/video are now becoming family entertainment, so a family can gather around a system and enjoy it as much as the guy sitting right in front of it.

Off to the left, off to the right, or even in the kitchen, the overall effect is much more enjoyable.

You've made it clear that your heart is with the high end. Why, then, have you bothered designing a line of popularly priced speakers at this point in your career?

Since I produce some of the most expensive speakers in the world, certainly that part of me is satisfied. But it's still very gratifying to take this kind of sound and technology down to where greater numbers of people are able to enjoy it. It's a continuation of what I've been doing since the beginning of Infinity.

Did you design Eosone speakers specifically for home theater?

For audio and home theater. They were designed for both.

During your career in the audio industry, you've seen quadraphonic sound and time-delay wither on the vine. Do you think multichannel home music reproduction is finally going to be accepted?

There's no doubt.

And will that lead to more specialized speaker design?

Yes, I think we'll get much more specialized kinds of loudspeakers that will enhance multichannel audio and home theater.

Dynamic range has always been important to you. Is this the frustrated conductor emerging?

[Laughs.] Probably, but if one is truly to create the sound of a symphony orchestra (and I'm just using that as an example because it's closest to my heart), then the dynamic range of loudspeakers and of the whole audio chain has to be enormous. And we're just getting to the point where we can see, in the distance, performance reminiscent of the dynamic range that I hear in Carnegie Hall, for instance. Digital technology has helped a lot, and some of the newer loudspeaker technology has helped a lot.

You've used the word "perfect" several times during our conversations. Is perfection your goal in speaker design?

Absolutely. It would be very nice if, in my lifetime, we were able to make the breakthrough and come very close to perfect reproduction of a live symphony orchestra. That would be wonderful. A

I can hear in my head what a speaker should sound like.

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D. B. KEELE, JR.

PARADIGM REFERENCE STUDIO/100 SPEAKER

The last Paradigm speaker I tested, the Eclipse/BP (August 1995), was a bipolar system. But the Studio/100, which comes from this Canadian company's new Paradigm Reference division, is a conventional, front-radiating, design. The four speakers in the Reference division's Studio series, of which the Studio/100 is the top model, are meant to compete with high-end models while selling for relatively modest prices (from \$1,800 per pair down to \$650 per pair).

To achieve the Reference Studio series' goals, Paradigm—which makes all its own drivers, crossovers, and cabinets—concentrated on the speakers' sound, as judged by double-blind listening tests, and not on fancy features that don't directly contribute to the sound. Though the company has extensive engineering and R&D facilities, it also uses the findings of Canada's National Research Council. Through its studies, the

Rated Frequency Response: 39 Hz to 22 kHz, ± 2 dB.

Rated Sensitivity: 88 dB at 1 meter, 2.83 V rms applied.

Crossover Frequencies: 270 Hz and 3 kHz.

Rated Impedance: Nominal, 6 ohms; minimum, 4 ohms.

Recommended Amplifier Power: 15 to 350 watts per channel.

Dimensions: 45 in. H x 10 $\frac{1}{4}$ in. W x 16 $\frac{1}{4}$ in. D (114.3 cm x 26 cm x 41.3 cm).

Weight: 87 lbs. (39.5 kg) each.

Price: \$1,800 per pair in cherry or black-ash laminate; hardwood finishes available at extra cost.

Company Address: c/o AudioStream, M.P.O. Box 2410, Niagara Falls, N.Y. 14302; 905/632-0180.

For literature, circle No. 90



National Research Council has found that listeners prefer speakers that have flat and smooth on- and off-axis frequency response (particularly through the midrange), smooth total energy response, and low distortion.

The Reference Studio/100 is a three-way, floor-standing system that uses four drivers: two vertically stacked 8-inch woofers in a vented enclosure, one 6-inch midrange in a sealed enclosure, and a 1-inch tweeter. The cabinet is only 10 $\frac{1}{4}$ inches wide but is 16 $\frac{1}{4}$ inches deep.

A long port tube, with a large diameter and flared ends, emerges just below the woofers. It tunes the vented box to 20 Hz, which lets the Studio/100 generate usable power down to 17 or 18 Hz—uncommonly low, even for subwoofers. Tuning the system this low raises the risk of increased distortion at higher frequencies, where most of the bass energy in recordings typically resides. For this reason, designers of vented boxes usually choose higher tuning frequencies,

between about 32 and 45 Hz; this minimizes bass distortion on most music.

The Studio/100's long-throw woofers and midrange driver have damped, mica-loaded polymer cones, which are said to provide smooth, uncolored response. These drivers also have large magnet assemblies with symmetrical field geometry, high-temperature multilayer voice coils, damped butyl-rubber surrounds, and diecast aluminum frames.

The tweeter has a low-mass aluminum dome with a textile suspension. Its voice

Photos: Michael Groen

coil is wound on a ventilated aluminum former and is cooled with magnetic fluid. The tweeter's faceplate is tapered, to minimize diffraction and to smooth on- and off-axis response.

Paradigm says it designs its drivers to have near-ideal response instead of designing crossovers to correct the drivers' flaws. This allows the use of simple crossover networks. The company states that its crossovers are phase-coherent, quasi-Butterworth designs built with high-quality, close-tolerance components. The Studio/100's crossover is on two small PC boards, one each for the high and low frequencies, and is on the rear of the input-

**WITH THE STUDIO/100s
IN YOUR SYSTEM,
YOU WON'T NEED
A SUBWOOFER!**

connector cup. It contains 10 components: two resistors, four inductors, and four capacitors. The woofers are connected in parallel and driven by a second-order low-pass filter. The midrange driver is fed by a band-pass network consisting of second-order low- and high-pass filters. The tweeter crossover is a second-order high-pass filter. The midrange and tweeter are connected in opposite polarity to the woofers.

Heavy-gauge copper cable is used for all internal connections, and the gold-plated input terminals can accept cables of large diameter. The terminals allow bi-wired or bi-amplified connections; straps are provided for conventional, single-cable, wiring.

The Studio/100 was designed to sound best with its grille on. The grille fits flush with the drivers, to minimize edge diffraction and smooth the response.

Like the Eclipse/BP, the Studio/100's cabinet uses a bracing system that Paradigm calls the Cascade Enclosure. Three large, full-perimeter shelf braces (effectively, shelves with large holes) connect the Studio/100's front, back, and side panels. Vertical braces lock the shelf braces to each other and to the cabinet's top and bottom. This assembly is said to be very rigid and strong. The cabinet stands on gold-plated, solid-

brass, adjustable feet that have sharp spikes and locking collars.

Measurements

I measure anechoic frequency response with and without a speaker's grille and usually find that leaving the grille on makes the response rougher. But with the Studio/100, I got much smoother and flatter response with the grille on (Fig. 1). Without the grille, there's a fairly sharp dip of about 6 dB at 6.9 kHz and a shallow dip at 1.9 kHz. With the grille, the curve is significantly smoother between 1 and 10 kHz but has a slight depression, two-thirds of an octave wide, just above 10 kHz. This curve fits a tight, 4.5-dB, window between 39 Hz and 20 kHz, essentially meeting Paradigm's specification; between 41 Hz and 10 kHz, the curve fits a much tighter, 3-dB, window. Bass response is quite extended: 3 dB down at about 40 Hz, 6 dB down at 37 Hz, and 10 dB down at about 30 Hz. In a typical listening room, a pair of Studio/100s would provide even greater low-frequency output and extension.

The Studio/100's sensitivity, averaged from 250 Hz to 4 kHz, measured 87.8 dB, essentially as specified. The right and left speakers matched fairly closely, ± 0.6 dB from 100 Hz to 16 kHz. Above 16 kHz, however, one speaker's output rose above its mate's, becoming 4 dB louder by 20 kHz.

Figure 2 shows the Studio/100's phase and group-delay responses, referenced to the tweeter's arrival time, as well as the speaker's waveform phase. The phase curve is quite smooth and well behaved. The group-delay curve, averaged between 1 and 3 kHz, indicates that the midrange is delayed about 0.36 millisecond relative to the tweeter.

This is caused partly by electrical delay in the crossover and partly by misalignment of the driver's acoustic centers. The curve of waveform phase indicates whether wave-shapes will be preserved in specific frequency ranges. The Paradigm's waveform phase

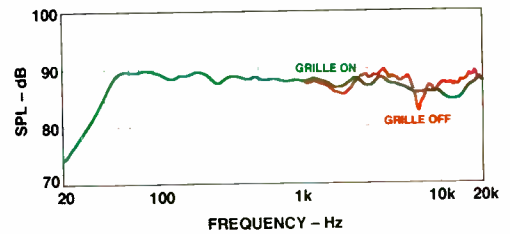


Fig. 1—One-meter, on-axis frequency response.

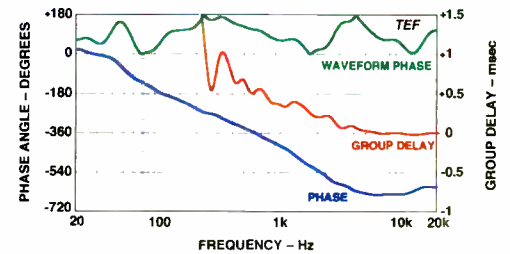


Fig. 2—On-axis phase response, group delay, and waveform phase.

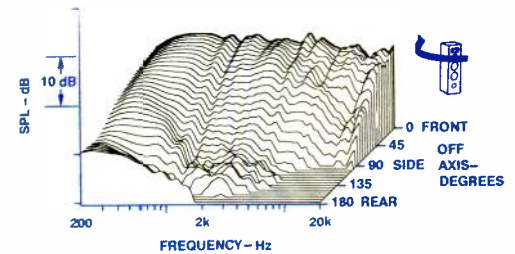


Fig. 3—Horizontal off-axis frequency responses.

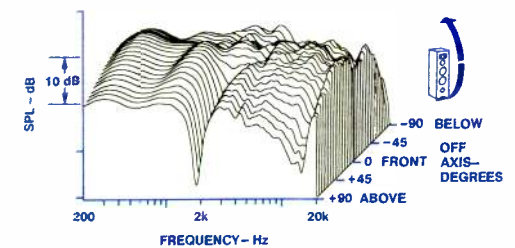
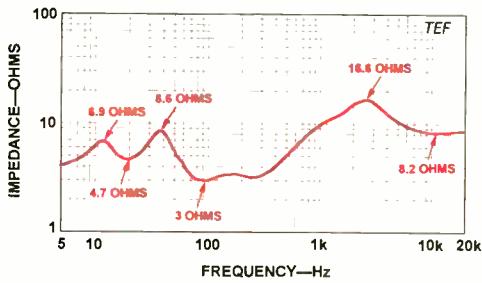
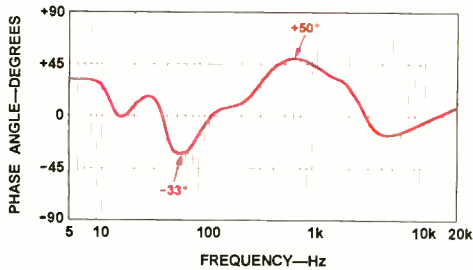


Fig. 4—Vertical off-axis frequency responses.

continually changes with frequency, never remaining at or near 0° or 180° . Therefore, waveforms will not be preserved over any significant bandwidth. This behavior, however, is very typical of speakers not specifically designed to maintain waveform phase.



A



B

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

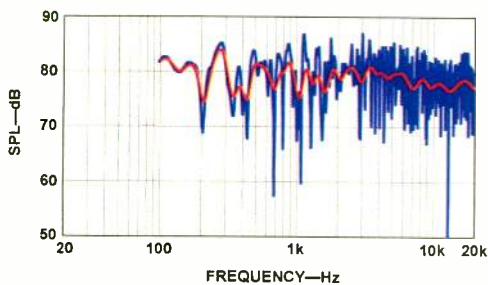


Fig. 6—Three-meter room response.



The gold-plated input terminals can accept cables of large diameter.

Figure 3 shows the Studio/100's off-axis response over a range of horizontal angles (the bold curve at the rear of the graph is the on-axis response). These curves are very well behaved and exhibit no high-frequency rolloff above 10 kHz in the main horizontal listening window (within $\pm 15^\circ$ of the axis). The curve-to-curve uniformity is excellent.

The Studio/100's vertical off-axis response is shown in Fig. 4 (on-axis response is the bold curve near the center of the graph). Response in the main vertical listening window (within $\pm 15^\circ$ of the axis) is very uniform on-axis and above the axis. Below the axis, there's a slight depression between 1 and 3 kHz, just below the upper crossover (not clearly seen, because the curves in front of it are higher). Above and below the main listening window, the response exhibits a deep dip at about 2 kHz.

At low frequencies, the Studio/100's impedance magnitude (Fig. 5A) has the normal double-peak characteristic of a vented enclosure. But in this speaker, the first peak is below the audio band, at 12 Hz; the second peak is at 39 Hz; and the dip between them is at 20 Hz, the frequency to which the vented box is tuned. These measured frequencies are significantly lower than in most other speakers. After reaching a minimum of 3 ohms at 95 Hz, the Studio/100's impedance rises smoothly and reaches a peak of 16.6 ohms at 2.8 kHz, just below the upper crossover.

The Studio/100's impedance phase (Fig. 5B) reaches its minimum of -33° (capacitive) at 55 Hz and its maximum of $+50^\circ$ (inductive) at about 600 Hz. These values, along with the speaker's low (3-ohm) minimum impedance, indicate that the Studio/100 will be a moderately difficult load for most amplifiers; I would definitely not recommend wiring two pairs of Studio/100s in parallel.

The Studio/100's cabinet was quite rigid; there were no significant side-wall resonances. The 8-inch woofers had a generous excursion capability of about 0.55 inch, peak to peak, and overloaded quite gracefully. I noted no dynamic offset at any drive level or frequency. The vented enclosure reduced the woofers' excursion by about two-thirds at 20 Hz, the enclosure's resonant frequency, a sign that the woofer is very well loaded. (I tested excursion by temporarily covering the vents.) Noise and turbulence from the vent were among the lowest I've measured, even when I fed the speaker high power at the enclosure's 20-Hz resonant frequency.

Figure 6 shows the Studio/100's 3-meter room response, with both raw and sixth-octave-smoothed data. Overall, the averaged curve is quite well behaved and balanced, and it does not have any extreme peaks or dips. Aside from a peak at 290 Hz, the averaged curve fits a fairly tight, 8-dB, window, including a slight reduction in level above 6 kHz.

In Fig. 7, the Studio/100's E_1 (41.2-Hz) harmonic distortion, the most prominent component (reaching a high 24% with an input of 100 watts) is the third harmonic.

**DELICATE ECHOES
CAME THROUGH
THE STUDIO/100s
WITH SPACIOUS,
UNCOLORED IMMEDIACY.**

This is a sign of symmetrical excursion limiting. The other harmonics, though lower, are still relatively high. Despite fairly high distortion at E_1 , the Paradigm speaker sounded fairly clean, thanks to low levels of higher-order harmonics (not seen in the graph). As noted earlier, tuning the woofer enclosure very low, to 20 Hz, reduces the distortion at very low frequencies but does not reduce it at higher bass frequencies, such as the 41.2-Hz tone used in this test. Even so, the A_2 (110-Hz) harmonic distortion (not shown) rose to only 1.4% second harmonic and 0.9% third at 100 watts. Higher harmonics were below the floor of my measuring gear. The A_4 (440-Hz) harmonic distortion (not shown) was also low,



Paradigm manufactures all the drivers, cabinets, and crossovers for its speaker systems.

The peak output then rises smoothly, first reaching 121 to 123 dB SPL between 90 and 250 Hz and then rising to the high range of 125 to 126 dB at all higher frequencies. The 110-dB SPL level is reached at a very low 22 Hz, and 120 dB SPL is reached at 70 Hz. The lower the frequency at which a speaker can deliver 110 dB SPL, the better its bass output. The Studio/100's 110-dB frequency is matched by only one other speaker I've tested, the Hsu Research HRSW10 subwoofer (November 1992 issue) and surpassed only by the Legacy Convergence (February 1993). You won't need to use a separate subwoofer with this Paradigm!

Use and Listening Tests

The Paradigm Studio/100s were quite simple to unpack, move around, and set up. They're just about the maximum weight and size one person can handle easily. For the money, construction quality and appearance were very good. The cabinets were vinyl-wrapped yet looked quite handsome.

The grille is designed as an integral part of the Studio/100. Without the grille, the drivers protrude from the front baffle to a distance that just equals the thickness of the wooden grille frame. When the grille is in place, the drivers' edges essentially disappear, and the front of the system forms a smooth, diffraction-free surface. The grille, which attaches with pegs that fit sockets in the baffle, was easy to remove and reinstall.

The speaker's spiked feet were also easy to attach and remove. The spikes pass through thick brass locking collars that can be used as ordinary feet if the spikes are reversed. I used the speakers with the spikes in place.

Paradigm recommends that the Studio/100s be broken in before use, so I fed them a high-level, low-frequency sine wave for several hours. I used conventional (single) wiring; the rear-mounted terminals were easily accessible.

The owner's manual folds out into six 8½ x 11-inch pages, one side in English and

with the third harmonic reaching only 2.5% and the second and higher harmonics remaining below 0.2%.

The Studio/100's intermodulation distortion (IM), tested with 440-Hz (A_4) and 41.2-Hz (E_1) tones of equal power, reaches only 6.3% at full power (Fig. 8). This is because the Paradigm's lower crossover frequency occurs at 270 Hz, which falls between the two tones of the IM test; as a result, the woofer handles the lower (E_1) tone's energy and the midrange handles the higher (A_4) tone.

Figure 9 shows the Studio/100's short-term peak input and output capabilities as a function of frequency. The peak input power starts very high (450 watts at 20 Hz), falls somewhat (to 150 watts at 45 Hz), rises to a small plateau (about 1,400 watts between 100 and 160 Hz), and then rises smoothly (to 7,000 watts above 800 Hz). The high power handling at 20 Hz is a direct result of the woofer enclosure's low tuning frequency; if the cabinet were tuned higher, to a more typical 40 Hz or so, power handling would rise significantly at 40 Hz but the 20-Hz power handling would be reduced considerably. The benefits of the Studio/100's low tuning outweigh the drawbacks.

As you can see in Fig. 9, the Studio/100's peak acoustic output with room gain starts very high, at 108 dB SPL at 20 Hz, one of the highest 20-Hz levels I have measured.

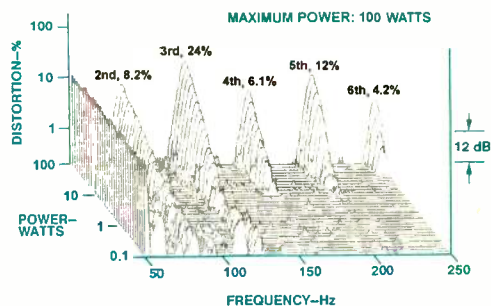


Fig. 7—Harmonic distortion for E_1 (41.2 Hz).

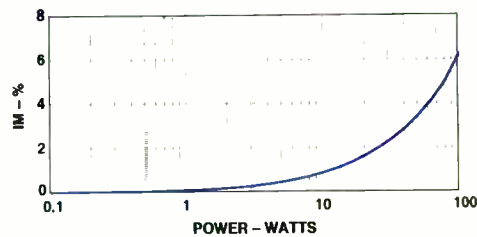


Fig. 8—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

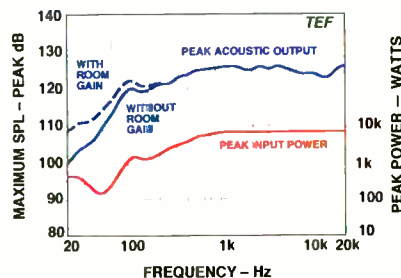


Fig. 9—Maximum peak input power and sound output.

the other in French, and covers all models in Paradigm's Studio series. It discusses the listening room, speaker location, connections (including a chart of suggested cable size versus length), prevention of speaker damage, bi-wiring, and passive biamping (driving the speaker's high and low sections with separate amplifiers but without an external electronic crossover). Paradigm recommends aiming the speakers toward the listener (which I did in my listening tests) and spacing them somewhat closer together than I normally do—6 feet apart for a distance of 9 feet from listener to speaker. (I normally space speakers 8 feet apart and sit 10 feet away).

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Spoiled by the performance of the speakers I tested for *Audio* last month, the KEF Model Fours (which cost about three times as much as the Studio/100s), my expectations for the Paradigms were not very high. Boy, was I surprised! From the beginning, the Studio/100s made an extremely favorable impression. They rattled my windows and doors on music that had high levels of low bass yet accurately reproduced the subtle nuances and room ambience of well-recorded chamber music.

On Pat Coil's excellent jazz/pop album *Schemes and Dreams* (Sheffield Lab 10042-2-F), the Studio/100s' sound and spectral balance were very similar to those of the B&W 801 Matrix Series 3 speakers I used for comparison. The Paradigms did particularly well with the percussion and high-

frequency sounds on this disc; their response was smooth and extended, without the hardness I've heard from some metal-dome tweeters. Their bass response on this music was very satisfying; the Paradigms delivered a lot of punch and articulation at only slightly lower levels than the B&Ws did. The Latin horns on track 6 were loud, clean, and pure, and their presentation was properly up-front. I had to turn the Paradigms down by about 2 to 2.5 dB so that they would not be louder than the B&Ws. The Studio/100s also had very broad horizontal and vertical coverage.

With pink noise, the Paradigms went as far up and down the scale as the B&Ws, sounding just slightly different from the 801s; a bit of tonality was evident in the midrange that the B&Ws did not exhibit. On the stand-up/sit-down test, the Paradigms' fine performance equaled that of the B&Ws. With band-limited pink noise, the Studio/100's clean output at the lowest (20-Hz) third-octave band equaled that of the best systems I have tested. There was less wind noise and turbulence from the Paradigm's port than from the B&W's played at the same level. The Paradigm's output in the next few third-octave bands was also extremely good. However, I noticed some limiting of the output at 32 and 40 Hz as compared to the B&W's output.

The Paradigm Studio/100 is one of the few speakers that can properly reproduce the low, 22-Hz, note on track 4 of Respighi's "Pines of Rome" (London 410 145). Even fewer can do justice to the 17-Hz organ pedal note on track 2 of Saint-Saëns' Symphony No. 3 (Philips 412619), but the Studio/100 succeeded here as well. When I play these two CDs through most speakers, I either don't hear this bass or hear intermodulation distortion of the higher frequencies. The Studio/100s also reproduced the orchestral passages on these discs very well—smoothly and cleanly and

with a broad, accurate soundstage.

These Paradigm speakers handled the extreme dynamics of the Rachmaninoff piece (track 18) on Antonin Kubalek's fine piano CD, *My Gift to You* (Dorian

DOR-90218), very well. These Paradigms reproduced the loud, massive chords with great authority and did not diminish the power of the composition, the performer, or the piano he played.

The Studio/100s played rock and modern country music at near-concert levels. The bass was satisfyingly gut-thumping, and I could really get into the large-scale presentation.

Well-recorded female vocals, such as on *Jewels of the Polish Baroque* (Dorian Discovery DIS-80136), were quite realistic, and the Studio/100s reproduced the delicate hall reverberations with a spacious and uncolored immediacy. The trumpets on track 7 were particularly effective; I heard no trace of hardness.

Reviewing two excellent systems in a row, the KEF Model Fours and these Paradigms, has made my job very enjoyable. The Studio/100 has many of the same fine qualities as the Model Four, but its price is far lower. And the Paradigm's low bass response is superior, bordering on the phenomenal (pipe-organ aficionados, take note). The Studio/100 delivers an excellent combination of attributes. It can play loud and clean while maintaining superb overall sound quality, has extended bass response, and also looks quite good—all for a reasonable price. Highly recommended!

A

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YAMAHA DSP-A3090 A/V INTEGRATED AMP



To an engineer, "DSP" signifies a microprocessor that is optimized to perform digital signal processing. To most audiophiles, "DSP" signifies the processing itself. But for Yamaha, "DSP" means Digital Sound Field Processing, an even more specific task. Yamaha's adoption of the term dates back a decade, when it introduced the DSP-1, the first device that attempted to re-create the sound-field patterns of real concert halls, jazz clubs, and other environments in the home.

The DSP-A3090 is the latest and most all-encompassing Yamaha Digital Sound Field Processing amplifier. It has seven built-in power amps, Dolby Pro Logic and Dolby Digital (AC-3) decoding, 28 digitally created sound-field enhancements that you

can customize, digital EQ, tone controls, unusually flexible recording facilities, and the ability to accommodate a remarkably broad array of program sources. Without question, the DSP-A3090 is the most complete and well-conceived A/V integrated amplifier I've seen.

To produce the DSP-A3090, Yamaha created a new VLSI DSP chip, the YSS-214, which reportedly has 33% more processing power than its predecessor. The YSS-214 is used strictly for Digital Sound Field Processing. Although Pro Logic decoding also is performed digitally, it's done with a different Yamaha chip, the YSS-213. This in itself is interesting, since the Zoran chip that Yamaha uses for AC-3 decoding can also handle Pro Logic decoding and is normally used for both functions. Obviously Yamaha prefers its own implementation of Pro Logic decoding.

The DSP-A3090's Digital Sound Field Processing offers 12 music modes: six based on the measured sound-field patterns of specific European and American concert halls, two based on the measured sound fields of churches (in Tokyo and Freiburg), two typical of rock-concert environments (one being the Roxy Theater in Los Angeles), and two representing jazz clubs (including the Big Apple's famous Village Gate). There are four "Concert Video" modes ("Classical/Opera," "Recital," "Pop/Rock," and "Pavilion") and two modes for television viewing ("Mono Movie" and "Variety/Sports").

Four DSP-based enhancement modes, which Yamaha calls "Cinema DSP," are available for surround soundtracks: "Spectacle," "Musical," "Adventure," and "Enhanced." The Digital Sound Field Processing comes after the surround decoding, so it builds upon whatever directional information is available. Because the sound fields generated from a Dolby Digital (AC-3) source are not the same as those derived from Pro Logic (Dolby Digital has stereo surround channels), the result is a total of eight "Cinema DSP" submodes: four each for Dolby Surround and Dolby Digital (AC-3) soundtracks. These are in addition to conventional (unenhanced) Pro Logic and Dolby Digital surround.

When Yamaha "Cinema DSP" is used with AC-3, the YSS-214 chip generates three distinct sound-field patterns, one based on left-surround information, another on right-surround signals, and the third ("Presence") on a mix of the main left, main right, and center channels. Each of the YSS-214's three processing blocks generates

Rated Power Output into 8 Ohms:

Main, center, and rear channels, 80 watts/channel at 0.015% THD, 20 Hz to 20 kHz; front effects channels, 25 watts/channel at 0.15% THD at 1 kHz.

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Weight: 46.3 lbs. (21 kg).

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four separate signals for the front-effects and rear channels. The three resulting pairs of front-effects signals are next merged by the YSS-214 chip and then fed to the left and right channels of the built-in front-effects amplifier.

Yamaha recommends that you place front-effects speakers outside of, and higher than, the main front stereo pair. If you choose not to use a second pair of front speakers, the front sound-field signals can be merged into the main front channels by setting the "Front Mix" switch (on the rear panel) to "5CH."

**YAMAHA'S DSP-A3090
IS THE MOST COMPLETE,
WELL-CONCEIVED
A/V INTEGRATED AMP
I'VE SEEN.**

The rear sound-field signals always merge with the AC-3 stereo surround information and feed the two rear speakers. For best results, Yamaha recommends that these speakers be placed 6 feet off the floor and behind the viewers rather than beside them. The front and rear speakers should be front-radiating types, not dipolar types.

The DSP-A3090's input array is the most comprehensive I've seen in an A/V integrated amplifier. For audio, there are provisions for a moving-magnet phono cartridge, a CD player, a tuner, and two tape decks (with record outputs for both). For audio/video sources, the amp has connections for a laserdisc player, a "TV/DBS" source, and three VCRs on the back plus a "Video AUX" input behind a hinged panel on the front. All VCR connections have recording outputs, and all video signals are carried on S-video and pin (RCA) jacks. There are S-video and pin jacks for one monitor, although, in an interesting twist, you can use the amp's setup menu to convert the "VCR3/DVD" output jacks to feed a second monitor. In addition to the analog audio inputs, the DSP-A3090 has optical digital inputs for a CD player, the "Tape 1" deck, a laserdisc player, "TV/DBS," and "VCR3/DVD." "Tape 1" is also outfitted with an optical digital output socket, for DAT or other digital recorders. The CD in-

put (but not the others) has a wired (coaxial) digital input as well as an optical digital input, and there's a coaxial "AC-3 RF" input for use with a laserdisc player.

The DSP-A3090 offers excellent versatility and should be quite resistant to premature obsolescence. Dolby Digital surround signals can be accepted from a laserdisc's RF output (the only way Dolby Digital is presently available) and demodulated and decoded by the DSP-A3090. In addition, AC-3 bitstreams (which will be available directly from DVD, HDTV, and possibly other sources) can be accepted via the amp's optical digital inputs and then decoded. Thus, the A3090 can accept up to three independent Dolby Digital sources (via the "AC-3 RF," "TV/DBS," and "VCR3/DVD" connections) and can switch audio and video together. The only restriction I see is that AC-3 bitstreams must be available via optical, not coaxial, connections—but that's the direction the industry is heading anyhow.

Further evidence of the DSP-A3090's obsolescence-proof design lies in its preamp-output facilities. Although the total power provided by this amp is impressive (450 watts into 8 ohms) and well distributed (80 watts in each of the five principal channels plus 25 watts for each front-effects channel), the DSP-A3090 also has preamp outputs for every channel and inputs for the three front power amps. Normally, these inputs are jumpered to their respective preamp outputs, but the jumpers are readily removed and the wiring can be easily rearranged. A "Main Level" switch on the back can be set to reduce the main front amps' gain by 10 dB. The center channel has two preamp outputs, so separate power amps could be used to drive a pair of center speakers. (One center-channel preamp output is jumpered to the internal power amp; the other is left uncommitted.) Inputs to the front-effects and rear amps are not accessible, but inserting a plug into these preamp outputs disconnects their internal power amps.

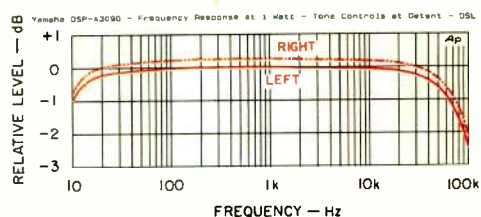


Fig. 1—Frequency response, stereo mode (no digital processing).

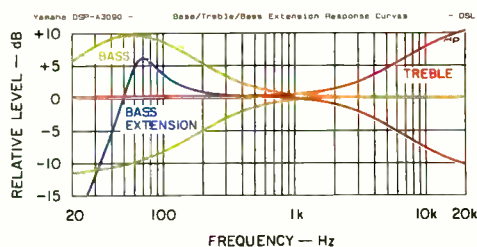


Fig. 2—Effects of tone controls and Bass Extension circuit.

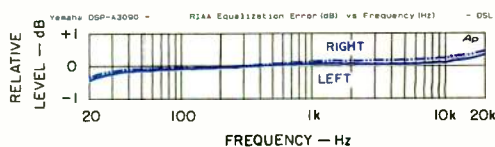


Fig. 3—RIAA equalization error.

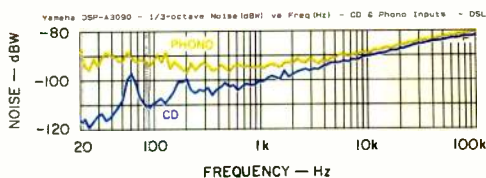
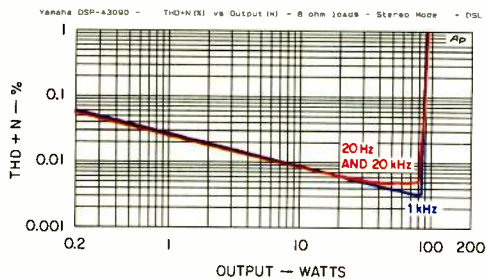
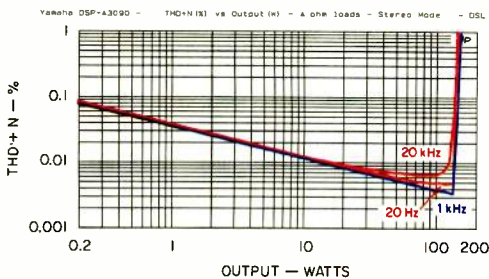


Fig. 4—Noise analysis.

Fleshing out the preamp connections are line-level feeds for "Mono" and "Split" subwoofers, three jacks in all. During setup, you choose whether to feed Dolby Digital's low-frequency effects (LFE) signal to the subwoofer outputs or to distribute it to the main front speakers if no subwoofer is used. You can also reroute the low bass energy (below 90 Hz) in each main channel to the subwoofer, send it to both the subwoofer and the main channel, or leave it in the main channels only. The "Mono" subwoofer output carries a mix of all signals assigned to the subwoofer. The "Split" jacks



A



B

Fig. 5—THD + N vs. output into 8 ohms (A) and 4 ohms (B), stereo mode.

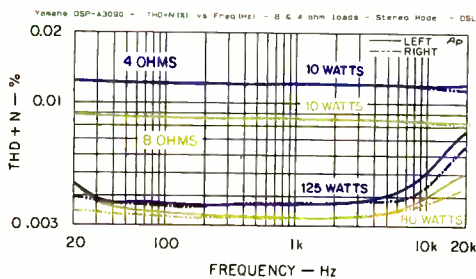


Fig. 6—THD + N vs. frequency, stereo mode.

assign bass from the left front and left rear to one subwoofer and assign bass from the right front and right rear to the other sub; the center and LFE bass go to both.

Multiway binding posts, spaced for dual-banana plugs, are used for all speaker connections. One set of main front, front effects, and rear speakers can be connected, but one or two center speakers can be used (a slide switch connects the center speakers in series if you do use two). All connectors on the rear panel are of base metal, though the "Video AUX" pin jacks and stereo headphone jack on the front panel are gold-plated. Three AC convenience outlets are provided, two switched and one unswitched.

In appearance, the DSP-A3090 makes a quiet statement. Tiny lights indicate the settings of its 10-position rotary source selec-

tor and its volume control. Both are motorized and can be actuated from the remote. Although the remote, which sports 64 buttons and three switches, is preprogrammed for Yamaha products, it can "learn" the control codes of other manufacturers' products. The remote is not illuminated, but it comes with overlays on which you can write button reassignments if you have a small pen and a steady hand. I'm not sure that will be necessary, since the controls for other components are logically grouped and carry standard designations.

The remote provides direct access to each of the 10 sources on the front-panel "Input Selector." It also provides access to all 30 processing modes, via 12 buttons. (The six audio and three TV DSP buttons have two alternative modes apiece, and the three theater buttons offer two separate choices for Pro Logic and AC-3 operation.)

The remote duplicates most front-panel functions. However, some functions are accessible only from the remote, whereas others are accessible only from the main chassis. For example, the "Bass," "Treble," and "Balance" controls are rotary knobs behind the main panel's door and are operable only from there. The same is true of the "Bass Extension" and "REC Out" switches. (The DSP-A3090's "REC Out" circuit, a variation on a traditional Yamaha nicety, enables you to dub from CD to tape 1 or to dub to VCR 1 from any of the other A/V sources while you're listening to or viewing a different program source. With "REC Out" set to "Source," the program selected for listening or viewing also feeds the recorders.)

With the "Input Mode" pad behind the front panel's door, you can choose the analog or the digital input for the four sources that offer both ("CD," "Tape 1," "TV/DBS," and "VCR 3/DVD") and choose the analog, digital, or AC-3 RF input for laserdisc audio. In "Auto" mode (the default condition), the DSP-A3090 selects digital signals over analog if both are present. It also identifies whether a digital signal is AC-3 encod-

ed or straight pulse-code modulation (PCM). If both coaxial and optical digital feeds are present on the CD input (the only one that accommodates both), optical is chosen over coaxial. The "Input Mode" pad lets you override these choices. Normally, "Auto" is fine, but, should a laserdisc AC-3 signal be interrupted by a pause or a chapter search, the A3090 will then revert to the digital or analog inputs. This briefly interrupts the sound, which can be avoided by defeating auto selection and locking in the AC-3 mode.

The final function accessible only from the main panel is "Input Trim." With this rocker bar, you can match each source's sound level to that of your CD player, which is taken as a reference. The gain change ranges from 0 to +6 dB in 2-dB steps. "Input Trim" also works in conjunction with the "Set Menu" button for system setup, but setup can be done from the remote just as readily. The "Program" rocker, behind the front panel's door, cycles through the DSP selections (although it's easier to choose them directly from the remote). The remaining button behind the door, "Effect," toggles between two-channel stereo and full DSP effect.

Whenever you select a different program source, its name appears for a few seconds in the amp's display, as does the audio input mode (e.g., "CD—Auto: Analog"). The display then reverts to the sound-field mode you've selected (e.g., "Church Tokyo"). Conventional stereo is indicated by "Effect Off."

You can change levels of the front effects, the center, and the rear channels only from the remote. Three sets of "+" and "-" pads are provided for this; each set allows adjustment from +10 to -40 dB or total muting. (The remote also has a "Muting" button that drops the level in all channels at once, by 20 dB.) A speaker-balancing "Test" function can be actuated from the remote. The master volume pads on the remote operate the main panel's motorized "Volume" knob ("Volume Up" or "Volume Down" appears in the display). The remote's "On Screen" key changes the display shown on your TV from full screen to a simple display along the bottom, or it turns this feature off.

Although the panel display is comprehensive, the on-screen displays are an important adjunct when setting up the DSP-

A3090. The permutations and combinations offered by Yamaha's DSP are astounding. There are 13 first-level choices in the menu system, many of which lead to further options.

The "Speaker Set" menu offers the usual choices to match your speaker arrangement (bass-cutoff choices for small or large main,



**WHAT MAKES YAMAHA'S
DSP DIFFERENT IS THAT
ITS SOUND FIELDS
ARE MORE BELIEVABLE
THAN MOST OTHERS'.**

center, and rear speakers plus a "Phantom" center). In addition, you can choose whether the bass from the LFE channel (and whatever bass may have been removed from the center and rear channels to accommodate small speakers) should go to the "Main" speakers, the "Subwoofer," or "Both."

From the "Low Freq. Test" menu, signals at 18 different frequencies (plus a noise signal containing frequencies from 35 to 250 Hz) can be routed to each speaker, individually, to check low-frequency balance. Two other first-level menus allow "LFE" output to be adjusted (in 1-dB steps over a 20-dB range) or muted, and you can adjust the center channel's delay (from 1 to 5 milliseconds, in 1-millisecond steps).

Another menu, "Center GEQ," is a digital graphic equalizer for the center channel. Each of its five EQ bands (100 Hz, 300 Hz, 1 kHz, 3 kHz, and 10 kHz) offers up to 6 dB of boost or cut, adjustable in 1-dB steps.

The "Cinema EQ" menu is more far-ranging. Comprising a shelving treble equalizer ("High") in tandem with a parametric equalizer ("PEQ"), it can be applied independently to the three main front channels, the front effects channels, and the rear channels. The "PEQ" can be centered

on any of 16 frequencies from 1 to 12.7 kHz; it can boost the selected band by as much as 6 dB (in 1-dB steps) or cut it by up to 9 dB. The "High" equalizer has the same curve shapes as a shelving treble control but starts at a lower frequency. (It offers the same frequency choices and control range as the "PEQ.") This amp's equalization possibilities are virtually inexhaustible.

The "Dynamic Range" menu offers three settings ("MAX/STD/MIN") that adjust AC-3 program dynamics to suit listening conditions—late night, noisy environment, etc. High-level compression and low-level boost are separately adjustable.

With the "VCR 3/Video" menu, you can "convert" the VCR 3 output to feed a second monitor. Even when the VCR 3 outputs are used for monitoring, the VCR 3 inputs remain available. In other words, you can still use them to play another program source but you can't record on that device. "Input Trim" and "Input Mode," two other first-level menus, were described previously. The "Dimmer" menu enables you to adjust the panel display's brightness.

Since you can modify the parameters of its DSP modes, the DSP-A3090 has menus for "Memory Guard" and "Parameter IN1." "Memory Guard" locks DSP parameters and other functions, to prevent accidental changes; "Parameter IN1" resets any DSP mode's parameters to their factory settings. You can reset any of the 12 basic modes, but doing so resets each of its two submodes (e.g., the submode used with Pro Logic decoding and the one used with Dolby Digital surround).

With any menu, you modify parameters by sliding a switch on the remote from "Set Menu" to "Parameter" and then use the up/down arrow and the "+" and "-" keys to select and change whatever you like. Because not every DSP pro-

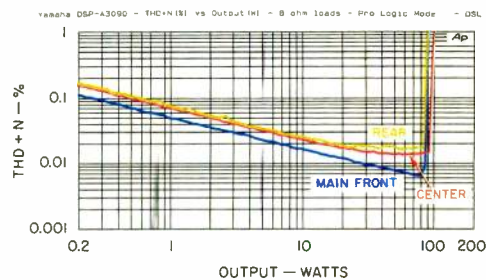


Fig. 7—THD + N vs. output into 8 ohms, Dolby Pro Logic mode.

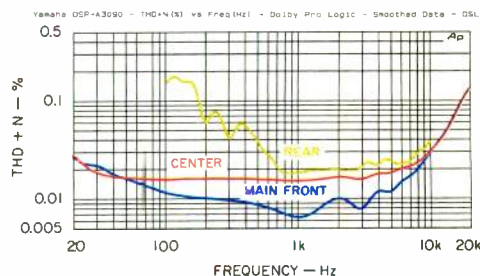


Fig. 8—THD + N vs. frequency, Dolby Pro Logic mode.

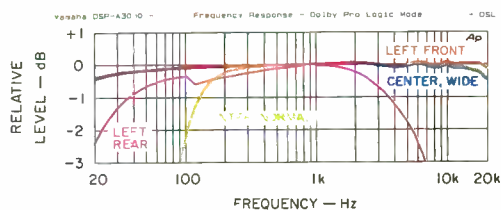


Fig. 9—Frequency response, Dolby Pro Logic mode.

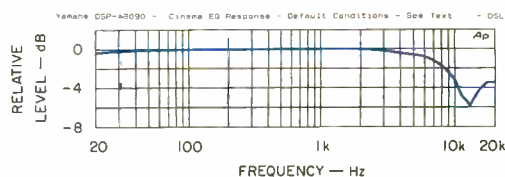


Fig. 10—One of 65,536 possible "Cinema EQ" curves.

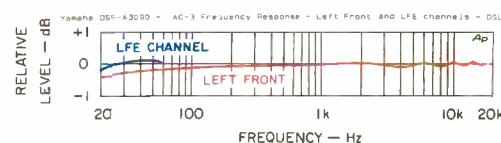


Fig. 11—Frequency response, AC-3 mode.

MEASURED DATA

STEREO MODE

Output Power at Clipping (1% THD at 1 kHz): 8-ohm loads, 95 watts/channel (19.8 dBW); 4-ohm loads, 150 watts/channel (21.8 dBW).

Dynamic Output Power: 8-ohm loads, 105 watts/channel (20.2 dBW); 4-ohm loads, 175 watts/channel (22.4 dBW).

Dynamic Headroom: +1.2 dB re 8-ohm rated continuous power.

THD + N, 20 Hz to 20 kHz: 8-ohm loads, less than 0.00496% at rated output and less than 0.00895% at 10 watts/channel out; 4-ohm loads, less than 0.00754% at 125 watts/channel and less than 0.0125% at 10 watts/channel out.

Damping Factor re 8 Ohms: 275.

Output Impedance: At 1 kHz, 31 milliohms; at 5 kHz, 42 milliohms; at 10 kHz, 62 milliohms; at 20 kHz, 91 milliohms.

Frequency Response, Tone Controls at Detent: 20 Hz to 20 kHz, +0, -0.23 dB (-3 dB below 10 Hz and at 112 kHz).

Tone-Control Range: Bass, +8.6, -8.3 dB at 100 Hz; treble, +7.8, -7.9 dB at 10 kHz.

Effect of Bass Extension: +6.1 dB at 70 Hz.

Subwoofer Crossover: -3 dB at 84 Hz and -6 dB at 95 Hz, 24-dB/octave slope.

RIAA Equalization Error: +0.35, -0.51 dB, 20 Hz to 20 kHz.

Sensitivity: CD input, 16.2 mV for 0 dBW out and 144 mV for rated output; MM phono input, 0.273 mV for 0 dBW out and 2.43 mV for rated output.

A-Weighted Noise: CD input, -82.9 dBW; MM phono input, -79.7 dBW.

Input Impedance: CD input, 42.8 kilohms; MM phono input, 48.6 kilohms + 180 pF.

Input Overload for 1% THD at 1 kHz: CD input, 8.78 V; MM phono input, 150 mV.

Channel Balance: CD input, ± 0.125 dB.

Channel Separation: CD input, greater than 71.7 dB, 100 Hz to 10 kHz.

Record Output Level: CD input, 0.495 V for 0.5 V in; MM phono input, 295 mV for 5 mV in at 1 kHz.

Record Output Impedance: 1 kilohm.

DOLBY PRO LOGIC MODE

Output Power at Clipping, 8-Ohm Loads: Main front channels, 92 watts/channel (19.6 dBW) with "Phantom" center setting; center channel, 105 watts (20.2 dBW) with "Wide" center setting; rear channels, 92 watts/channel (19.6 dBW) with "Wide" center setting.

THD + N at Rated Output, 8-Ohm Loads: Main front, less than 0.135%, 20 Hz to 20 kHz; center, less than 0.130%, 20 Hz to 20 kHz; rear, less than 0.172%, 100 Hz to 10 kHz.

Frequency Response: Main front, 20 Hz to 20 kHz, +0.08, -0.40 dB (-3 dB below 10 Hz and at 23.1 kHz); center ("Wide" mode), 20 Hz to 20 kHz, +0.04, -0.48 dB (-3 dB below 10 Hz and at 23 kHz); center ("Normal" mode), 91 Hz to 23 kHz, +0.04, -3 dB; rear, 17 Hz to 7 kHz, +0, -3 dB.

A-Weighted Noise: Main front, -78.7 dBW; center ("Wide" mode), -77.4 dBW; rear, -81.3 dBW.

Channel Separation at 1 kHz: 56.4 dB or greater.

DOLBY DIGITAL MODE

Output Level re Left Front: Right front, +0.12 dB; center, -0.61 dB; left rear, +0.61 dB; right rear, +0.17 dB.

Frequency Response: Main front, center, and rear, 20 Hz to 18.5 kHz, +0.09, -0.40 dB; LFE (low-frequency effects) channel, 20 to 60 Hz, +0.09, -0.26 dB (see text).

THD + N at 0 dBFS: Main front, 0.0045% at 1 kHz; center and rear, 0.012% at 1 kHz; LFE, 0.054% at 30 Hz.

Channel Separation at 1 kHz: Between rear channels, 52.7 dB; between all others, 68.4 dB or greater.

gram uses all parameters and, in general, the movie parameters differ from the music parameters, it's best to choose a DSP mode that comes close to what you want and then modify it. (Modifications will hold for about two weeks without AC power, after which the parameters revert to their original settings.) In one program or another you will find ways to modify the room's apparent size, the initial delay (which changes the apparent distance from the source), the room's liveness, its reverberation time, and the reverberation delay and level. You also can vary the overall level of the sound effects over a range of ± 3 dB.

Measurements

I tested the DSP-A3090 as a conventional stereo amplifier, as a Dolby Pro Logic and AC-3 surround processor, and as a sound-field processor. When decoding and DSP are not called into play, analog signals remain in the analog domain; when decoding or DSP is used, analog signals are digitized, processed, and then converted back to analog form. (The converters involved are all 20-bit delta-sigma types, A/D with 64-times oversampling and D/A with eight-times oversampling.) Signals that enter as digital data remain in that form until converted to analog by the 20-bit D/A. I used analog test signals for all measurements so that the A/D converter would be exercised when appropriate. For the plain stereo tests, I fed signals to the CD and phono inputs; when testing Pro Logic and DSP, I used the laserdisc input. The Dolby Digital measurements were made from the AC-3 RF input, with a Yamaha CDV-W901 laserdisc player as the source.

Figure 1 shows the DSP-A3090's stereo frequency response, through the CD input and with the tone controls at their detents. Although the amp has no tone-defeat switch, none is needed as far as response goes: With the controls centered, response is within +0, -0.25 dB across the audio band (and was down 3 dB way out at 112 kHz). The range of the bass and treble controls, and the response of the "Bass Extension" circuit, are shown in Fig. 2. The range of each control is about ± 10 dB, with maximum bass effect around 60 Hz and maximum treble spread at 20 kHz. "Bass Extension" provides a 6.1-dB boost at 70 Hz, below which response drops off rapidly.

This boost would seem to be most useful with relatively small vented speakers, which can use the infrasonic filtration as well as the shot of extra bass at 70 Hz. Larger speakers probably don't need help at so high a bass frequency.

To assess the crossover between the amp's main-front and subwoofer outputs, I set the system for a "small" front speaker, drove the left channel's input, measured response at the left front and mono subwoofer outputs, and normalized the curves. The low-pass feed to the subwoofer was down 3 dB at 84 Hz and 6 dB at 95 Hz; it then fell sharply at 24 dB per octave. The high-pass feed to the front speaker had -3 and -6 dB points of 94 and 72 Hz, respectively, and a slope of 12 dB per octave.

In Fig. 3, the RIAA equalization error (phono response) has a slight upward bias. On the whole, however, the response is pretty good (+0.35, -0.51 dB across the band). The channels are even better balanced than they were in Fig. 1, measured through the CD input. Phono input impedance (see "Measured Data") was "classic" and appropriately chosen; CD input impedance was more than adequate. Recording output level from either of these inputs was fine, as was the recording circuitry's output impedance.

Sensitivity from the CD and phono inputs was typical of integrated amplifiers, and the input overload points were fully adequate for normal use. As mentioned, the "Input Trim" menu can be used to adjust the sensitivity of the other analog inputs; you can raise it as much as 6 dB relative to the CD input. This equalizes level when you switch from one input to another. Raising the gain of the other channels would presumably lower their input overload points; even with maximum gain, however, input overload would be about 4.4 volts, still more than adequate.

With that in mind, the A-weighted noise levels I obtained from the CD and phono inputs are quite respectable. Spectrum analyses of the noise from the CD and phono inputs appear in Fig. 4. Except for small amounts of power-line hum at 60 and 180 Hz in the "CD" curve, both spectra are notably free of coherent components.

The DSP-A3090's power amplifiers use discrete output devices, and my test data suggests traditional Class-AB topology. The

main amplifiers are rated at 80 watts per channel, at 0.015% THD, into 8 ohms. In my lab, they performed *far* better than that. As you can see in Fig. 5A, clipping doesn't occur until 95 watts per channel (with two channels driven), and total harmonic distortion plus noise (THD + N) at 1 kHz, just prior to clipping, barely exceeds 0.003%. That's five times better than spec! Although Yamaha doesn't rate the amp for 4-ohm



**THE ADROIT
PRO LOGIC DECODING
YIELDED SOUND FIELDS
OF UNUSUAL STABILITY.**

loads, Fig. 5B shows what you can expect: 150 watts per channel at clipping, with less than 0.004% distortion just prior to that point. With the IHF tone burst, I measured short-term output power of 105 watts per channel into 8 ohms (175 watts per channel into 4 ohms), for a dynamic headroom of 1.2 dB relative to the 8-ohm rating.

Based on the THD + N curves in Fig. 5B, I "assigned" the DSP-A3090 a 4-ohm rating of 125 watts per channel and measured THD + N versus frequency at that level and at 10 watts. These results, and similar data taken with 8-ohm loads against Yamaha's rated power of 80 watts per channel, are shown in Fig. 6. (Note that I've greatly magnified the vertical scale because the distortion is so low.) The 10-watt curves appear to be dominated by noise rather than distortion, since they're relatively flat and lie well above the "rated power" curves. With 8-ohm loads, worst-case distortion at rated

power is less than 0.004% from 25 Hz to 10 kHz; with 4-ohm loads, it is less than 0.005% from 20 Hz to 10 kHz. I'd say that's pretty bloody good for an amplifier whose distortion is rated three times higher!

I was also impressed with the main-channel amplifiers' low and reasonably uniform output impedance (see "Measured Data"). I find this characteristic often correlates with superior sound, but it's a point often ignored by designers. Although I've tested amplifiers that had lower and more uniform impedance than the DSP-A3090's, most of them were high-end American power amps.

Let's turn now to the DSP-A3090's Dolby Pro Logic performance. Figure 7 shows THD + N versus output at 1 kHz. Within the limits of experimental error, these curves correlate well with the stereo curves; that is, with two channels driven (either front or rear), the A3090 produces 92 watts per channel into 8-ohm loads at clipping. With one channel driven (center), it delivers 105 watts at clipping.

The DSP-A3090's THD + N versus frequency, at rated power in Pro Logic mode, is shown in Fig. 8. (The curves have been smoothed to average the sharp peaks and valleys of the raw data but should represent performance with reasonable accuracy.) The results indicate higher distortion in Pro Logic mode than in stereo. But compared with other Pro Logic integrated amplifiers and receivers, the DSP-A3090 performs exceptionally well. This, I believe, can be attributed to Yamaha's YSS-213 Pro Logic VLSI chip.

Figure 9 shows frequency response with Pro Logic decoding. If you refer to "Measured Data," you'll realize that treble response in this mode is limited to 23 kHz by the A/D converter's anti-aliasing filter. This is typical of digital decoders and applies to any signal that uses digital processing. That said, the responses of the main-front channels and of the center channel (in its "Wide" mode) are admirably flat, within ± 0.25 dB from below 10 Hz to 23 kHz. (The minor high-frequency ripples in the curves for the front and center channels are probably due to the D/A converter's digital filter, since they also appear in the Dolby Digital response curves in Fig. 11.) The rear channel's response is down 3 dB at 7 kHz (precisely on target, per Dolby Labs' standards),

and the center channel rolls off at low frequencies in "Normal" operation (-3 dB at 91 Hz, which also is close to the mark).

The DSP-A3090's A-weighted noise ranged from -77.4 dBW (center channel, "Wide" mode) to -81.3 dBW in the rear channels—not bad for a Pro Logic integrated amp. Steady-state channel separation at 1 kHz ranged from a low of 56.4 dB (between the rear and the center or between the rear and the right front) to a high of 77 dB (from the center to the left front). The latter figure is fairly close to the separation available in stereo. Separation between the center and rear, the most important axis, was excellent (67.3 dB).

While testing the DSP-A3090 in Pro Logic mode, I measured frequency response of its center-channel graphic equalizer, exercising each filter in turn. The results were right on the money: Each filter had a ± 6 dB range at precisely 100 Hz, 300 Hz, 1 kHz, 3 kHz, and 10 kHz. Ah, the wonders of digital: Everything is so precise!

I considered performing the same test on "Cinema EQ," but a little mathematics dissuaded me. As mentioned, there are 16 frequency settings for the treble equalizer, 16 frequency settings for the parametric equalizer, and 16 level adjustments for each setting. That comes out to 65,536 combinations, which I thought would be just a tad excessive to plot on one graph. I therefore settled for a single curve (Fig. 10), showing Yamaha's default settings: the parametric EQ at 12.7 kHz with a gain of -4 dB and the treble EQ at 12.7 kHz with a gain of -3 dB.

The only Dolby Digital test disc currently available leaves much to be desired. Although its response sweeps extend to 20 kHz in the main channels and to 120 Hz in the LFE channel, my Audio Precision test gear refuses to track the disc's fast-moving sweeps once their level begins to drop. Such as they are, the frequency responses taken on the DSP-A3090's left front and LFE channels are presented in Fig. 11. There's no reason to suspect that the treble response in the main channels does not extend to 20 kHz or that the LFE channel's response terminates abruptly at 60 Hz, but this is the best that I can document with the Dolby Labs test disc.

If I were to quibble about the DSP-A3090's AC-3 performance in any respect, it would be about its channel balance. A

match within ± 0.6 dB isn't bad, but it could have been better. The THD + N at 1 kHz (at maximum recorded level) was exceptionally low in the main front channels (0.0045%) and adequately low in the center and rear (0.012%). I doubt *anyone* can hear 0.054% THD in the LFE channel, subwoofers being the distortion generators that they are! Minimum channel separation (52.7 dB) occurred between the two rear channels, where I consider separation least important. Between other channels, separation at 1 kHz ranged from 68.2 to 79.4 dB—not tops in the numbers race but audibly indistinguishable from anything better.

Use and Listening Tests

Considering the Yamaha DSP-A3090's extensive facilities, it's not difficult to use. Good on-screen menus, sensible ergonomics, and a well-written manual help guide you through the intricacies. This is not to say that you'll master everything in a few hours; I still don't feel I've mastered it completely after several weeks. (Given the number of combinations possible, I'm not sure I would ever master "Cinema EQ"!) But it didn't take long to get the DSP-A3090 up and running.

As I've said in the past, I usually find ambience-simulation systems overly aggressive on music, especially the simple processing that's tacked onto the Pro Logic decoders of many A/V products. Whether their designers don't know any better, whether they actually *like* the results, or whether they are pressured by marketing departments to design products that enable even the donkey-eared to hear the effects during a demo, I can't tell. The result (for me) has usually been the same: twings, twangs, and clangs.

Out of the box, some of the DSP-A3090's music modes also seemed rather aggressive, though more to my liking than those of most ambience simulators. Many pop and rock recordings can take aggressive processing, but classical music can be overwhelmed (especially solo performances, which are more to my taste).

The important difference between the DSP-A3090's simulations and those of most other integrated amps and A/V receivers is that Yamaha's sound fields seemed more dense and believable. Further, there's a real advantage in being able to modify the parameters and soften the effects (if you

wish) rather than simply having a choice of using the factory settings or dispensing altogether with the benefits of sound-field processing. In this sense, the A3090 is more akin to the stand-alone Digital Sound Field Processors on which Yamaha earned its DSP reputation than to ordinary A/V integrated amplifiers or receivers. Make no mistake about it, that's saying a lot!

The same can be said for the DSP-A3090's Pro Logic decoding, which was far better than what I've found in many other home theater components. Its sound fields were unusually stable, and dialog never popped up in the surround channels. I consider this a mark of fine Pro Logic operation, because sibilant splats in the rear are very annoying. I also found the A3090's Pro Logic sound notably cleaner and possessed of far more realistic and extended bass than usual. In these respects, especially, the A3090 gives many high-end separate decoders a good run for their money.

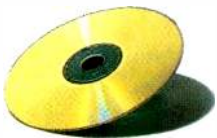
It was difficult for me to compare the DSP-A3090's Dolby Digital performance with that of competitive products. The technology is so new (which means that I haven't built up a critical body of experience). Certainly, I could find nothing to complain of with the A3090's AC-3 operation. I find Dolby Digital sound much more realistic and enjoyable than Pro Logic sound, even in the face of the A3090's unusually adroit Pro Logic decoding. I have yet to find a laserdisc available in both Dolby Digital Surround (AC-3) and Dolby Surround (which Pro Logic decodes) that I did not prefer in the newer format.

Last, but far from least, is the DSP-A3090's functionality. This is a home theater component that has adequate input, output, and recording facilities for today and tomorrow. Its adequate power capability (and the facilities to augment that if and when you wish) and its fine ergonomics make the A3090 usable by mere mortals (even if most of us will never use all of its capabilities). Such sensible engineering is surprisingly rare. This factor alone would tempt me to recommend the DSP-A3090, even if its sonic performance were only marginally acceptable. Fortunately, I have no problem in that area, either. The sound quality is excellent, the engineering is superb, and I give the Yamaha DSP-A3090 my enthusiastic endorsement. A



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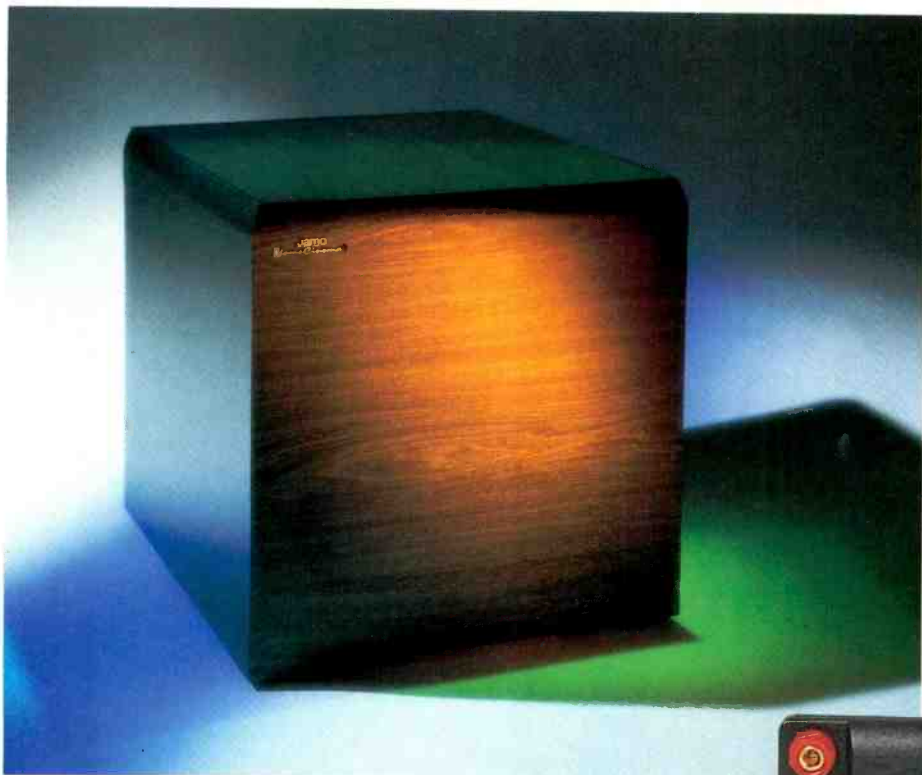
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JAMO SW 505E POWERED SUBWOOFER



Although not as widely known in the United States as some competing brands, Jamo (pronounced "Yah-moe") says it is the world's third largest speaker manufacturer, and the Danish company has been selling its diverse line of products here for more than 15 years.

The SW 505E is the larger of two new powered subwoofers in Jamo's Home Cinema series. Although it carries a suggested

retail price of just \$699, the SW 505E boasts a 100-watt internal amplifier and a 12-inch, long-throw woofer in what the company calls a "bass-reflex" enclosure. Apparently Jamo uses this term for any system whose driver is loaded by a tuned enclosure from which sound exits through ports. But whereas this definition usually applies to the loading of the driver's back wave, Jamo applies it to the loading of the SW 505E driver's *front* wave. The rear wave from the cone is trapped and absorbed by a sealed cavity; the front wave couples to the outside through a tuned en-

closure, lined with acoustical foam, that's vented by two ports at the cabinet's rear. Each port is 3¾ inches in diameter and has a 4-inch-long internal tube that's flared slightly at both ends to reduce turbulence. In the strictest sense, Jamo's driver is front-loaded by an acoustical bandpass filter and rear-loaded by a sealed box. The driver cone is of felted paper and is supported by a butyl-rubber surround.

Jamo specifies the enclosure volume (which is usually taken to mean internal volume) as 92.1 liters, but the volume occupied by the entire cabinet amounts to only 90 liters. The enclosure is finished in simulated black ash.

The SW 505E is meant to be placed on the floor, with its ports facing a wall. Jamo suggests at least a 2-inch clearance between wall and cabinet to permit the sound to enter the room. Connections and controls are on the rear and include an "On/Off" rocker near the top of the panel and three rotary controls. The topmost of these is the "Level" control, which adjusts the subwoofer's sensitivity. The "Cut Off Frequency" knob, just below, varies the SW 505E's upper response limit (the crossover point of its electronic low-pass filter) between 70 and 150 Hz. The "Phase" control, farther down the panel, is not just the 0°/180° switch found in many powered subwoofers; it actually

varies the phase of the SW 505E's output relative to that of your main speakers. Jamo suggests you adjust the control until you "find the setting which provides the richest sound in the upper bass range as heard from the listening position." The bass response is specified as extending down to 32 Hz.

Signals are fed into two gold-plated RCA jacks near the bottom of the SW 505E's back panel. You'd use both jacks if you connected this subwoofer

to your two stereo channels individually; you'd use its "Left/Mono" jack by itself for connection to a mono subwoofer-out jack. The Jamo's jacks accept line-level signals from the subwoofer output of a processor,



THE SW 505E COMES WITH AN INTERFACE BOX THAT ENABLES CONNECTION TO SPEAKER-LEVEL OUTPUTS.

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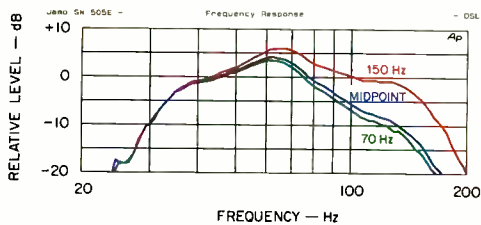


Fig. 1—Frequency response.

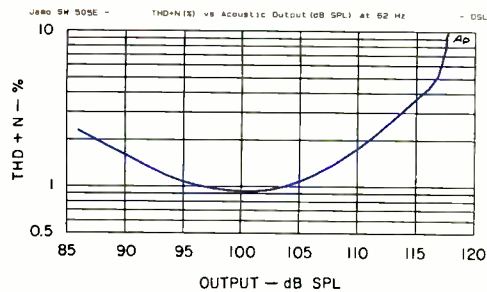


Fig. 2—THD + N vs. output at 62 Hz.

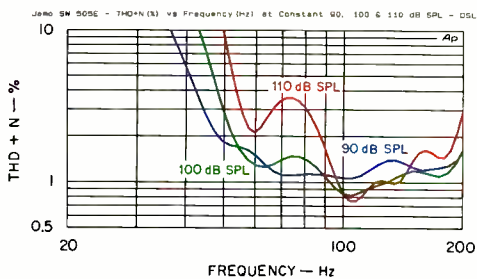


Fig. 3—THD + N vs. frequency.

integrated amplifier, or receiver and have a rated input impedance of 10 kilohms. A permanently attached line cord and a power-line fuse-holder complete the back panel's layout.

For use with components that don't have appropriate line-level outputs, the SW 505E comes with an external combining network that interfaces the subwoofer with speaker-level signals. The network, which is in a small plastic enclosure (3½ x 3⅜ x 1¼ inches), has four pairs of gold-plated multi-way binding posts to connect to your power amplifier and main speakers, and a single gold-plated RCA jack for connection to the SW 505E's "Left/Mono" input. The multi-way posts have holes that are large enough for heavy-gauge speaker wire, but they're too far apart to accommodate double-ban-

ana plugs. Single-banana plugs can be used, however.

The external network is a passive divider that attenuates the main speaker signals by approximately 20 dB and combines the two channels into a mono drive for the subwoofer. The network also contains simple high-pass filters comprising a nonpolarized electrolytic capacitor between each channel's "+ Amp" (input) terminal and its "+ Speaker" (output) terminal. These filters remove bass from your main speakers when your power amplifier is connected to the network's "Amp" input terminals and the main speakers to its "Speaker" output terminals. Full-range main speakers can be connected directly to your system's amplifier (or to the input side of the combining network), thus bypassing the high-pass crossover in the combining box.

Measurements

My measurements of the Jamo SW 505E were made in quarter-space free field—that is, with the subwoofer near only two reflecting surfaces, the floor and a wall 6 inches behind it. I placed the test microphone 1 meter from the front of the SW 505E's cabinet, used the subwoofer's "Left/Mono" input, and set its "Level" control to maximum. (The setting of the "Phase" control had no effect on my lab tests, since it simply varies relative phase between the subwoofer and main speakers.)

Figure 1 shows the SW 505E's frequency response, with the "Cut Off Frequency" control at its midpoint and at its extremes. If we define the crossover point as the frequency where response is down 6 dB, the control varies the subwoofer's crossover from 97 Hz (at the "70 Hz" position) to 155 Hz (at the "150 Hz" position). As you can see, most of the effective adjustment range lies in the upper half of the control's rotation, since there's relatively little difference in response between the middle and 70-Hz settings. At the highest crossover setting, frequency response is within ±6 dB from 32 to 155 Hz.

For all crossover settings, peak response occurs at about 62 Hz. With its "Level" control fully advanced, the SW 505E required an input of just 24.3 millivolts to produce a sound pressure level of 100 dB at this frequency (measured 1 meter in front of the cabinet). Obviously, this subwoofer has more than adequate sensitivity.

The SW 505E's acoustic output at 62 Hz is likewise more than adequate. This can be seen in Fig. 2, a plot of total harmonic distortion plus noise (THD + N) versus acoustic output, which was taken at a distance of 1 meter and with a 62-Hz input signal. At 10% THD + N, the SW 505E delivers almost 118 dB SPL at 62 Hz and can deliver almost 114 dB SPL with less than 3% distortion! These measurements were taken at the frequency where the Jamo subwoofer is most sensitive, which, as is the case in most speakers, corresponds to a point of low distortion.

Figure 3 shows THD + N versus frequency at three acoustic output levels, measured 1 meter in front of the cabinet. As the figure suggests, the Jamo subwoofer produces clean sound, to levels well above 100 dB SPL, over a broad range of bass frequencies. From approximately 50 Hz up, THD + N remains below 2% at 90 and 100 dB SPL. At 110 dB SPL, THD + N tops 3% (but barely exceeds 3.5%) in the region between 67 and 80 Hz; at higher frequencies, distortion is well below that. If we define 10% distortion as the maximum acceptable amount, the SW 505E can produce sound levels of 110 dB SPL at frequencies as low as 49 Hz, 100 dB SPL down to 43 Hz, and 90 dB SPL down to 36 Hz.

MEASURED DATA

Minimum Input for 100 dB SPL at 1 Meter: 24.3 mV at 62 Hz.
 Maximum Acoustic Output, with 10% THD + N, at 1 Meter: 117.7 dB SPL at 62 Hz.
 Frequency Response at Highest Crossover Setting: 32 to 155 Hz, ±6 dB.
 Crossover Frequency Range at -6 dB: 97 to 155 Hz.
 Lowest Frequency at 10% THD + N: 49 Hz at 110 dB SPL, 43 Hz at 100 dB SPL, and 36 Hz at 90 dB SPL.

Use and Listening Tests

The Jamo SW 505E subwoofer did an excellent job of extending the bass response of small (satellite-type) main speakers that usually roll off around 150 Hz. Even with somewhat larger main speakers that get down to 80 Hz or so, the SW 505E made a decisive impact. In these applications, the Jamo subwoofer extended overall response by one or two octaves. The difference was both clearly audible and very useful for music as well as for theater sound.

When used with larger speakers whose response extends down to, perhaps, 40 Hz, the SW 505E did not so much extend response as augment bass output. Many speakers (including many towers) may respond down to 40 Hz but can produce relatively little acoustic output in this range without generating high distortion. Unfortunately, once a woofer cone begins to travel in a nonlinear manner (i.e., to generate distortion at the primary frequency), it distorts whatever higher-frequency signals also are present. With the SW 505E handling the high-level bass energy, your main speakers are relieved of that task, enabling the combined system to play louder and cleaner.

However, I should mention that it's impossible to predict exactly what high-pass crossover frequency you'll get if you use the network in Jamo's combining box. When a crossover consists simply of a series capacitor, as this one does, the frequency where the main speakers come in depends on their impedance. The value of capacitance that Jamo uses seems appropriate, but the final results will be determined by the complex

impedance of the speakers connected to the SW 505E. This is generally true of passive crossover networks when they're used in this manner, so you'd face this situation with any subwoofer providing such a feature. The low-pass filter to the subwoofer itself is handled by the SW 505E's internal electronic crossover no matter how it is connected, so there's no ambiguity there. It's always better to use line-level crossovers whenever possible.

If you're looking for a subwoofer to deliver deep sub-bass that is more palpable than audible, you'll need one that has more

**THE SW 505E HAD
A DRAMATIC IMPACT WITH
SMALL MAIN SPEAKERS
AND AUGMENTED THE
BASS OF LARGER ONES.**

low-frequency extension than the Jamo does. Still, many (dare I say most) subwoofers have no better sub-bass response than the SW 505E—and the Jamo is “clean,” whereas many others are not. (By this I mean that the 505E was not only low in distortion but also free from box rattles or buzzes, even when I subjected it to a frequency sweep at 110 dB SPL!)

I would have liked a music-sensing circuit that turned the SW 505E's amplifier on and off automatically. But that's my sole complaint, and power consumption at idle is low enough that you could simply leave it on all the time. Overall, I think the Jamo

SW 505E offers very good value for the money. What it does, it does very competently. It plays loudly and cleanly and has sufficient bass extension to make it useful in almost all systems. That's saying a lot, especially for a subwoofer in such a moderate price range! A

Connections, vents, and switches are out of sight, on the SW 505E's back panel.



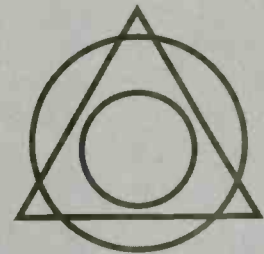
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SPECTRON 1KW SWITCHING AMP



Switching, or Class-D, amps offer high efficiency and linearity, but their designers face some engineering challenges, such as keeping the switching circuits from radiating interference into radios, TVs, and other electronic gear. John Ulrick of Spectron, who designed the 1KW, has been studying and designing switching amps since the 1970s, when he helped design one at Infinity Systems (a company he co-founded). That amp, which

appeared in 1976, was one of the first of its kind produced commercially, and possibly the first. (For more on their history, see my article, "Switched-On Amps: Power with a Pulse," in the February 1995 issue.)

Because transistors handle on/off pulses more efficiently than they handle audio's varying signals, switching amps gain efficiency by turning audio signals into pulses. It is for this reason that these amps are sometimes referred to as "digital"; however, instead of using the pulse-code modulation (PCM) found on CDs and most other present-day digital media, switching amps use pulse-duty-cycle modulation (PDM) or pulse-width modulation (PWM).

Like most power amps, the Spectron 1KW has a fairly simple front panel. Its most prominent features are gold-plated

level-control knobs near each end. Each channel has a window for 10-segment displays of peak output voltage ("V," in 8 peak volts per segment) and current ("I," in 5 peak amperes per segment). A green "CH On" indicator in each window tells you which channels are operating; the right-hand display also has an orange "Fan On" message that gets brighter as the fan, which sucks air through an inlet in the panel's center, speeds up. (The fan is off when the amplifier is first turned on; it comes on slowly and nearly inaudibly as the 1KW comes up to operating temperature.) The power on/off rocker is to the right of the air inlet, and a green power-on LED is to the inlet's left.

The rear panel has two sets of five-way binding posts for speaker connections, XLR and RCA input connectors for each channel, a power-line fuse-holder, and an IEC AC cord socket. Holes near each end allow heated air to escape from the chassis. Because its cooling air flows from front to back, not top to bottom, the 1KW can be safely stacked with other components.

Balanced or unbalanced input is selected by flicking internal toggle switches for each channel with a small screwdriver. Slots on the sides of the top cover provide access to the switches.

Should you wish to take the top cover off, you must remove 26 flat-head machine screws. Removing this cover reveals a large toroidal power transformer, 6 inches in diameter and 3 inches high, flanked by two large, 22,000-microfarad filter capacitors. Located in front of the transformer are separate fuses for each channel's positive and negative power rails.

**SWITCHING AMPS
OFFER HIGH EFFICIENCY
AND LINEARITY
BUT POSE ENGINEERING
CHALLENGES.**

The switching amplifier circuitry is contained in two shielded modules at either side of the chassis. Yet another shielded module, near the front, houses circuitry for system control, temperature

and fan control, and the display as well as auxiliary power-supply components. There are no cooling fins on the amplifier modules; the output devices are mounted to a ¼-inch plate that forms one side of each amp module. These side plates transfer

Rated Power Output: 300 watts per channel into 8 ohms, 500 watts per channel into 4 ohms.

Dimensions: 19 in. W x 3½ in. H x 13½ in. D (48.3 cm x 8.9 cm x 34.3 cm).

Weight: 35 lbs. (15.9 kg).

Price: \$4,900.

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For literature, circle No. 93

most of their heat to the cooling air as it passes between the front and rear vents, but they also transfer some heat to the top and bottom of the 1KW's chassis.

Overall construction and wiring in my sample were nicely executed, and the parts were of high quality.

THE COMMON-MODE REJECTION RATIO FOR THE BALANCED INPUTS WAS AMONG THE BEST I'VE MEASURED.

Spectron recently introduced another Class-D amplifier, the Digital One, which has the same power output as the 1KW but costs \$2,495. The main differences between the two are that the Digital One lacks the 1KW's level controls and peak-output displays, uses thinner heat-sink plates, and has slightly lower gain.

Circuit Highlights

Spectron was reluctant to let me disclose the intimate details of the 1KW's circuitry, but I can describe them in general terms. Like most switching amps, the 1KW comprises three distinct functional blocks for each channel.

The first of these blocks contains a differential-to-single-ended converter and the circuitry for the balanced inputs, the balanced/unbalanced selector switch, and the front-panel level controls. It also has an output amplifier to drive the next block.

The second block holds circuitry for the modulator and for power switching, which are the core of a digital switching amplifier. The modulator converts audio input voltage to a constant-amplitude output pulse train (Fig. 1). This pulse train's duty cycle (and hence its average value) is proportional to the input voltage. But the pulse train, which feeds output power switches, is a two-state signal, alternating between two voltage levels. Because of this, and because much of the circuitry uses digital logic chips, it is reasonable to call such a circuit a "digital" switching amplifier.

Most modulation schemes for switching amps, including the Spectron 1KW's, keep the switching frequency constant for low

input levels and let the frequency drop at signal peaks when the input signal's amplitude approaches full scale. This enables the duty cycle to more nearly approach 0% and 100% at full modulation, so the peak levels of the recovered audio output will almost reach the power supply's rail voltages.

The 1KW's output power devices are power MOS-FETs, which switch between rail voltages of +85 and -85 volts. Two MOS-FETs are used in parallel for each of the two switching devices. Because these devices are of the same, rather than complementary, polarity, special means are required to get equal drive to each switch. Spectron's solution in the 1KW is to use proprietary isolating and coupling circuitry to ensure this.

A switching amplifier's third functional block is a high-level low-pass filter. This screens out the ultrasonic frequencies of the switched pulse train but passes the audio signal (equivalent to the average value of the pulse train's varying duty cycle) to the speaker load. The filter's cutoff frequency in large part determines the high-frequency limit of the amplifier's bandwidth. In the 1KW, this limit varies from about 30 to 40 kHz, depending on the output loading.

The Spectron amp's overall negative feedback is taken from the speaker output side of the high-level low-pass filter back to a signal-summing junction, which is at the modulator's input. Appropriate frequency- and phase-compensation circuitry precedes and follows this summing junction to shape the 1KW's frequency and phase response and enhance its stability. A servo circuit is intended to keep the DC offset level in the output signal low.

Measurements

Because of the nature of its output filter, a switching amplifier's frequency response varies with load more than a conventional amp's does. The Spectron 1KW's frequency response is no exception, as can be seen in Fig. 2. Note the peak in the open-circuit curve of Fig. 2A; Spectron supplies a "cable terminator" to control this peak if you use speakers whose impedance rises at high

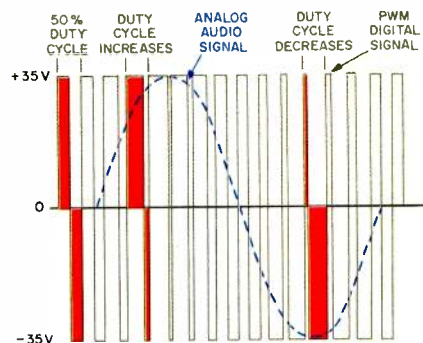
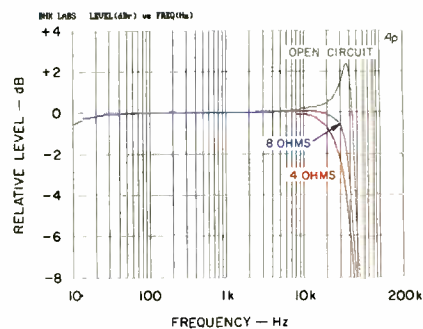
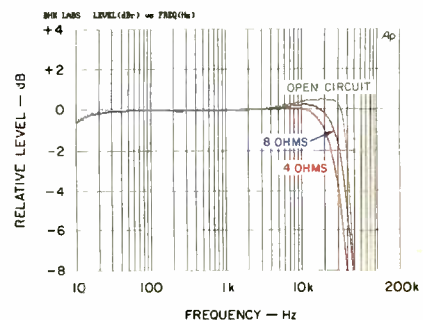


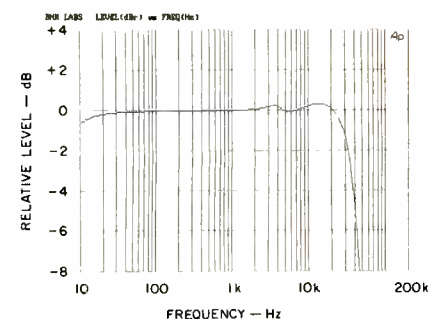
Fig. 1—Pulse-duty-cycle modulation of a switching amplifier.



A



B



C

Fig. 2—Frequency response of 1KW vs. load without its cable terminator (A) and with its terminator (B), and response into dummy load without terminator (C).

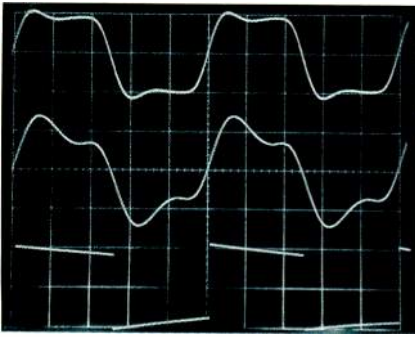


Fig. 3—Square-wave response for 10 kHz into 8 ohms (top), 10 kHz into 8 ohms paralleled by 2 μ F (middle), and 40 Hz into 8 ohms (bottom).

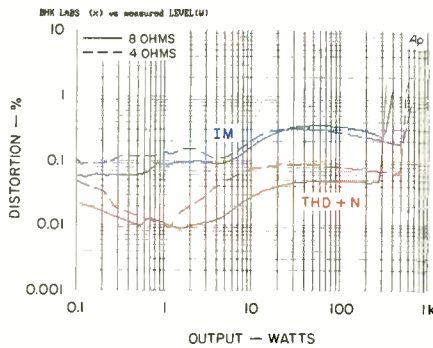


Fig. 4—Distortion vs. power.

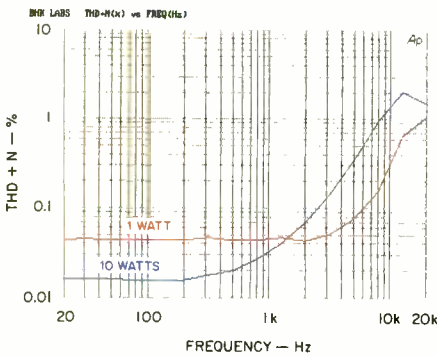


Fig. 5—THD + N vs. frequency.



Rear panel of the Spectron 1KW

frequencies. The terminator, which is placed in parallel with the speaker cable, is a series RC network in a potted cylinder about the size of a 35mm film can; a pair of posts, spaced $\frac{3}{4}$ inch apart like a double-banana plug, enable you to plug this terminator into the amplifier's output terminals. As you can see from Fig. 2B, placing this network across the output does reduce the out-of-band, high-frequency peaking seen in Fig. 2A but at the expense of a slight increase in energy between about 5 and 15 kHz with normal speaker loads.

Figure 2C shows the results of a new test of frequency response, made with a dummy speaker load (built for me by NHT, through the auspices of Ken Kantor). The dummy load's impedance characteristic is typical of a two-way speaker system that has a compensation circuit to keep its high-frequency impedance down to 4 or 5 ohms. This load's impedance varies with frequency, but the 1KW handles that well, exhibiting only small variations in its frequency response.

Oscilloscope traces of the 1KW's square-wave response are shown in Fig. 3. Rise and fall times with 8-ohm loading are about 10 microseconds.

Figure 4 illustrates how total harmonic distortion plus noise (THD + N) at 1 kHz, and SMPTE-intermodulation distortion, change with output power. The THD + N curves indicate that noise predominates at low power levels, as it does on most amps. But the distortion rises rather noticeably out of the noise at a level of 1 to 4 watts, depending on the load. Below this transition point, the distortion is low and consists of only low-order harmonics; above this point, the distortion becomes a series of primarily odd harmonics.

The 1KW's distortion at 1 kHz could be measured at high power levels, but its high-frequency distortion could not. This is because the amp's low-pass output filter has a series RC filter connected between the output signal and ground. The low-value resistors this RC network requires for good frequency response can be damaged or destroyed if the 1KW delivers its full power at the upper end of the audio range. You will not

have a problem when listening with the amp, since music seldom has high levels of steady-state high-frequency energy, but it does restrict testing somewhat. I measured the 1KW's THD + N versus frequency (Fig. 5) only at output levels of 1 and 10 watts. You can see that the distortion does rise

**THE SPECTRON 1KW
DELIVERS ON
SWITCHING AMPS'
PROMISE
OF HIGH EFFICIENCY.**

with frequency, although this behavior is typical of most other amplifier designs to varying degrees.

The Spectron amp's A-weighted output noise for the balanced inputs was 186.4 microvolts for each channel, yielding an IHF signal-to-noise ratio of 83.6 dB. The amp was quieter when I used its unbalanced inputs: A-weighted output noise was 136.7 microvolts for the left channel and 124.3 microvolts for the right; equivalent IHF S/N was 86.3 and 87.1 dB, respectively. Without the A-weighting filter, about 190 millivolts of the amp's switching frequency (approximately 500 kHz) appeared at the output terminals.

The 1KW's common-mode rejection ratio for the balanced inputs was among the best I have measured. It was greater than 100 dB at frequencies up to about 400 Hz, then rose at 6 dB per octave, and finally reached about 70 dB at 20 kHz. Crosstalk, from the right channel to the left or vice versa, was about -100 dB from 10 Hz to just above 1 kHz. It then rose, at more than the usual rate of 6 dB per octave, to about -70 dB at 20 kHz.

Steady-state power at the visual onset of clipping was 340 watts with 8-ohm loading and 565 watts with 4-ohm loading. This corresponds to clipping headroom of 0.54 and 0.53 dB, respectively. Dynamic power attainable with 8-ohm loading was 420 watts (yielding dynamic headroom of 1.25 dB) at the beginning of the IHF tone burst used in these tests and was 400 watts at its end. For 4-ohm loading, the results were 840 watts (1.82 dB of dynamic headroom) at the start of the burst and 760 watts at its

end. Peak current into a 1-ohm load with one channel driven was ± 50 amperes.

Damping factor, referred to an 8-ohm load, was highest (around 450) from 10 to 100 Hz, decreased to 130 at 1 kHz, and fell

to 5.5 at 20 kHz. Gain was 28.4 dB and sensitivity was 107.5 millivolts, for either the balanced or unbalanced inputs. Polarity from input to output was normal for the balanced inputs and inverted for the unbalanced inputs. The amp's DC offset measured 1 millivolt in the left channel and 4 millivolts in the right.

As you'd expect from a Class-D amplifier, the 1KW proved quite efficient. Its AC line current at idle

was 0.52 ampere, rising to 8 amperes when the amp was delivering 300 watts per channel into 8-ohm loads. If you ignore power factor, that gives an efficiency of, very roughly, 62.5%. The efficiency of a conventional, Class-AB solid-state amp would run somewhat less than 50%.

Use and Listening Tests

For my listening tests of the Spectron 1KW, I employed my usual analog and digital program sources. The preamplifiers in my system were a Parasound P/LD-2000, a Spectron Model 10, and a Forssell balanced tube line driver; other power amplifiers used for comparisons were a Crown Macro Reference and a pair of Quicksilver M135s. In addition to B&W 801 Matrix Series 3 speakers (augmented from 20 to 50 Hz by a subwoofer on each side), I used Genesis Technologies' Model V speakers (designed by Arnie Nudell, another co-founder of Infinity Systems, and Paul McGowan).

You might well be wondering how the sound of Spectron's switching amplifier compared to that of more conventional amps. Not surprisingly (or surprisingly, depending on your point of view), the 1KW sounded very good. In fact, it sounded much like other high-quality amplifiers in my system, differing no more from them

than they do from one another. Specifically, I would characterize the 1KW as having an easy, slightly laid-back sound. Its bass was powerful, tight, and "tuneful," and its upper mids and its highs were spacious and

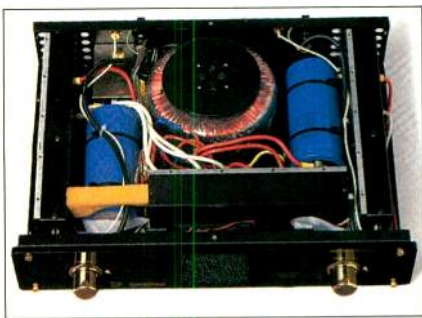
open. Depth and soundstaging were very good. The combination of the Parasound preamp and the 1KW, with the amp's balanced inputs and with its level controls set halfway up, sounded particularly smooth and easy. This combination reproduced some of my more difficult CDs with remarkably little irritation. And the Spectron 1KW's highs were considerably better than I remem-

ber the original Infinity switching amplifiers' highs to have been.

After getting the Genesis Technologies V speakers settled in to the point where they were approaching their potential, I used the 1KW to drive these speakers' main section, which covers frequencies above 80 or 90 Hz. (The Genesis V's woofer is driven by its own servo electronics.) The sound was quite exceptional; its spatial presence, dimension, and overall believability made me quite thankful that this combination reunited the work of two former Infinity collaborators, Spectron's John Ulrick and Arnie Nudell at Genesis Technologies.

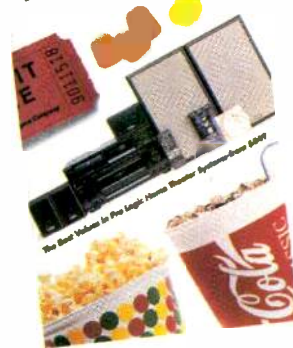
Operation of the 1KW was flawless; I never heard any clicks, pops, or zaps. Fan noise was audible right near the amplifier but not at my listening position. My FM tuner worked normally, with no noticeable interference from the 1KW. (The original Infinity switching amps rendered my tuner unusable except for strong local stations.)

I definitely liked the Spectron 1KW. Switching amps are supposed to be very efficient and linear. The 1KW was very efficient. When I tested linearity, the Spectron didn't produce the super-straight curves I often get from good transistor amps; it responded and sounded more like a tube amp. In my book, that's a virtue, not a flaw. **A**



THE 1KW HAS AN EASY, LAID-BACK SOUND, WITH POWERFUL, TIGHT, AND TUNEFUL BASS AND SPACIOUS, OPEN HIGHS.

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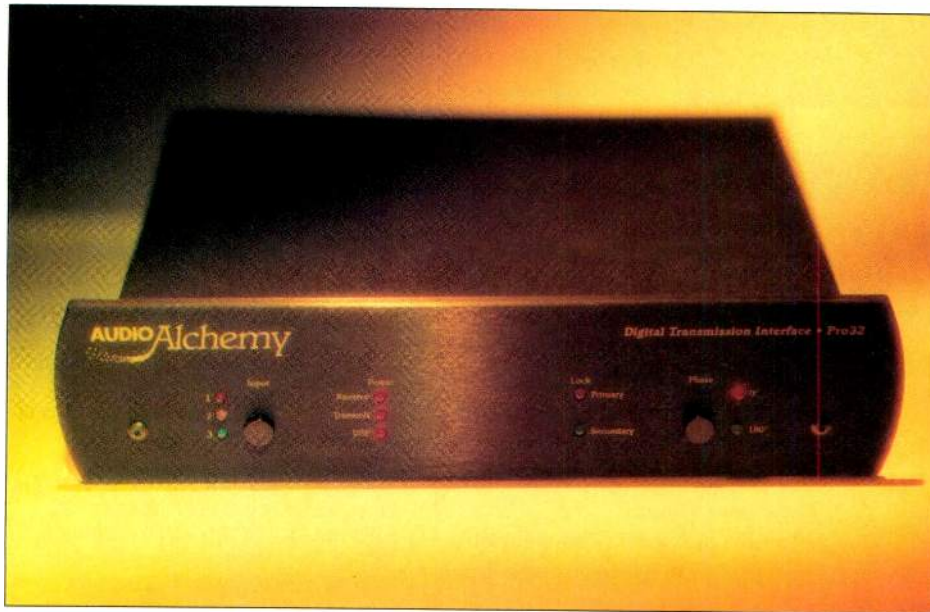
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AUDIO ALCHEMY DTI•PRO 32 DIGITAL INTERFACE



I have heard many "solutions" to the problems of CD sound, but the only ones that have impressed me are jitter-reduction devices. They do not enhance all discs, and they serve little purpose if you have a top-quality, low-jitter CD transport and D/A converter. But these devices do show that reducing jitter can result in sound that has more natural harmonics, detail, sweetness, and soundstage information.

Most other attempts at CD enhancement demonstrate none of these benefits. There is no clear, consistent correlation between the word lengths and oversampling rates of the D/A converters in CD players

and their sound quality; even models built around the same basic chips do not necessarily sound equally good. Most esoteric CD accessories are expensive rubbish, producing little, if any, improvement in sound quality. High-priced digital cables usually sound no better than any other digital cables that meet the proper technical specifications. Record companies' vaunted noise-shaping and other enhancement systems, including HDCD, yield discs that are not consistently better (and sometimes worse) than CDs for which no special claims are made.

Audio Alchemy's latest anti-jitter system, the DTI-Pro 32, sells for \$1,595, and it is the first device I've heard in a long time that addresses the basic problems of musical realism in CD sound. Let me briefly summarize its operation: A phase-locked loop (PLL) locks onto the incoming bitstream. A voltage-controlled crystal oscillator (whose

center frequency has been carefully chosen to avoid interference within the audio band) then locks onto the PLL's output signal, to reduce jitter; the oscillator also provides a master clock output that is mixed into the signal that feeds the D/A converter. The data signal is processed by a 32-bit Texas Instruments DSP chip, using an Audio Alchemy resolution-enhancement interpolation algorithm. This algorithm is stored in an EPROM memory chip that can be replaced as improved algorithms are developed.

Physically, the DTI-Pro 32 is a small black box. On its rear panel are three signal inputs: a BNC coaxial connector that can easily be converted to an RCA input, a Toslink input, and an I²S bus input for connection to Audio Alchemy CD transports. (The I²S bus, used within many companies' digital audio components, is also used by Audio Alchemy for digital links between components.) You can substitute an AT&T input for the Toslink at an additional cost of \$179. The outputs are BNC, AES/EBU, AT&T optical, and I²S. The external power supply connects to another rear-panel jack.

Inputs are selected by a front-panel pushbutton; three LEDs show which input has been chosen. The other panel button ("Phase") selects normal or inverted polarity and also has LED indicators. Between the controls are two more sets of LEDs; one set shows when the unit is receiving, transmitting, and processing signals, while the other set indicates when the PLL and crystal oscillator are properly locked to the signal. Pressing the buttons in combination lets you change the dither setting to select word lengths of 16, 18, 20, 22, or 24 bits for output to your D/A converter; you can also turn dither off. (Anytime a digital signal is re-quantized, as in Audio Alchemy's resolution-enhancement process, it should be redithered to minimize distortion.) Since the DTI-Pro 32's resolution-enhancement algorithm conflicts with HDCD, another

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switch combination turns the enhancement off for HDCD reproduction; this must be done each time you use HDCD.

The DTI•Pro 32 is not complicated, but not all of its features are obvious. You *must* follow the instructions in the owner's manual to set it up, although basic setup (including reading the instructions from cover to cover) takes all of five minutes.

Deciding on the proper operating mode requires extensive listening. Start with the word length set to 18 bits, then try 20 bits, and so on. Many audiophiles who have 20-bit D/A converters instinctively go for the higher settings, but the 18-bit setting may sound better. (Audio Alchemy offers advice by phone if you're unsure about the optimum setting for your system.)

The improvement the DTI•Pro 32 makes depends significantly on the rest of your CD playback system and on the quality of individual discs. For example, I found the benefits more audible with old CD transports than with top-quality newer models.

By contrast, the sonic improvements were more musically significant with really high-quality D/A converters, such as the Mark Levinson No. 30.5 and Theta Digital DS Pro Generation V. But I *heard* only minor differences when I used the DTI•Pro 32 with medium-quality 1-bit D/A converters. It sometimes made a striking improvement with medium-quality multibit converters, but there were also cases where I couldn't properly hear the DTI•Pro 32's benefits.

The improvement made by the DTI•Pro 32 also varied from CD to CD. The benefits seemed to be governed by the sonic quality or clarity of the recording and not by the disc's age or whether it was made from a 20-bit master or noise-shaped. The DTI•Pro 32 does not solve all of CD's sonic problems. It cannot alter the word lengths and sampling rates of recordings or make CDs sound like the best digital tapes. However, when I played recordings of solo violin or grand piano through it, I noticed an impressive improvement in their harmonic integrity. The common high-end terms for such improvements, "sweetness" and "air," don't really apply. The DTI•Pro 32 did not sweeten or add "air": It provided added definition that made properly recorded instruments sound more real.

With other instruments, the sonic benefits varied. Although solo guitar often

sounds very good on CD (better than violin, for some reason), the DTI•Pro 32 still made a difference with a number of guitar recordings. For example, Julian Bream's recordings, which often sound less harmonically realistic on CD than on LP, gained a bit more life when I used the DTI•Pro 32. And although I rarely find the harpsichord musically convincing on CD, LP, or tape, it did sound more real on CD with the DTI•Pro 32.

As an ex-drummer, I've noticed that CD often has considerable trouble reproducing brush, cymbals, triangles, and drumhead textures. The DTI•Pro 32 gave me a lot less sonic improvement with these instruments than with the others I have just described, but it did make a difference, particularly with really clean acoustic jazz recordings. Again, there seemed to be a significant improvement in musical resolution and realism. Bass dynamics also seemed to improve, though this may have been the result of improved transient and soundstage-detail resolution rather than greater or more extended bass energy.

The Audio Alchemy processor also improved the resolution of orchestral detail on some discs; many Reference Recordings orchestral CDs sounded better and more natural with the DTI•Pro 32's processing than with HDCD decoding.

With voice, the Audio Alchemy processor made choral textures and definition a bit clearer, and it often improved the fine details of soprano and tenor voices. (The effect with baritones was less clear.) I did not, however, find the improvement as striking with voice as with instruments, perhaps because my ear is tuned more to classical instrumental sounds.

My sons preferred listening to many of their electric rock and jazz CDs through the DTI•Pro 32. I'll rely on their opinion, since I don't particularly care how unnatural the unnatural gets.

The DTI•Pro 32 is one device that really makes a difference in CD sound. The aging standards on which CD is based set a ceiling on its sound quality. This becomes more and more apparent as superior equipment comes into common use. Audio Alchemy's DTI•Pro 32 can't break through that ceiling, but it can make sizable cracks in it. If your main concern is musically natural sound, the difference it makes can be vital. **A**

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—Howard Swimmer
The Audio Gallery
Pittsburgh, PA



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—Joe Weber
Corner Audio
Portland, Oregon



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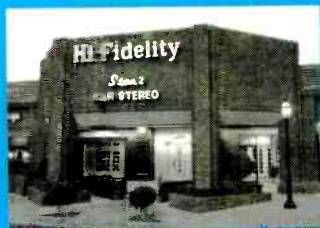
Each month, Audio Magazine's feature "See a Specialist" showcases the finest audio/video dealers from across the country. The dealers, chosen as a result of recommendations from equipment manufacturers, Audio Magazine staff and industry organizations, exemplify the best audio/video dealers from New York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

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Q Do I need as many as five or more speakers for surround sound?

A Not necessarily. An alternative first step would be to start with a pair of very good front speakers. The surround information on the soundtrack of a movie is accomplished by phase information. This information, when played through a pair of phase coherent speakers can provide a surround effect from just two speakers. A surround test disc for channel identification on a pair of good speakers is startling. The listener will swear that they hear a center channel speaker and even rear effects. As the customer builds the system, additional speakers can be added. This "building block" approach offers a degree of safety in times of rapidly changing technology. But more importantly, the enthusiast is able to enjoy each purchase in the process of building the whole system.

—Don Hamby
Don's Hi-Fidelity
Amarillo & Lubbock, TX



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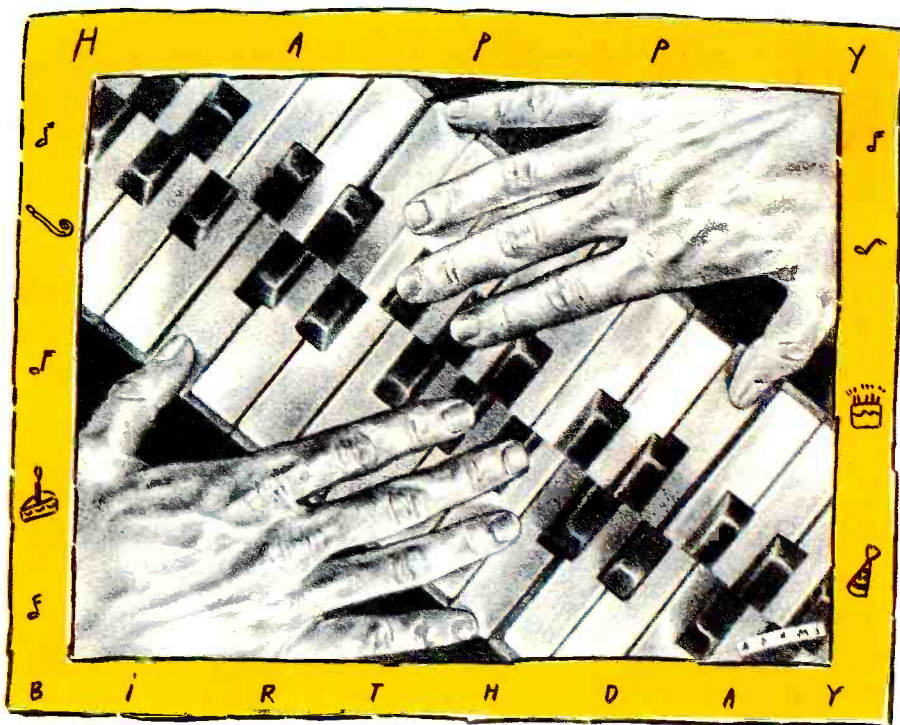
A We believe that specific, isolated comparisons among components work best. To compare CD players, we would play musical excerpts on several different CD players, through the same amplification and speakers. The *control* of keeping the variables the same other than what you are evaluating, always works for the client. People expect significant differences through speakers. Customers also easily observe discernible difference among CD players, tuners, and amplifiers. The principle is that a stereo is first an *information retrieval* system. The components closer to the source must first get the information for the rest of the system to preserve and amplify. The CD player must be high performance: If the note coming from the CD player is wrong then the speaker will do nothing to correct the "wrongness". This comparison should be performed with only one pair of speakers in the room: the pair which is playing. The non playing speakers will resonate, distorting the music's pitch, rhythm and amplitude. Don't use the store's switching systems. Have the salesman connect exactly what you want to listen to. When comparing speakers keep the amplifier and CD constant. When comparing amplifiers, keep the speakers and CD player the same, etc.

—Elliot Fishkin
Innovative Audio
Brooklyn Heights, NY



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CLASSICAL RECORDINGS



Beethoven: Piano Sonata No. 14 in C-Sharp Minor ("Moonlight"), No. 21 in C ("Waldstein"), and No. 31 in A-Flat
Eugene Istomin, piano
REFERENCE RECORDINGS
RR-69CD, CD; 57:56
Sound: B, Performance: A-



Mozart: Piano Concerto No. 21 in C (K. 467) and No. 24 in C Minor (K. 491)
Eugene Istomin, piano; Seattle Symphony Orchestra, Gerard Schwarz
REFERENCE RECORDINGS
RR-68CD, CD; 59:34
Sound: A, Performance: A

In 1943, at 17, pianist Eugene Istomin's stunning debut made him the talk of the American musical world: Within four days he played Chopin's F Minor Concerto with Eugene Ormandy and the Philadelphia Orchestra and Brahms' mighty B-Flat Major Concerto with Artur Rodzinski and the New York Philharmonic. Istomin soon became a favorite chamber

music partner of the international musical elite; Pablo Casals, the greatest cellist ever, virtually adopted him as a son. Istomin's musical training allied him with his two Central European masters, Rudolf Serkin and Mieczyslaw Horszowski, and—through Serkin—with the greatest German violinist of his day, Adolf Busch, Serkin's father-in-law. Istomin's numerous recordings included possibly the finest recording ever of the Schumann Concerto, with Bruno Walter.

And then came that flashy Juilliard armada of steely fingered young keyboard athletes, headed by Van Cliburn and John Browning and tooled to technical perfection by Rosina Lhévinne. This new contingent replaced Central European meat-and-potatoes pianism with Russian-style technical razzmatazz. Istomin quietly continued going his own way; in 1960, for instance, he joined his admiring pals Isaac Stern and Leonard Rose to form a peerless trio. Istomin continued to enjoy the undiminished esteem of his peers

(Mstislav Rostropovich, for one, invited him to play a concerto at the 1981 Presidential Inaugural Concert), but the fickle American public let itself get seduced more and more by flash and showiness.

These two discs, which mark Istomin's 70th birthday, bear ample testimony to the rare musicality of one of the most imposing pianists the United States has ever produced and to the continuing development of his phenomenal gifts. Some of the ascending bursts of 16th notes in the "Moonlight" Sonata's finale get puzzlingly blurred. (*Editor's Note:* This Beethoven CD is the first Reference Recording *not* engineered by Keith Johnson.—D.H.) Otherwise, these performances offer pianism of the highest order throughout, and Istomin gets sympathetic support from orchestra and conductor on the Mozart Concertos. *Paul Moor*

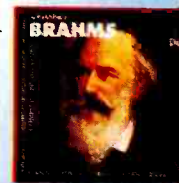
Illustration: Lisa Adams

Brahms

Complete Organ Works

Rudolf Innig, organ
MDG 317 0137, CD; DDD; 51:12
Sound: A+, Performance: A

We usually don't think of the organ when we consider the musical output of Johannes Brahms, but he did compose a number of noteworthy smaller works for this instrument. At the urging of Robert Schumann, Brahms spent months studying older music (a musicological propensity rare in his day), particularly the music of J. S. Bach. Results of Brahms' studies include the 11 Chorale Preludes, Op. 122, and the Preludes and Fugues on this disc. Organist Rudolf Innig offers a very sensitive performance of these works, and his legato touch lends clarity even in the most complex passages. He performs on the Klais organ of St. Dionysius in Rheine, and the recording quality is superb, giving a precise representation of the church's spatial dimensions and of its magnificent instrument. *Patrick Kavanaugh*



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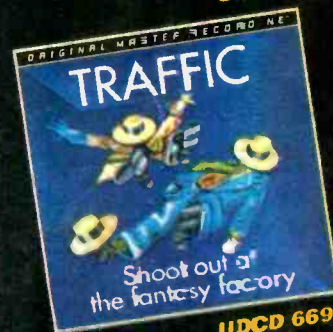
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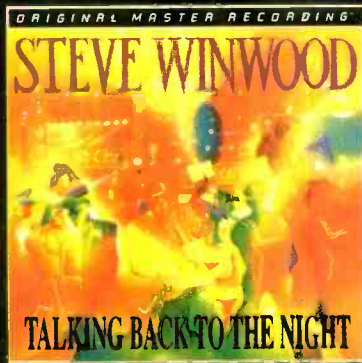
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Trios for Piano, Clarinet, and Cello

Emanuel Ax, piano; Richard Stoltzman, clarinet; Yo-Yo Ma, cello
SONY CLASSICAL SK 57499
CD; DDD; 69:38
Sound: A+, Performance: A+

Whenever one finds several great soloists on the same stage, the inevitable question is, "But can they work *together*?" Although artistic temperaments often fight one another, this recording answers the question with a resounding "Yes!" Its display of the true spirit of chamber music is impeccable, giving new meaning to the musical term "blend." A superb collection of trios for clarinet, piano, and cello, this disc deservedly won a Grammy and is destined to become a classic.

Emanuel Ax and Yo-Yo Ma have performed together for two decades, and the addition of Richard Stoltzman could not have been a better choice. As one of the world's leading clarinetists, Stoltzman naturally assumes a leadership role in these works, which he has so often performed throughout his career. It is not for nothing that Stoltzman has also written the CD's program notes, in which he blends information about the compositions with amusing anecdotes about the recording itself.

The foremost work of the clarinet trio, the Trio in A Minor, Op. 114, by Johannes Brahms, begins the program. It was late in the composer's life when he met German clarinet virtuoso Richard Mühlfeld, whose splendid playing inspired Brahms to compose some of that instrument's finest works. The Trio in A Minor is full of pathos and tenderness, and the interplay between the clarinet and cello is exquisitely executed by Stoltzman and Ma.



From a late Brahms composition, we move to an early work of Beethoven, the Trio in B-Flat Major, Op. 11. The tone is completely different, and the ensemble plays the rollicking music with reckless abandon. The zest and brashness of Beethoven's Trio is typified in the finale, a set of variations on a melody, "Pria ch'io l'impegno" (from Joseph Weigl's opera, *L'Amor Marinaro*), which, as Stoltzman comments, "can be loosely translated as 'Before I work, I must have something to eat!'"

Elements of humor are brought out in Mozart's Trio in E-Flat Major, K. 498, "Kegelstatt" (Game of Ninepins), so nicknamed because it supposedly was composed during one of Mozart's many bowling games. Yet it is in the most lyrical sections of the Andante that the three performers reach their greatest moments. Ax skillfully undergirds the counterpoint of the clarinet and cello in an alliance so strong as to suggest one musician rather than three.



Miracles of Sant'Iago



Anonymous 4
HARMONIA MUNDI FRANCE
HMU 907156, CD; 71:20
Sound: B+, Performance: A+

I don't know what it is about female voices singing medieval chant, but there is a resonance of depth and sensuality rarely experienced with male choirs. (Perhaps that's why Abbess Hildegard von Bingen's chants seem so timeless.) Anonymous 4, a quartet of women singers from New York, has been captivating listeners with its interpretations of medieval chant. On *Miracles of Sant'Iago*, the group has enlisted works from the *Codex Calixtinus*.



Anonymous 4 specializes in polyphonic chant, where the voices can weave through the melismatic melodies in undulating cascades. Sometimes it's an ecstatic cry, other times the most serene lullaby from the heavens. Anonymous 4 turns chants from solemn rumination to rapture.

This album was recorded in Campion Center in Boston. Although a low-frequency rumble is present throughout, the Center's incredible reverberation lets the voices hang suspended in the air, curling the melismas in ascending spirals. As with previous Anonymous 4 recordings, extensive liner notes set the historical scene. But you don't need directions to be seduced by these celestial hymns.

John Diliberto

These soloists spent many hours in the New England Conservatory's Jordan Hall recording this disc. Engineer Charles Harbutt is to be commended for capturing such a beautiful sound in this intimate chamber performance.

Both the Beethoven and the Mozart Trios are often performed with a slightly different scoring, the violin substituted for the clarinet in the former and the viola for the clarinet in the latter. Nevertheless, after hearing the original settings on this excellent album, most listeners will likely agree with Richard Stoltzman, who insists: "Naturally, I don't think the substitutions are as felicitous!" Patrick Kavanaugh

Music by Frank Zappa

Omnibus Wind Ensemble
OPUS 3 CD 19403, CD; DDD; 65:20
Recording: A+, Performance: A+

Frank Zappa summarized his off-the-wall concert music as "anything, any time, any place, for any reason at all—that's the leitmotif." With Zappa's attitude in mind, the dozen members of this Swedish wind group couldn't resist playing an amazing rendition of Ravel's *Boléro* as an encore to their 14 short Zappa arrangements.



Titles such as "Brown Shoes Don't Make It," "Dog Breath Variations," and "Uncle Meat" didn't throw the enthusiastic members of this classical serenade ensemble. Neither

did the often forbidding technical difficulties in arranging Zappa's complex orchestral works and then actually playing them. As always, Opus 3's sound preserves the natural acoustics.

John Sunier

Spoehr: Complete Piano Trios

Beethoven Trio Ravensburg
CPO 999 246, three CDs; DDD; 2:37:31
Sound: A, Performance: A

Though German, Louis Spohr affected the French spelling of his first name, Ludwig. He was nearly the same age as Carl Maria von Weber, and his career fell squarely between those of Ludwig van Beethoven and Felix Mendelssohn in historic time, in contemporary international esteem, and in the saga of burgeoning Romanticism. He was a violinist and conductor (the first to use the baton in London) as well as a prodigious composer. His *oeuvre* ranges from beautiful to banal; most of it is well crafted and conservative in style.

Spohr's symphonies and concertos were much admired at the time, but they tend to be stuffer and more pompous than his chamber music. The latter often was composed for his own performance in concert with his wives—the first a harpist, the second a pianist. In fact, Spohr appears to have taken little interest in the piano, except as accompaniment, until af-



ter his first wife's failing health had forced her to give up the harp. You'd never know it from these delightful pieces, relatively late works that are full of delicious pianistic filigree as well as the playful syncopations and sly modulations for which Spohr was celebrated. The music is tuneful, fresh, and graceful—in short, the most consistently engaging scores I've heard from his pen.

The Beethoven Trio (whose full name reflects sponsorship by the city of Ravensburg, Germany) seems utterly at home in this music. The Trio's supple response to its changing moods should stand as an object lesson to lesser groups, and they make their points without posturing. The recording was done in a Bremen radio studio, but its attractive ambience rises well above radio norms. The subjective effect is that of standing on stage in a good recital hall to hear some unaggressively eloquent music-making.

Robert Long

Armer: Uses of Music in Uttermost Parts

Elinor Armer and Ursula K. Le Guin, narrators; choral singers; chamber musicians; The Women's Philharmonic, JoAnn Falletta
KOCH INTERNATIONAL CLASSICS

3-7331, two CDs; DDD; 1:39:08

Sound: A-, Performance: A

If intelligent musical whimsy tickles you, don't miss this. If it tends to give you the pip, caveat emptor!

Ursula K. Le Guin, a writer honored with a National Book Award and numerous other prizes, is famous worldwide for her novels, stories, poetry, children's books, screenplays, and so forth. Elinor Armer chairs the San Francisco Conservatory's Composition Department and co-founded Composers, Inc., one of the leading presenters of contemporary music in this country. Originally these two artists set out to create a multi-movement work pegged on the idea of music as serving—how best to put this?—in various fanciful capacities. For instance, they originally intended to devote an entire movement to music as sex. (In the San Francisco Bay Area, where both women live, unbounded disappointment followed the announcement that they had abandoned this idea.)

In the opening movement, "The Great Instrument of the Geggerets," their invented island of Gegge remains above water only as long as its inhabitants (Pluckers and Pickers, Blowers and Bowers, Holedrillers, Holefillers, Clankers, Ineffable Vibrants, the Thingers of Thongs, and the Reedbeeblers) can appease the regional deity Geg by doing their respective things endlessly, without interruption. "If

they don't keep playing, they're sunk." The other movements display similar fantasy, culminating in an environmental paean entitled "Island Earth."

The work's eight movements require forces ranging from a single narrator, to three instrumentalists, up to a full symphony orchestra plus chorus. Le Guin takes a frisky approach to language, and her jolly texts abound in delicious invention and wordplay. Armer composes music that must be classified as atonal, but it has great good humor and imagination.

This recording project attracted some of the Bay Area's finest resident musicians, and they do a thoroughly professional job. The predominant laid-back pace throughout, although certainly evocative of that exotic region, leaves one wondering whether literary caprice can ultimately carry a musical work of this length. But the combination of the text and music adds up to considerably more than mere poetic recitation plus sound effects.

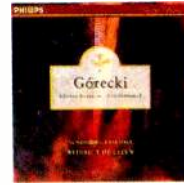
Górecki: Kleines Requiem für Eine Polka; Lerchenmusik

Schönberg Ensemble, Reinbert de Leeuw
PHILIPS 442 533, CD; DDD; 66:48

Sound: A-, Performance: A

Piet Mondrian, the Dutch painter, came to the conclusion that repetition in art is essentially a cheap trick, one that has no aesthetic virtue. In music, the rules of "tone-row" composition, as promulgated by Arnold Schoenberg and his circle at the beginning of this century, reflected a similar concept. Both Mondrian and Schoenberg went a long way in shaping the severe side of modernist sensibilities.

By contrast, our end of the century may be remembered as the age of the ostinato. Mesmerizing repetition is a characteristic found in



The Septet, Op. 20, and Serenade, Op. 25, are among the pieces I love to cite in arguing how unfair is the stereotype of Beethoven as a morose genius. The vivacity and humor, some of it laugh-out-loud funny, that informs his early work is almost as valuable as the profundity of the late masterpieces. From the listener's viewpoint, it makes a whole man of what would otherwise be a mere monument. Would that we could this readily glimpse the humanity that resides in all great thinkers!

The Serenade is scored for flute, violin, and viola; the Septet includes violin, viola, cello, double bass, clarinet, bassoon, and horn. Violinist Ani Kavafian and her colleagues (Ran-

The Chamber Music Society of Lincoln Center
DELOS DE 3177
CD; DDD; 64:04
Sound: A
Performance: A, B

BEETHOVEN



IN NEW YORK

som Wilson on flute and Paul Neubauer on viola) light into the Serenade in fine style. Joseph Silverstein, the violinist of the Septet, takes a more rarefied approach, and the rest of the group (including its artistic director and clarinetist, David Shifrin) seems to hold back a mite in deference to him, limiting the piece's impact somewhat. The sound is fairly close-to and surrounded by a nice sense of acoustic space.

Don't be put off by the contrived cover art. It is justified, more or less, by Shirley Fleming's colorful notes, which come in two flavors: detailed and informative for

adults, breezy and provocative for kids.
Nice touch!

Robert Long

Supporters of the women's movement will especially want to snap this up, not only because of Le Guin and Armer but because of the symphony orchestra involved. From 1981 on, San Francisco's valiant and estimable Women's Philharmonic did trailblazing work on behalf of history's unfairly neglected women composers, giving their music top programming priority. Sad to say, this splendid group of women instrumentalists has since gone the way of such other unique cultural institutions as *Musical America*, the monthly magazine.

Paul Moor

the music of several of our most eminent contemporary composers. It can be mind-numbing, almost as though the music is beating its auditor into submission.

Henry Górecki's use of repetition is witty and less brutal than most, but it can be momentarily irritating, perhaps deliberately so. What saves it from becoming a debilitating fixation is, above all, Górecki's vivid sense of drama, which invests his music with sharply focused emotional content. The present works even border on the sentimental in their more rapt moments, always counterbalanced by an

outcry or a touch of the rowdy. The Requiem, composed in 1993, is a suite for 13 instruments. The juxtaposition of the words "requiem" and "polka" presumably is intended to reflect the tendency of this serious piece toward self-mockery. The *Lerchenmusik*—for clarinet, cello, and piano—dates from 1984 and is lighter in texture musically as well as emotionally. Both pieces are engrossing.

The music strongly exercises CD's dynamic range. The recording, made in 1993 in an Amsterdam church, preserves this range, but some unclear bell sounds at the climax of one movement in the Requiem limit my grade for sound to A-. Since these points don't strain the quantization scale to its 0-dB breaking point, I assume the overload (if that's what it is) occurred in a microphone or an input stage. A detail, indeed, but noticeable in the overall excellence.

Robert Long

Ernesto Lecuona

The Complete Piano Music, Volume 1

Thomas Tirino, piano;
Polish National Radio Symphony
Orchestra, Michael Bartos
BIS CD-754, CD; DDD; 78:11
Sound: A, Performance: A+

Ernesto Lecuona's (1895-1963) great melodies and strong Spanish and Afro-Cuban rhythms influenced much Latin music, including today's salsa. Admired by Ravel and Gershwin, among other composers, he had an international career that took him to Hollywood and New York.

Lecuona's virtuoso improvisatory piano style is heard in this album's centerpiece, the *Musica Española*. Familiar tunes, such as "Andaluza" (popularized as "The Breeze and I"), act as a counterbalance to the less familiar ones, such as the spectacular "Aragón." The pianist, Thomas Tirino, handles difficult passages with ease, and the piano sound is clean and unforced in both solo and concerto settings, including the Gershwinesque "Rapsodia Negra" for Piano and Orchestra.

John Sunier



J. S. Bach, W. F. Bach, C. P. E. Bach, and J. C. Bach: Concertos & Duets for Two Keyboards

Christopher Hogwood and
Christophe Rousset, keyboards
L'OISEAU-LYRE 440 649
CD; DDD; 65:30

Recording: A+, Performance: A+

These duets and concertos for two keyboards were composed by the Bachs for the Bachs, a household full of keyboards including clavichord, harpsichord, organ, and fortepiano. These compositions are also the complete works for two keyboards alone by all the Bachs.

Johann Sebastian's lovely C Major Concerto for Two Harpsichords opens the collection. A sonic shock may set in when one hears Wilhelm Friedemann's Concerto for Two Keyboards, because the performers chose a pair of 1760-vintage clavichords for this (and for Carl Philipp Emanuel's Four Duets), and the producer courageously kept the levels perfectly realistic. Therefore, if you play back the harpsichords at a lower level, the clavichord concerto may be totally inaudible. Hogwood advises setting overall level by the harpsichords and resisting the temptation to turn it up for the clavichords.

A pair of Zumpe-style square pianos from 1770 is heard in Johann Christian's G Major Duet. Though unable to achieve the high volume levels of modern pianos, they are still jolting after the subtle clavichords.

The miking reveals well-separated instruments. The spatial element adds interest to the listening, especially when heard through stereo headphones.

John Sunier

Zender: Schubert's *Winterreise*— A Composed Interpretation

Hans Peter Blochwitz, tenor;
Ensemble Modern, Hans Zender
RCA VICTOR RED SEAL 68067
Two CDs; DDD; 1:30:35
Sound: A-, Performance: A

Hans Zender's "creative transformation" of *Winterreise*, Schubert's great song cycle, challenges some deeply ingrained notions of both classical sonics and performance practice. As such, it should be at least sampled by anyone who takes audio seriously as a medium.

In the accompanying notes, Zender observes, "Many place a great deal of importance on a performance that sounds closer to the historical original. . . . And although this is a good thing, we should not fall prey to the illusion that the presentation of

performances with historically authentic instruments can of itself bring back the spirit of the times when the music was composed. Our listening habits and our ears have changed too much. . . ." Hear, hear! From this position (and, he says, from years of trying to perform Schubert as objectively as possible, only to discover that each performance is perforce a subjective interpretation), Zender extrapolates the current score, with a chamber orchestra as a major participant.

In this particular realization, the recording venue (the Hessian Radio Sendesaal) also is a participant, since the physical placement of the tenor, Hans Peter Blochwitz, and the instruments within the soundstage is one of its important variables.



For example, the first song opens with distant, ultrapianissimo thumps that gradually approach and coalesce into the percussive rhythm of Schubert's piano part; only when that is established are tone color, pitch, and harmonic structure added.

The tone colors employed are at times quite unconventional. The more arcane colors, like the spatial effects, suggest the possibility of multitracking and electronic manipulation during mixdown—an impression that is, if anything, strengthened by the rather turgid, harsh sound that occasionally results on climaxes. (The sound is otherwise generally clean and believable.) In any case, this is not a performance whose attributes could all be duplicated in a concert hall. Nor is it intended to be. Zender specifically pokes fun at the notion that "two men in tuxedos, a Steinway, and usually a very large concert hall" can adequately convey what Schubert had in his heart in writing *Winterreise*. This interpretation is Zender's attempt to express more of what he perceives as Schubert's creative impulse than a conventional concert can encompass.

Much of it is very successful, though a few of the effects do strike me as a mite soporific. Make no mistake, we are not dealing with "switched-on Schubert" here; a "fun" version of this masterpiece would be as bizarre as a block dance on death row. The intent is utterly serious, and the means are consistently inventive. Much of the vocal part, which is expertly sung, is unaltered from Schubert's score. The instrumental parts venture much farther afield, but the most radical departures are mainly confined to introductions or interstrophic bridge passages. All the cycle's songs are included (with the German texts and English translations in the booklet), in the usual order, preserving the original *Winterreise*'s integrity at the bedrock level, whatever you may think of the superstructure Zender has erected.

Robert Long

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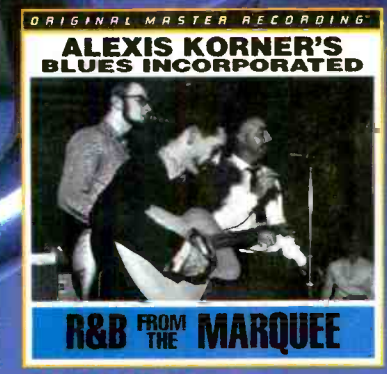
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**Bowles: Concerto for Two Pianos,
Winds, and Percussion;
Sonata for Flute; Music for a Farce;
Sonata for Oboe and Clarinet;
Hippolytos and Salome;
Scènes d'Anabase; Night Waltz**

Various soloists; HCD Ensemble of Frankfurt
LARGO 5131, CD; DDD; 70:47
Sound: B, Performance: A to B

Without going into a lot of detail, this is an excellent cross section of the music of Paul Bowles, in thoroughly competent and generally quite engaging performances and recorded in professional (if uninspired) style in the



Frankfurt studios of the Hessian Radio. The excellent booklet is filled with biographical material. If you like playful and inventive modern music and have not yet encountered the work of Bowles, I know of no better introduction.

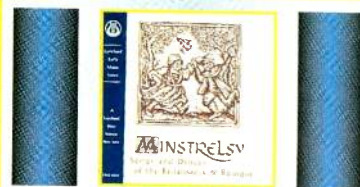
Robert Long

The bulk of the settings were written for performance by Britten himself (as pianist) with his life partner, tenor Peter Pears. As Britten's health failed, he began writing for other accompanists (guitarist Julian Bream and



harpist Osian Ellis) so that Pears could continue without him. The extremely distinctive characteristics of Pears's voice are irrevocably stamped into these songs, and there is no more fitting latter-day exponent of them than Philip Langridge. His voice retains enough of Pears's reedy, British quality to remain true to the songs but is richer and more mainstream overall.

Presumably for variety, Collins has chosen to intersperse some performances by Felicity Lott, whose singing I generally admire, among the solo songs sung by Langridge. She sounds somewhat out of place, because the songs are so redolent of Pears's voice and style. A few of the songs are scored for chorus (or tenor plus



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EARLY MUSIC SERIES

LEMS 8018, CD; DDD; 48:47

Sound: A, Performance: A

If you're looking for an old-music sampler with super-clean sound that makes the performers (five of them, in this case) appear to be right in your living room, this is it. The performances, moreover, are fresh, enthusiastic, and unfussy. My only complaint is the short measure; even listeners wary of old music will want more than is included here.

Robert Long

Singing for Pleasure

Westminster Choir,
Joseph Flummerfelt

DELOS DE 3193, CD; DDD; 50:58
Sound: A, Performance: B

This all-Brahms recital gets a B for performance only because I much prefer such fare sung by fewer voices. If you like your Brahms big, this may be the performance for you. You'll find goodies galore: one six-minute

motet ("O Heiland") plus shorter selections from the *Liebeslieder Waltzes* (both sets), the *Zigeunerlieder*, the folk songs, and the vocal quartets. The chorus numbers under 40, and it's arrayed across the



soundstage so that you get a strong sense of individual voices instead of a homogeneous blur.

Robert Long

of musical heritage and his ambition to master string technique.

Most of these symphonies were lost for 130 years and discovered only in 1950 in East Berlin. The first six are scored for only four parts; the Seventh begins to show a more individual voice. The Eighth was later fully orchestrated, becoming Mendelssohn's first real symphony, and is performed with the wind parts. In later symphonies the strings are divided, and in No. 11 (clocking in at 40 minutes!) three percussion instruments are added.

The slow movements of all these symphonies are especially exquisite, and little touches, such as a Swiss folk song in No. 11, add spice and interest. Shades of Bach, Handel, Mozart, and even Rossini are heard in



some, but the music is so lovely that Mendelssohn can easily be forgiven. The music, which has what one critic called a "languid chromaticism," is so infectious and fresh-sounding that you may find you prefer it to the familiar Mendelssohn symphonies.

Seeing "Performed on Period Instruments" on the booklet's cover might make some collectors anticipate thin and strident string tone. Fear not: These 19th-century instruments' string tone is full and rich. The recording perspective is distant, conveying a genuine feeling of the hall acoustics.

John Sunier

Britten: The Folk Songs

Felicity Lott, soprano; Philip Langridge, tenor; Thomas Allen, baritone; Carlos Bonell, guitar; Osian Ellis, harp; Christopher Van Kampen, cello; Graham Johnson, piano; the Wenhaston Boys Choir; the BBC Singers; Northern Sinfonia, Stuart Bedford

COLLINS CLASSICS 70392

CD; DDD; 3:18:47

Sound: A, Performance: B+ to A+

None of Benjamin Britten's output is more personal or more endearing than his folk song settings, and it is wonderful to have them all together in this complete set—including even the few unpublished items. The songs are captured here in clear, clean sound that never achieves the exquisite but never falters below excellent either.

chorus); some have orchestral accompaniments. In the latter case, the conductor is Stuart Bedford, the artistic director of the Collins Britten Edition series, of which this set is a part. If you admire Britten's music, this series is worthy of investigation.

Robert Long

**Mendelssohn:
String Symphonies (Complete)**

The Hanover Band, Roy Goodman

RCA RED SEAL 09026-68069

Three CDs; DDD; 3:45:07

Sound: A, Performance: A

These 13 glorious pieces were completed when the precocious Felix Mendelssohn was only 14 years old. They were part of his studies but are far from dry academic exercises, revealing the young composer's solid knowledge

ROCK ~ POP RECORDINGS

"God Only Knows" are among pop's defining moments. There are the melancholy sounds of a loving man trying to reconcile the heartbreak of a world in which he has no control.

The Pet Sounds Sessions was fabulously mastered and exhaustively annotated (by David Leaf). This impeccably executed excavation is *Pet Sounds* in the raw. It contains elements of the recording done every which way: alternate renditions and outtakes, vocal tracks, a first-ever stereo version and a remastered mono version, takes and retakes from the tracking dates, and a plumbing of "Good Vibrations" (written during the sessions but left off the original album). It's everything you ever wanted to hear from *Pet Sounds*-era Wilson, and much, much more. Too much, in fact, for the casual listener. (Isn't it more titillating to see an attractive body with just a trace of clothing?)

Granted, few records in the history of rock could even come close to lending themselves to this kind of detailed exploration. Today, a full 30 years later, the original song list still astounds. And in light of Brian Wilson's well-publicized mental deterioration, his lucid patter between takes is sobering; he's a man on a singular

peaks on *Pet Sounds*. The cathartic choral finish of "You Still Believe in Me," the wrenching disappointment in the opening line of "Caroline, No," and the helpless romance of

**The Pet Sounds Sessions:
A 30th Anniversary Collection**
The Beach Boys
CAPITOL CDP-37662
Four CDs; 3:15:57
Sound: A, Performance: A+

How do you feel when someone you don't know very well gives you a generous gift? Kind of awkward, right? Well, that's the way you might feel when you listen to this set.

Yes, we know The Beach Boys and Brian Wilson. And yes, we know Wilson's blinding 1966 masterpiece, *Pet Sounds*. But what do we make of this monster, four-disc celebration, *The Pet Sounds Sessions*? Doubtless, it is important music archaeology, but dare we accept such a gift from The Beach Boys? And do we really benefit from their undue generosity?

Clearly, few moments in the history of pop music rival the emotional

Dan Baird gets better and better with each recording. On his second post-Georgia Satellites effort, he turns the guitars and backbeat up way, way loud, rivaling The Sats at their most deafening.

Buffalo Nickel also reminds us how formidable Baird is as a songwriter. Its tunes are chugging, swampy rock that rely on humor, guitars, solid grooves, and undeniable riffs posing as hooks. A particular winner is "Cumberland River," a hard-luck story about a songwriter who ventures to Nashville, finds it cold and heartless, and latches back to the Appalachian hellhole he calls home. Another standout is the lead track, the Paul Westerberg-inspired "Younger Face," in which a

rock 'n' roll has-been muses about being replaced by the latest batch of young, skinny lads with guitars.

Baird's famed wit is definitely alive and well.

Speaking of guitars, *Buffalo Nickel* is a guitar-fest that could prick up the ears of über-twangers like Albert Lee or Pete

Anderson. Most of it is courtesy of producer Brendan O'Brien, who's better known for producing Stone Temple Pilots and whose own chops are very much on display here. Solidly Marshall-sized one second, tugging mightily at the Telecaster the next, O'Brien gives Baird's latest the distinction of being a great contemporary guitar record in addition to being, simply, a great record.

Mike Bieber

BUFFALO NICKEL

BUFFALO NICKEL

Dan Baird

AMERICAN 9 43037, 47:34

Sound: A, Performance: A



LOVE IS DEAD

The Mr. T Experience
LOOKOUT RECORDS LK134, 40:32
Sound: B, Performance: B+

Ten years of minimal evolution yielded The Mr. T Experience's *Love Is Dead*, an over-before-you-know-it, 16-track whirlwind of Bay Area Ramones-style fervor. The Experience's legitimate credo, "Dumb Little Band," is truly the most hilarious commentary on the rock 'n' roll lifestyle since Motorhead's "We Are the Road Crew."

What sets The Mr. T Experience apart are its vocal harmonies and

tales of relationship woes. There's the blast of lead guitar in "Can I Do the Thing?" and a side-swiped Pete Town-



shend riff in the Who-like "I'm Like Yeah, but She's All No," while "That Prozac Mcment" and "You're the Only One" convey the band's sense of humor. Really, there is something to be said for The Mr. T Experience's raging adolescent tempos and astute commentary on matters of the heart. *Love Is Dead* is a fun little release of energy.

Tom Ferguson

mission, eager to chisel his vision into musical marble. You can hear him in the role of taskmaster as he takes absolute control of every note on the record. Mike Love can shove his lawsuits; *Pet Sounds*, "Good Vibrations," hell, The Beach Boys themselves belong solely to Brian Wilson.

Everything on *The Pet Sounds Sessions* is remarkable, both creatively and sonically (re-issue co-producer Mark Linett's stereo mix was done on the same type of machine that Wilson used back in '66). So why is this gift so difficult to accept? Why do I feel uncomfortable about seeing this bride stripped so unequivocally bare?

Bob Gulla

Change My Life

Epic Soundtracks

BAR/NONE AHAON-074, 44:10
Sound: B, Performance: A

For those familiar with Epic Soundtracks only through his two previous albums of shadowy, piano-based melancholia, the brash, rollicking tone of *Change My Life* may come as a shock. *Rise Above* and *Sleeping Star* were



somewhat dour, introspective displays of his consummate craftsmanship, whereas *Change My Life* finds Epic spreading his rock 'n' roll wings. Fully embraced by the

classicism of rock's better moments, *Change My Life* sounds like it could be a few different records: the great album John Lennon would have made in the mid-'70s were he not so distracted, the Big Star album that would have been made had the group not been so nihilistic, or, better yet, *The Slider*, if Marc Bolan hadn't believed he was an alien priest. High praise, to be sure, but given Soundtracks'

background as a sort of post-punk Harry Nilsson, he seems incapable of little.

There's the gritty, Nick Cave-like grunt of "Landslide," the infectious provocation of "You Can Be My Baby," and the swooning, string-laden melodrama of "Ring the Bells." There's the contemplation of "The Wishing Well," the bouncy swing on "The Rain Came Down," and a drunken, lo-fi medley of Big Star's "Nighttime" and "Thirteen" that somehow captures the falling-apart beauty of the originals. There's clearly a lot here, but Soundtracks' passionate delivery and delicate mastery of his muse make it a worthwhile journey. After all, since when was rock about stagnation?

Jason Ferguson

Lay It Down

Cowboy Junkies

GEFFEN GEFD-24952, 51:19
Sound: B+, Performance: B+

Like an animal that's been hit with a tranquilizer dart, Cowboy Junkies' ethereal latest will send you into a stupor, and any struggle against it is fruitless. Michael Timmins' minimal, swampy guitar is the dart, and sister Margo's hymn-delicate voice is the drug.

After a couple of ambitious, more ornate records, the team has returned to the gothic country sound of its 1988 breakthrough, *The Trinity Session*. Even on "Angel Mine," the most uptempo track on *Lay It Down*, there's a sparseness to the arrangement and a carefully plotted restraint in the vocals that give the song a poisonous taint. Or perhaps "friendly darkness" is a better term.

Folks who didn't connect with Bruce Springsteen's latest, the brilliant *The Ghost of*



Tom Joad, will likely miss the gorgeous subtlety of such folkloric dirges as "A Common Disaster" and "Lonely Sinking Feeling" and of the despairing "Bea's Song (River Song Trilogy: Part II)." Everything is implied; one twanged note stands where four might run rampant. And Margo Timmins, sounding like she's on lithium carbonate, breathes soft, wicked phrases across the barren soundscape ("Now I know what it means to be broken" or "Grief is a word to describe the absence of feeling").

Tension builds in the music in a way that may leave you feeling like those phosphorescent fish swimming way down in the pressurized depths. But that's Cowboy Junkies' stock in trade, and it's great to hear them milk it for all it's worth.

Tom Lanham

Billy Mann

DV8/A&M 31454 0365, 45:40
Sound: B, Performance: C+

At his best, Billy Mann displays the kind of lyrical smarts that call Squeeze to mind. His clever, tempting use of an electric organ on "Tossing Pennies (in a Well)" serves to reinforce this impression. On his self-titled debut, unfortunately, Mann lacks Squeeze's wry sense of the absurd or the rocking grit that powers that group over its rougher lyrical conceits. Instead, this new-jack folk/soul artist's most raucous moments sound very much like an eviscerated Lenny Kravitz or a mellow Stevie Wonder, especially around the vocals of "Let's Start Over Again."

Mann's weaker moments find him reaching for something just beyond his grasp, while some of his music just simpers. You can make a game out of counting the clichés in "In the Rain." Lyrically, many of his songs are just too precious for their own good. The clean but stark recording of this album does little to hide these inadequacies, almost as if Mann is proud of them.

And he might be. Many of the well-crafted bits of acoustic new-jack swing display promising flourishes. "Ain't Gonna Keep Me Hangin' Around" has an Al Green-like Hi Records ambience, and flamenco guitar licks flow through "You Only Love Once." Mann infuses "Killed by a Flower" with jazz licks (albeit feeble ones) and couches "Will I Ever" as a semi-samba. Don't be surprised if "(Tell Me) When God Will Speak" sounds like an antidote to Joan Osborne's "One of Us."

The songs here that fall short of their ambitions at least do so honestly. However, Billy Mann's overall musical sensibility filters Seal through Dan Fogelberg. Ultimately, it's your choice as to whether that's a warning or a recommendation.

Hank Bordowitz

Tarantula

Ride

SIRE 61893, 50:28

Sound: B, Performance: B+

In the final days of its existence, Ride exhibited little of the camaraderie and unity it began with. The group's leaders, vocalist/rhythm guitarist Mark Gardener and vocalist/lead guitarist Andy Bell, became obsessed with their own stardom, and the friendship that began at an art school in Oxford, England, turned into a bitter battle for artistic control.

Ironically, the hostility didn't affect the sound of the group's fifth and final album,



Tarantula. Aside from the torrential opening number, "Black Nite Crash" (a hard-stomping cross between MC5 and The Stooges), the music is lively and passionate.

It's filled with soaring harmonies, memorable melodies, and spacious jams. Compared to the band's early records, which reeled with roaring guitar storms and sleepy, defeated vocals, *Tarantula* is like a peace offering. Yet in many respects, it's also a declaration of war.

Many of the songs revolve around themes of betrayal and revenge. On "Burnin'," Bell sings, "This place won't get me down/Because I'm gonna burn it down." On "Deep Inside My Pocket," Gardener revels in the distrust that developed in the band: "When someone cares, it's nice to know/Til that care turns to runnin' the show/And then I'll turn on ya." In a way, the conflict works in Ride's favor, as each of its members does his best to outperform his mates.

Although the songs on *Tarantula* are dynamic and crafty, they rely heavily on outside influences, sounding at various moments like a mutation of Jimi Hendrix, Traffic, The Stones, and The Byrds. Perhaps the lack of a clear identity on *Tarantula* comes from Ride's inability to fuse into a single unit. Regardless, the band that ushered in a wave of "shoegazing" glory in 1990 goes out with a powerful, if less musically chaotic, bang. *Jon Wiederhorn*

Primitive Streak

The Subdudes

HIGH STREET 72902 10344, 49:51

Sound: A-, Performance: A

The Subdudes, a good-time rock 'n' roll band, unabashedly wears its influences on its sleeves. The group's music is a melting pot of blues, rock, and soul that's filtered through a strong dose of New Orleans (where this album was cut). The band's musicianship has always been fabulous, but the quality of its songwriting has held it back. *Primitive Streak*, however, is far and away The Subdudes' best

As Good As Dead

LOCAL H

ISLAND 314-524 202, 49:24

Sound: B+, Performance: A

The scrappy drum/guitar duo Local H is fast becoming the Gilbert Gottfried of alternative rock. Like that annoying, loud-mouthed twerp, H-men Scott Lucas and Joe Daniels yell a lot and constantly push their luck in the taste department. But beneath the clamor, these guys—just like comedian Gottfried—are pretty damned hilarious.

Local H's noisy homages to Pearl Jam ("Eddie Vedder"), *Back to the Future* films ("Manifest Destiny"), and even old black-and-white thrillers ("I Saw What You Did and I Know Who You Are") are all fine and good. But the main attrac-



tion here, the reason to race out and get this record pronto, is the album's hilarious centerpiece, "High-Fiving MF"—a tip of the fedora to everything that's shallow and disgusting about the record industry. And, not surprisingly, for radio release the naughty track's invectives have been masked by overdubbed guitar feedback.

Nevertheless, if this outrageous, raucous rocker isn't the surprise hit of the summer, there's something se-

riously wrong in radio and MTVland; Local H has crafted one of the most memorable, sneering ditties since "Smells Like Teen Spirit." Still, not everyone enjoys hearing ribaldry at maximum volume. For those who do, *As Good As Dead* will hit like a quick rush of adrenaline. *Tom Lanham*

album; the songwriting has jelled at last, giving the band the sturdy vehicles that it previously groped for.

Primitive Streak gets your immediate attention with the Huey "Piano" Smith-styled rocker, "All the Time in the World," which opens up with a signature quote from The Troggs' "Wild Thing" before latching onto a groove that won't let go. From there, the program is both diversified and balanced. Rockers include "Break Down These Walls," the shuffling "Love O' Love," and the party-vibed "Sarita." Mid-tempo numbers include the cha-cha "Why Do You Hurt Me So," the greasy "Don't Let 'Em," and a great pairing with Bonnie Raitt on "Too Soon To Tell." Some of the slower songs echo harmonies of The Allman Brothers, especially the country "Carved in Stone" and the wistful "Faraway Girl."



The Subdudes' sound is loaded with seductive textures that include accordions, Lowell George-esque slide guitars, mandolins, occasional horns, angelic voices, and even a banjo (on "Do Me a Favor"). Clark Vreeland's production and Ray Ganucheau's engineering are excellent on *Primitive Streak*; they have helped cook up an album of terrific Crescent City gumbo. *Michael Tearson*

Electriclarryland

Butthole Surfers

CAPITOL 29842, 51:15

Sound: B+, Performance: B

Throughout the '80s, the one band that could consistently make the hair on your neck stand on end was Butthole Surfers. From *Rembrandt Pussyhorse* and *Locust Abortion Technician* to the sublime *Hairway to Steven*, Gibby Haynes, Paul Leary, and King Coffey—a self-described "clique of creeps" for the ages—frequented the crossroads of the bizarre, the grotesque, and the musical. And they loved to let us hear about it.

Since leaving the independent ranks, however, the Buttholes have suffered from major-label malaise. Their sound has veered from peculiar and nonlinear to predictable, straight-ahead punk and mid-tempo, country-tinged pop. For a group once regarded as the archetype of alternative rock, that's strange.

Electriclarryland, the band's 13th album, is not all traditional *Sturm und Drang*. Though the punk rock electricity coming from Leary's guitar could light up Las Vegas, the more eccentric moments, "Jingle of Dog's Collar" and "My Brother's Wife," suggest the ghoulish an-



tics of Buttholes past and are the most successful. And when Haynes laughs himself into hysterics at the beginning and end of "Space," you thank the stars that the band still hitches joyrides on the blue bus now and again. Without moments like these, this "creep clique" would sound almost mundane, an execrable state for any Butthole Surfers fan. *Bob Gulla*

Secaucus

The Wrens

GRASS RECORDS 13021, 54:04

Sound: C, Performance: B

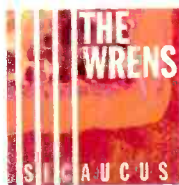
"Recorded in our basement, June-August 1995," boast The Wrens in the CD booklet for *Secaucus*. Gee, what a surprise—as if this surly, sloppy, garage punk fare could've been taped anywhere else. But what these New Jersey knuckleheads lack in musical inventiveness, they more than make up for in humor. On "Indie 500," to the curious accompaniment of cheesy power chords and furious honky-tonk piano, roguish bassist/vocalist Whelan G. E. snaps, "Spare me those failed cars that sound like the pavement they rode in on." And if you get that "pavement" dig (a reference to the of-

ten imitated indie band Pavement), then you are nearly on board The Wrens' wacky tongue-in-cheek ship.

The songs rocket past, all oddly diverse and most subtly winning. There's a Raspberries-school ode to making out, "Dance the Midwest"; a scruff-necked riffer, "Hats Off to Marriage, Baby"; and a dreamy, Beach Boys-esque "Jane Fakes a Hug," which could pass as Brian Wilson singing while on some '90s Ecstasy high.

Just what are The Wrens trying to achieve? Chances are, they themselves have no clue. Listen to the way the twin vocals clumsily overlap and eventually collide on "Rest Your Head" (an existential musing on the everyday burdens and responsibilities of being human). Lyrically, there's something thoughtful going on. Musically, it feels like the album required barely any thought at all, as if fueled by a couple of 12-packs of cream ale. Hats off to The Wrens for (as they said) not being Pavement and not doing the same old alterna-guitar-swirl thing. And just for being their weird, screwball selves.

Tom Lanham



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In his early '70s pop outfit, Big Star, Alex Chilton (along with the late Chris Bell) created some of the

most memorable songs in modern rock history. Unfortunately, no one noticed at the time, and after outright commercial rejection Chilton turned to drugs and alcohol. Since then, the memory of Big Star has been invoked by every band that's aspired to a crunchy melodic sound, including The Replacements (who named a song after Chilton) and Seattle's finest pop band, The Posies.

Chilton's relationship with The Posies has, in fact, been symbiotic. Ken Stringfellow and Jon Auer, the band's principals, actually performed in Chilton's reunited version of Big Star. The duo folded seamlessly into Chilton's smooth, singular style, which was more a testament to their admiration of the singer's talents than to their own instrumental dexterity.

Amazing Disgrace

The Posies

DGC DGC0-23244, 49:58

Sound: A- Performance: A

1970

Alex Chilton

ARDENT 7-1515, 44:26

Sound: A- Performance: B-



Amazing Disgrace, The Posies' fourth record, is the band's strongest release yet. Armed with a crushing new rhythm section and

a passel of emphatic songs, The Posies sound reborn. There's venom on their lips ("Daily Mutilation"), and you can hear shades of uncharacteristic adventure ("Broken Record"). Auer and Stringfellow still have the best organic vocal harmonies in pop. And their

guitars, in overdrive for much of *Amazing Disgrace*, give the material a fabulous urgency.

And speaking of urgency, there was a decided lack of it on Chilton's part in releasing *1970*, heretofore unheard material that he wrote at the beginning of Big Star's day. Though much of it is clichéd, post-Beatles blues, "Free Again" and "Something Deep Inside" hint at Chilton's brilliance.

Bonus points for the "Jumpin' Jack Flash" cover and the bleetooed rendition of "Sugar Sugar." *Bob Gulla*

JAZZ~BLUES RECORDINGS

Dave Holland



melody breezing through a gentle Afro-Cuban rhythm in "The Wind-ing Way." Over Gene Jackson's con-stantly shifting drum-ming, vibist Steve Nelson plays a lyrical solo that quickly cli-maxes and then relax-es into gentle chordal work behind an alto sax solo by Eric Per-son. Pointed and driv-en, Person's solo melds seamlessly into the composition's melody. Leading his new quar-tet, Holland seems to wring the best from each player: Jackson refines a formerly heavy touch, Nelson contributes some of his most surprisingly pleasurable and melo-dically lush playing ever (almost stealing the record), and Per-son reaches the full potential hinted at during his time spent in Chico Hamilton's group. All involved find open paths to ex-

Photograph: © 1996, David Gahr

Dream of the Elders

Dave Holland Quartet

ECM 1572, 77:09

Sound: A, Performance: A



For almost 30 years now, Dave Holland's bass has been at the core of some of the most vibrant jazz recordings. Though his worldclass presence is renowned and his own compositions admired, all too often he's been considered a sideman. Holland's sumptuous tone and mammoth grasp of the instrument underpinned Miles Davis's experimental recordings of the late '60s, the freer expanses of the Chick Corea-led Circle quartet, his own debut as a leader (1972's *Conference of the Birds*), and the seminal work of The Gateway Trio.

Holland's compositions (aided by his choice of musicians) have been marked by rich detail and engaging sensitivity, resulting in a handful of groundbreaking recordings. Perhaps his restless nature leads to long breaks between his own projects, but not many can boast about such consistently excellent work. In a turn-around from his heralded (if raucous) '80s records, *Dream of the Elders* is a more pastoral outing, swinging and soothing with trademark Manfred Eicher production. Subtle yet powerful, with a lushly diffuse tone, Holland draws everyone around him into his sphere of influence.

The first album of all-original material since his 1972 debut, *Dream of the Elders* is a sublime example of Holland as bandleader, composer, and bassist. It begins with a poignant

expression, stimulated by Holland's engrossing melodies and brisk, rhythmic shifts. Cassandra Wilson guests on the pulsating "Equality"; "Ebb & Flo" does just that, while "Second Thoughts" swings like a hot-air balloon zipping over windy countryside. The title track unfurls slowly through Holland's pensive figures and a swaying melody doubled on alto sax and marimba. Nelson's switch to vibes on the bridge provides a beautiful cascading effect, like a waterfall drenching the music.

If this is the first in a series of recordings from Holland's new band, jazz fans have much to look forward to. If not, *Dream of the Elders* (along with a tide of current Holland releases) marks yet another peak in the bass legend's mountain of music.

Ken Micallef

Surrender to the Air

ELEKTRA 61905, 49:23

Sound: A-, Performance: A-

Miles Davis never liked Sun Ra; he couldn't see the relationship between Sun Ra's Ellington-on-acid-like controlled chaos and his own hallucinatory electric improvisations. But that apparently hasn't stopped guitarist Trey Anastasio from finding a meeting ground for the two departed masters. Best known as a guitarist and writer with the jam band Phish, Anastasio has gathered a big band of jazz, rock, and out-music artists. He's orchestrated two days of improvisation into 30 seamless minutes that should have Miles Davis producer Teo Macero taking notes.



Using loosely composed frameworks, Anastasio maintains a flow through ecstatic blowouts and modal space vamps. Wized Sun Ra veteran Marshall Allen wails on pneumatic alto solos as another of Sun Ra's cosmic crew, Michael Ray, blows his New Orleans-in-space trumpet. But just

as quickly, the ensemble segues into a circa-1970 Miles groove, with Phish drummer Jon Fishman doing a good impersonation of Jack DeJohnette's loping, off-center rhythms and Aquarium Rescue Unit's Oteil Burbridge providing the deep bass. John Medeski (of Medeski, Martin & Wood) fulfills the keyboard roles of Larry Young, Herbie Hancock, and Sun Ra with spacey organ swirls, bluesy vamps, and Fender Rhodes pointillism, while Marc Ribot spins morphic guitar punctuations.

There are moments of indecision and Morse code-like noise sent out unanswered. But like Miles and Sun Ra, Anastasio usually keeps a grip on this postcard from heliocentric worlds.

John Diliberto

Transition

Graham Haynes

ANTILLES 314 529 039, 57:03

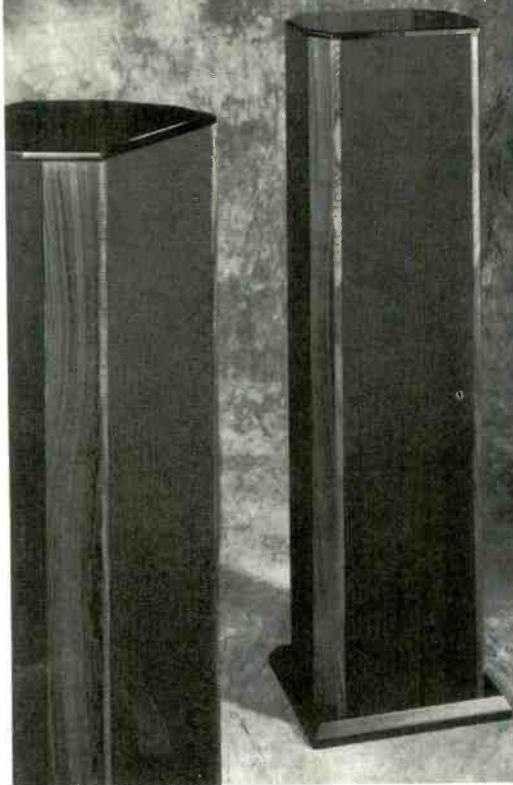
Sound: B+, Performance: A

Turntables in contemporary jazz often occupy the same space as the conga in the '60s: a bit of hip rhythmic shorthand that translates as "I'm down." Like erstwhile urban fusioners today, many a hepcat "went Latin" for a forgettable album. But some found a primal call in the percussion. Think of the solid creative/political vision that electrified The JB's, and you get it: true soul power.

Of course, there's a lot more than scratching happening on cornet-wrecker Graham Haynes's sophomore shot, but his attitude toward the 'tables tells a lot about *Transition*. Listen: Out of a tape-manipulated dream of Portuguese fado rips a hip-hop drum pattern.

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brooks

There's something about the way she moves through a song, and Hadda Brooks always knows where she's going. *Time Was When* is a portrait of a supremely confident, lyrical blues singer. And she should be. After 50 years in the game (she'll be 80 this year), Brooks has learned a thing or two about how to sell a song. In 1945, she was the spark for Jules Bihari to start Modern Records, the label that would become home to Ray Charles, B.B. King, Etta James, and Jimmy Witherspoon. But it was our Ms. Brooks who started the company's ball rolling with her first single, "Swingin' the Boogie," and the hits just kept coming for her. Brooks became a sophisticated torch singer; she even had a brief flirtation with a film and television career. But by the early '70s, she cashed in her

Time Was When
Hadda Brooks
POINTBLANK
7243 8 41364, 59:47
Sound: A, Performance: A-



chips, retiring down under to Australia. That's not the end of the story, however.

Hadda is back, and if *Time Was When* connects with the right audience, she just might have another hit on her hands. She's not singing and playing the boogie-woogie anymore, but she sure can tickle the ivories oh so sweetly. Her vocal prowess on the bittersweet "I'm a Fool To Love You" cuts all the way to the bone. She reworks Bessie Smith's "Need a Little Sugar in My Bowl" with such supple phrasings that you might call it her own. These arrangements—in intimate settings of cello, guitar, and bass—could be called "chamber blues." They're perfect. If it's true that life really begins at 40, Hadda Brooks is just now getting her second wind. *Steve Guttenberg*

In the Gutta

Robert Stewart

QWEST/WARNER BROS. 9 46167, 56:56
Sound: B, Performance: A-



Robert Stewart's quartet lays down some of the juiciest grooves since the 1960s' glory days of King Curtis and Booker T. Jones. *In the Gutta* celebrates those

finger-poppin' funk fests, but the feel is harder, more aggressive. The tenor saxophonist and his men update the Stax/Atlantic sound with real chutzpah, even tackling Booker's classic "Green Onions," the ultimate Memphis soul stew. Where the original simmers, Stewart's version boils. His cohorts—Larry Bradford on organ, Ralph Byrd on guitar, and Ranzel Merritt on drums—form a tight little unit that's always in the right place at the right time. But it's Stewart's honking sax that sets the fires.

Byrd's guitar is the chameleon of the band: His smooth Steve Cropper sound on "Honky Tonk" goes down easy, while Marvin Gaye's "Inner City Blues" gets the George Benson treatment. And on Stewart's own "West Virginia Red," Byrd throws down some

mean Albert Collins riffs. More than a mere mimic, he's a guitarist who's going places.

Stewart's vocals could stand some improvement; he sounds a little embarrassed on the title track when he rap/sings, "I lost my job this morning and now I got no cash flow." But once that intro is out of the way, he blows his horn and all is forgiven. When Stewart sits down at the Hammond B-3 on "To My Mother," it's a whole new ball of wax. His touch on the organ is so damned sweet (he overdubs his sax), this track has a certain melt-in-your-mouth quality.

In the Gutta takes rhythm and blues into the '90s. Stewart's a young player who's not afraid to take chances, but his music is a sure thing. *Steve Guttenberg*

The Promise

John McLaughlin

VERVE 529 828, 78:89

Sound: A, Performance: A

Guitarist John McLaughlin has always responded well to a musical challenge. Whether he went toe-to-toe with synth burner Jan Hammer in the Mahavishnu Orchestra, exchanged ferocious metal-bop licks with Miles Davis, soared with Carlos Santana, or jammed with Jimi Hendrix, he always came out blazing. He had that perfect combination of, as John Coltrane put it, "elation, elegance, and exaltation." On his third Verve recording, McLaughlin squares off with an impressive list of guests, and the results are scintillating.

The last time McLaughlin did this sort of thing was *Electric Guitarist*, his 1978 all-star outing for Columbia. *The Promise* is far more successful and covers a wider spectrum of music over the guitarist's highly eclectic career. Not only is McLaughlin reunited with his acoustic trio mates Al Di Meola and Paco de Lucia on the fiery flamenco offering "El Ciego," but he also evokes the memory of his mid-'70s East-meets-West band Shakti on "The Wish"—a spirited collaboration with tabla master Zakir Hussain, sitarist Nishat Khan, and percussionist Trilok Gurtu.

The biggest surprise here is the pairing of McLaughlin and rock guitar god Jeff Beck on John Lewis's haunt-

Photo: Carol Friedman

And then D.J. Logic gets to work on turntables, scratching furiously against black-rock-and-then-some guitarist Vernon Reid's angular lead. Live drums and percussion kick in, and then Haynes drops a hard/bop head that not only says "I'm down" but also pulls together a passel of references to the Diaspora. Amid rock, hip-hop, jazz, and the European-African language interface that starts things off (and reappears throughout the album), Haynes says "I'm here."

Transition is about location—and flux: Tunes travel down gritty city blocks ("Free-stylin'"), through Eastern-tinged trancescapes ("Walidiya"), and leave the atmosphere ("Mars Triangle Jupiter"). There are dancehall beats and sitars, skronk and soul. To his credit, Haynes never sets up a track to showboat but shares the spotlight with his ridiculously talented team—which includes Reid, tenor man Steve Williamson, and Cheick Tidiane-Seck on keys. Of course, Haynes's own playing—which is strident, warm, and precise—matches his conceptual ambitions. This is the man who knocked it out of the park on three straight discs (Rodney Kendrick's '94 sets and his own debut, *The Griot's Footsteps*). Haynes is a talent as eclectic as he is bankable, and his *Transition* is a smooth one. *Mark Schwartz*



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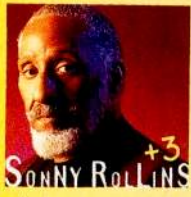
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SONNY ROLLINS

+3
MILESTONE MCD 9250, 56:01
Sound: A, Performance: A-



Elder jazzman Sonny Rollins is at the peak of his saxophone prowess. Through the years, his numerous, self-indulgent sabbaticals have yielded a more mature musician. Yet Rollins has never recorded with more poise, dignity, and sheer power than he does here. Using a typical repertoire of standard tunes at medium tempo, the full-toned tenor man continues in hot pursuit of pure, momentary improvisation with a true-to-the-art urgency that belies his 65 years.

Two distinct, individual rhythm sections flank Rollins for his 48th recording as a leader. On "What a Difference a Day Made," "Biji," "Mona Lisa," "H.S.," and "I've Never Been in Love Before," veteran pianist Tom-

my Flanagan, electric bassist Bob Cranshaw, and drummer Al Foster provide a breezy, spacious setting for Rollins's flights of fancy. Taking advantage of the sparse accompaniment, Rollins fills every void with flurries of notes or stretches the time with behind-the-beat, eighth-note meanderings.

Whereas Rollins is in the driver's seat with the aforementioned rhythm section, Jack DeJohnette's busy drumming takes charge on "They Say It's Wonderful" and "Cabin in the Sky." On these tunes, pianist Stephen Scott's inside-out probing of each chordal sequence seems to goad Rollins into a more competitive barrage, emphasizing the outer extensions of the basic song forms at hand.

The contrast in the two groups' approaches is interesting, but the more empathic setting is Rollins with Flanagan, Cranshaw, and Foster (appropriately constituting the bulk of this release). After so many years and so much music-making, Rollins belongs at the helm. *James Rozzi*

ingly beautiful ballad "Django." While McLaughlin burns up the fretboard with dizzying displays of 64th notes, Beck more than holds his own with liquid lines from his masterful whammy-bar technique and generally gutsy and expressive approach. The most daring piece is "Jazz Jungle," an explosive, incendiary jam with tenor sax great Michael Brecker that is powered by Dennis Chambers's mighty backbeats and James Genus's groove-heavy bass lines. Nearly 15 minutes long and frighteningly intense, this track is hardly a candidate for airplay. But it does harken back to fusion's heyday, when stretching was the watchword. McLaughlin, Sting, and Vinnie Colaiuta make a formidable power trio on the too-brief "English Jam," and David Sanborn (who also appeared on *Electric Guitarist*) contributes his signature alto sax voice on "Shin Jin Rui." McLaughlin swings forcefully with Chambers and Hammond B-3 wiz Joey DeFrancesco on the Monk tribute "Thelonious Melodious," and DeFrancesco offers up some Miles-inspired trumpet work on the funky, hip-hop flavored "No Return." But perhaps the loveliest moments happen on McLaughlin's heartfelt interpretation of Jimmy Rowles's melancholy ballad "The Peacocks," with acoustic guitarist Philippe Loli and acoustic bassist Yann Maresz.

McLaughlin's last release on Verve, *After the Rain*, was a trio project with jazz legend Elvin Jones and DeFrancesco that failed to live up to the expectations of that highly anticipated

meeting. But this one more than lives up to *The Promise*. *Bill Milkowski*

Shabeesation

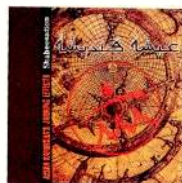
Aisha Kandisha's *Jarring Effects*
RYKODISC RCD 10336, 52:18
Sound: B-, Performance: B

Altered states of consciousness are not unknown in Morocco, a country that has brought us the trance-inducing sound of Gnawan musicians.

Aisha Kandisha's *Jarring Effects* bring us a less spiritual state, one with a penchant for giddy ecstasy. Originally a band that played "shaabee" party music, the *Effects* now have a hallucinogenic sound that mixes acid-house sampling techniques with their own traditional Moroccan music and instruments.

Shabeesation is a crazed concoction of the ecstatic voice of My. Cheb Ahmed, sampled rhythms, cut-and-paste sound bites, and screaming psychedelic guitar that sounds like Randy California goes to Morocco.

Producers Pat Jabbar El Shaheed and notorious World Music deconstructionist Bill Laswell use all the modern production techniques. Rhythms drop in and out of the mix, slashing shards of sound (including gunshots) rip through the grooves, and throbbing dub



meeting. But this one more than lives up to *The Promise*. *Bill Milkowski*

bass lines (often provided by Laswell) lend a sexual undercurrent. Darbukas synchronize with drum machines to form the nonstop Moroccan rave grooves that run straight through *Shabeesation*. Joining the party are some of Laswell's World Music marauders: The Last Poets' Umar Bin Hassan drops a rap into "Dunya," while Bernie Worrell provides some organ swirls.

Shabeesation lives up to the name of its band's patron saint, Aisha Kandisha. She's a mythological Moroccan witch who seduced men and then left them raving mad. *Shabeesation* probably won't drive you insane, but it will certainly seduce you. *John Diliberto*

FAST TRACKS

Colors: Ken Nordine (*Asphodel 0954*, 54:05). That voice, so resonant, so deep, so colorful. . .Nordine, a full-time announcer (Taster's Choice, etc.) and a part-time jazzier, became known in the '50s and '60s for his Word Jazz series of recordings. Quirky, hip wordplay from the '60s is set here against groovy jazz back-grounds; Nordine gives 34 colors his most sensuous, luscious treatment: "Azure was bored with just being blue. . ." What you get are Technicolor dreams in sound. (Asphodel, P.O. Box 51, Chelsea Station, New York, N.Y. 10113.) **S.G.**

R&B from the Marquee: Alexis Korner's *Blues Incorporated* (Mobile Fidelity UDCD 657, 37:30). MoFi has unearthed a British blues classic that'll take you back to the very birthplace of the blues revival. Korner was a magnet for talent; his band wowed audiences at these live 1962 shows with spirited performances of undiluted Chicago blues. This gold CD offers a glimpse of how it all began. **S.G.**

How Long Has This Been Going On: Van Morrison with *Georgie Fame & Friends* (Verve 314 529 136, 50:58). Morrison recorded this album one night in May 1995, at Ronnie Scott's in London. It's a gas, a swinger from front to back. Selections are mostly '50s jazz standards, such as "The New Symphony Sid" and "Centerpiece," with a hot run-through of "Moon-dance." Great fun. **M.T.**

Phantom Blues: *Taj Mahal* (Private Music 100582139, 48:03). What a treat! The versatile Mahal serves up a solid album of rocking blues and R&B, two of his strongest suits. Eric Clapton, Bonnie Raitt, and Mike Campbell do cameos. These are spirited performances of tight, crisp arrangements. **M.T.**

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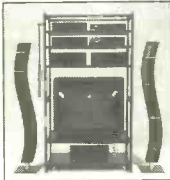
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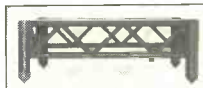
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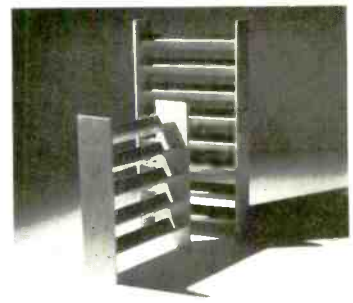
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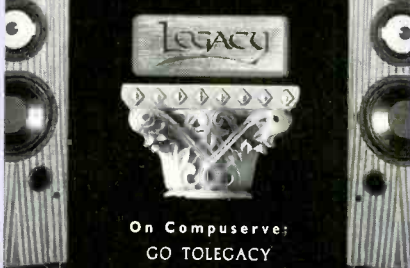
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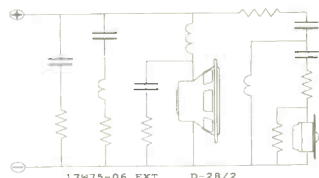
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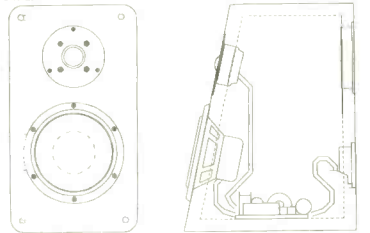
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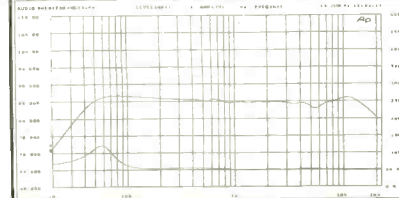


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PlayBack

AudioSource Project One Speakers

I didn't expect much from these speakers; plastic enclosures are usually not my cup of tea. But the AudioSource Project Ones surprised me. For small speakers, they're pretty good. And they cost just \$200 per pair.

The Project Ones have rotatable stands that double as mounting brackets, making them a good choice for surround. Weather resistance makes them good for outdoor installation, and video shielding makes them equally suitable for computer audio. Their easily accessible connectors accommodate banana plugs. And, according to AudioSource, the 4-inch polypropylene woofer and 3/8-inch polycarbonate tweeter are time-compensated. Power handling is listed at 100

GRADE: B+

watts maximum, and sensitivity is 90 dB. Rated bandwidth is 60 Hz to 20 kHz, but these speakers are bass-shy unless they are positioned right against a wall. Even then, I found that they rolled off below 75 Hz, so I combined the Project Ones with a Velodyne subwoofer to get better bass. The resulting sound was open and detailed, without any cabinet coloration. Off-axis dispersion was fairly uniform. And the sound was better with the perforated grilles removed.

John Gatski

For literature, circle No. 120



Tascam DA-P1 Portable DAT Recorder

Finally, there's a full-featured, professional portable DAT recorder available to home-recording audiophiles for a reasonable price. But don't look for the Tascam DA-P1 at your audio store; you'll have to get it from a store or mail-order outlet that sells to professional musicians.

At \$1,899 retail (and as little as \$1,300 from discounters), Tascam's DA-P1 portable is a great value, even though it costs more and is bigger and heavier than such consumer DAT portables as Sony's TCD-D7 (now being replaced by the TCD-D8). The DA-P1 is about four times as large as the TCD-D7, but between that and its metal-reinforced case, it doesn't seem as fragile. I find the Tascam's size a good compromise, small enough for portable mobility yet large enough to be used as a home deck.

The DA-P1's features make it a good home deck, too. Instead of the fragile mini-plugs found on most

consumer portables of all kinds, it has RCA jacks for unbalanced analog input and output plus built-in coaxial digital input and output (extras on the little Sony). It also has balanced XLR microphone jacks instead of mini-plugs, so it can accept professional mikes without adaptors.

As a professional machine, the DA-P1 frees you from the Serial Copy Management System (SCMS). It also lets you record for two hours from one charge of its battery. Like the Sony, the Tascam has phantom microphone power, a microphone limiter, and an illuminated LCD display. And like the newer TCD-D8 (but not the D7), it lets you select sampling rates of 32, 44.1, or 48 kHz when you're recording from analog sources.

I made tapes via the microphone, analog line, and digital inputs and found the DA-P1's recordings to be more open and detailed and fuller in bass than those from the consumer Sony. The headphone amp sounded nice, too. And I really appreciated the DA-P1's ability to copy SCMS-encoded tapes made on consumer DAT decks.

John Gatski

For literature, circle No. 122

GRADE: A



CREEK AUDIO OBH-11 HEADPHONE AMP

Their "hair-shirt audio" leanings have led many high-end component makers to skip such useful features as tone controls or to offer underpowered op-amp headphone circuits as an afterthought. You could get around that by driving your headphones from a separate power amp with resistors on its output. But a dedicated headphone amp is more compact and often cheaper, and it lets you get the best sound possible from stereo headphones.

Creek's OBH-11 headphone amp costs \$199 and can deliver 300 milliwatts into 30 ohms. It had no trouble powering several different headphones, including power-hungry Grado Signatures. The Creek sounded slightly leaner than my reference headphone amp (which cost seven times as much) and had less bass support. Nevertheless, it sounded transparent and pleasing.

The OBH-11 comes with a simple "wall-wart" outboard 24-volt transformer; a beefier power supply is available for an additional \$99. A better power supply would probably improve the OBH-11's bass.



GRADE: B+

John Sunier

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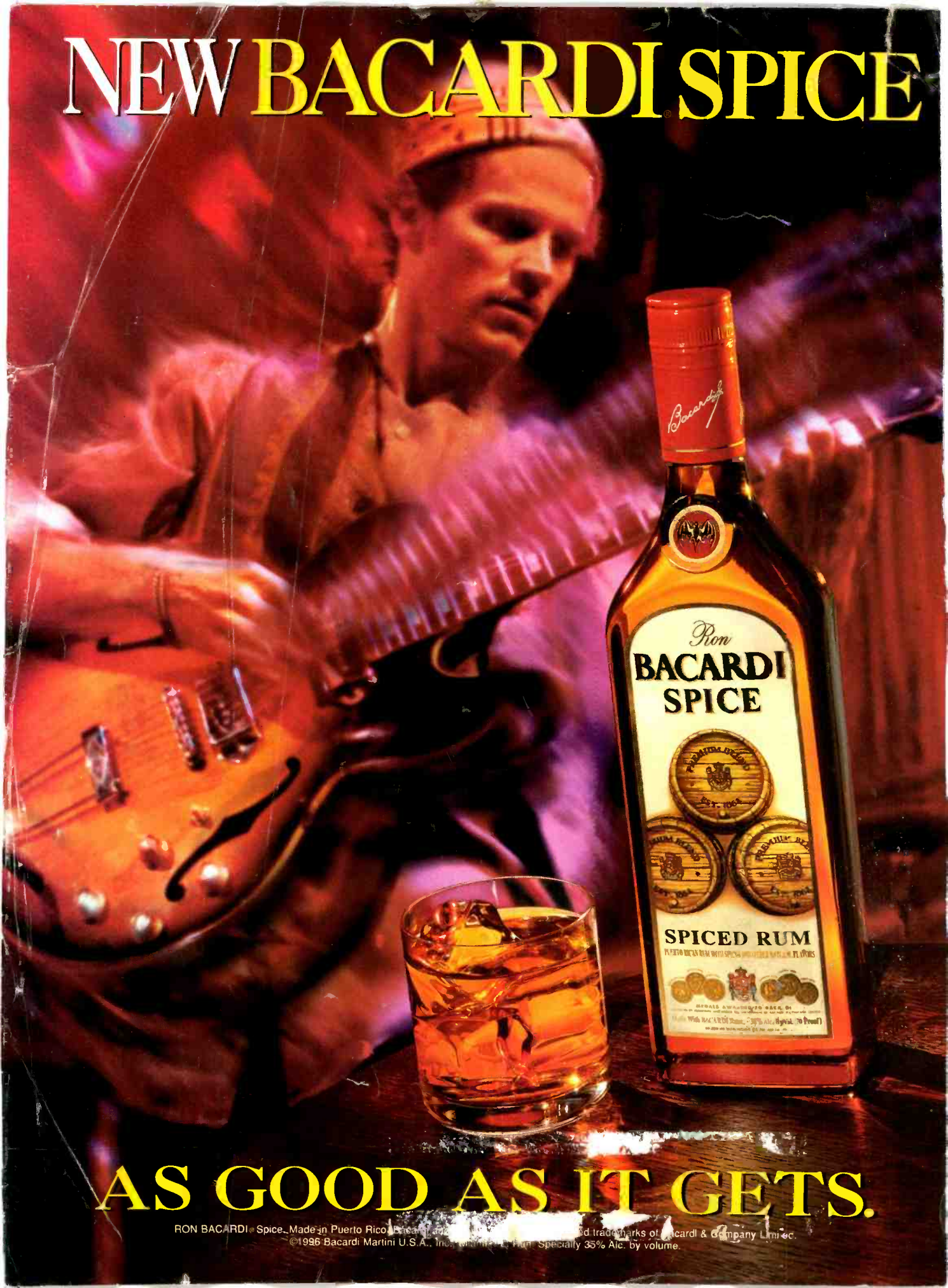
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