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

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

Patented MIT Terminator Network

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

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

iconn™ interchangeable connector system

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

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

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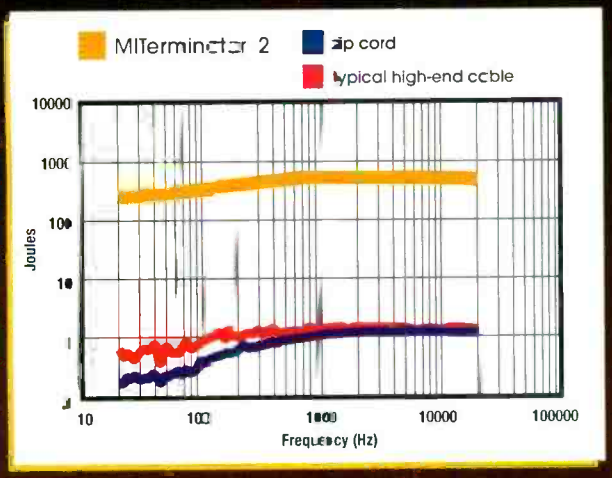
More Than Just Cable!™

MIT

Why MITerminators sound better



Superior Final Energy Component

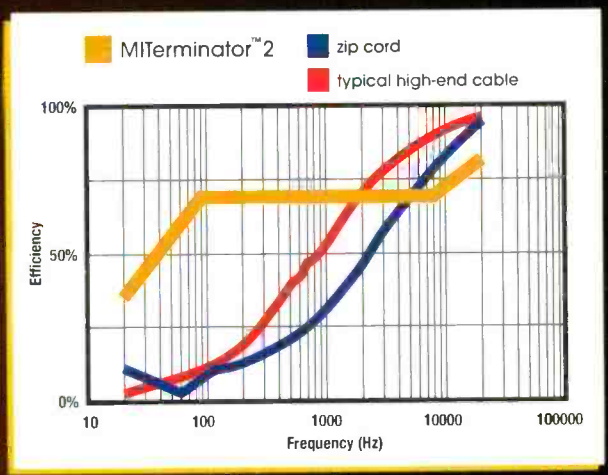
In transmitting electrical energy, cables store and release energy. MIT calls the amount of energy that is stored and released the Final Energy Component. Unfortunately, as shown in the plot, the Final Energy Component in ordinary 12-gauge "zip cord" and a typical high-end cable is non-linear — It changes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

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

Superior Efficiency

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

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



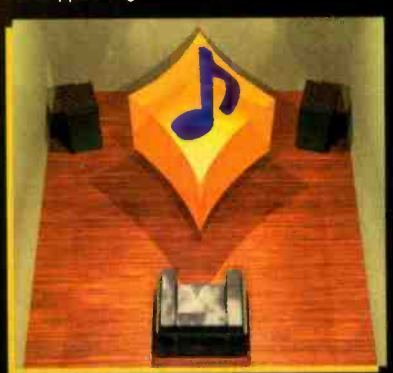
Superior Imaging

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

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

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

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



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Most MIT retailers offer a no-risk home trial program.. Call 916-888-0394 or Fax 916-888-0783 for the location of your nearest authorized MITerminator dealer.

Our components make your components sound their best.™

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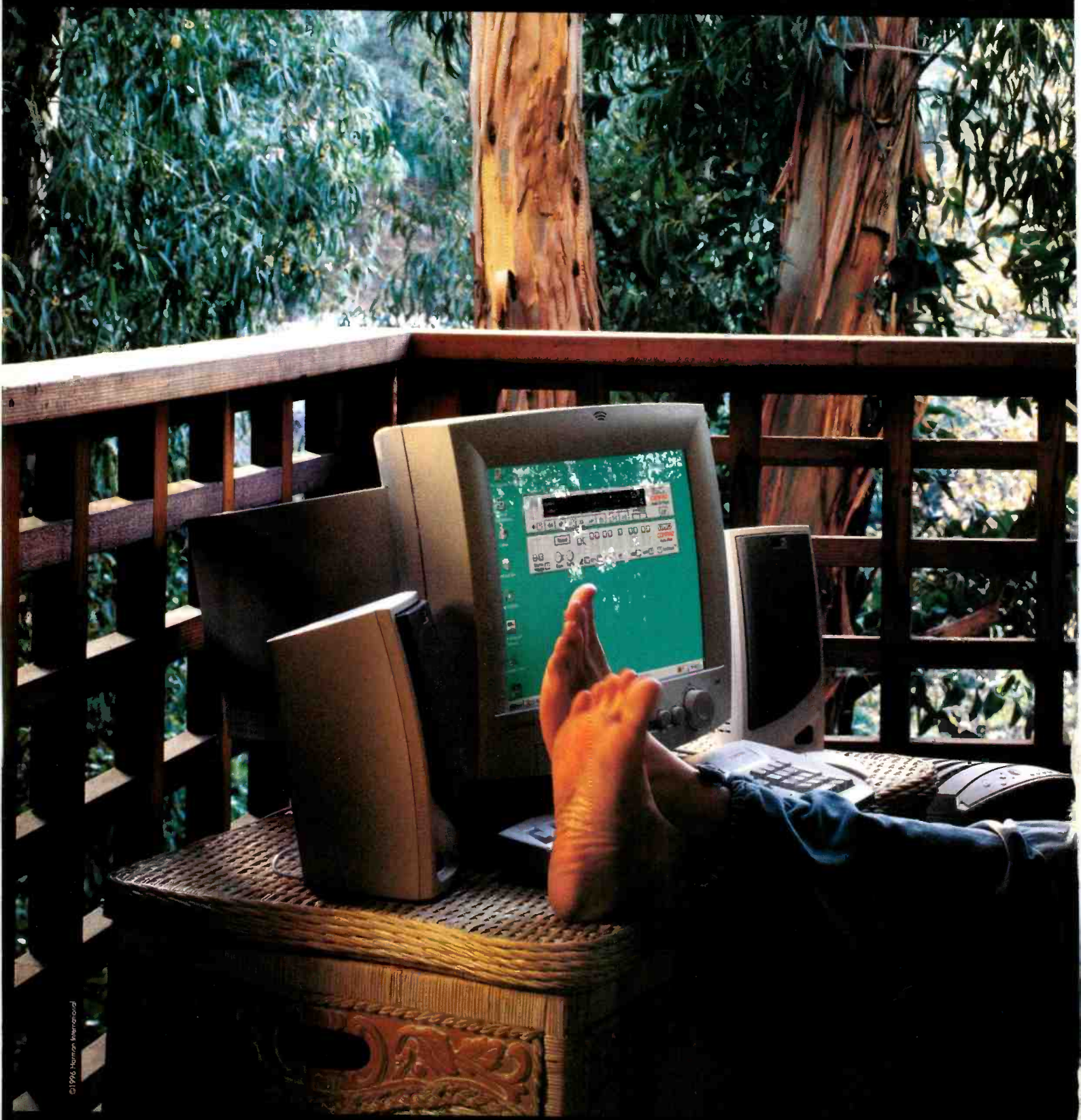
CIRCLE NO. 17 ON READER SERVICE CARD

WAS AT WORK.



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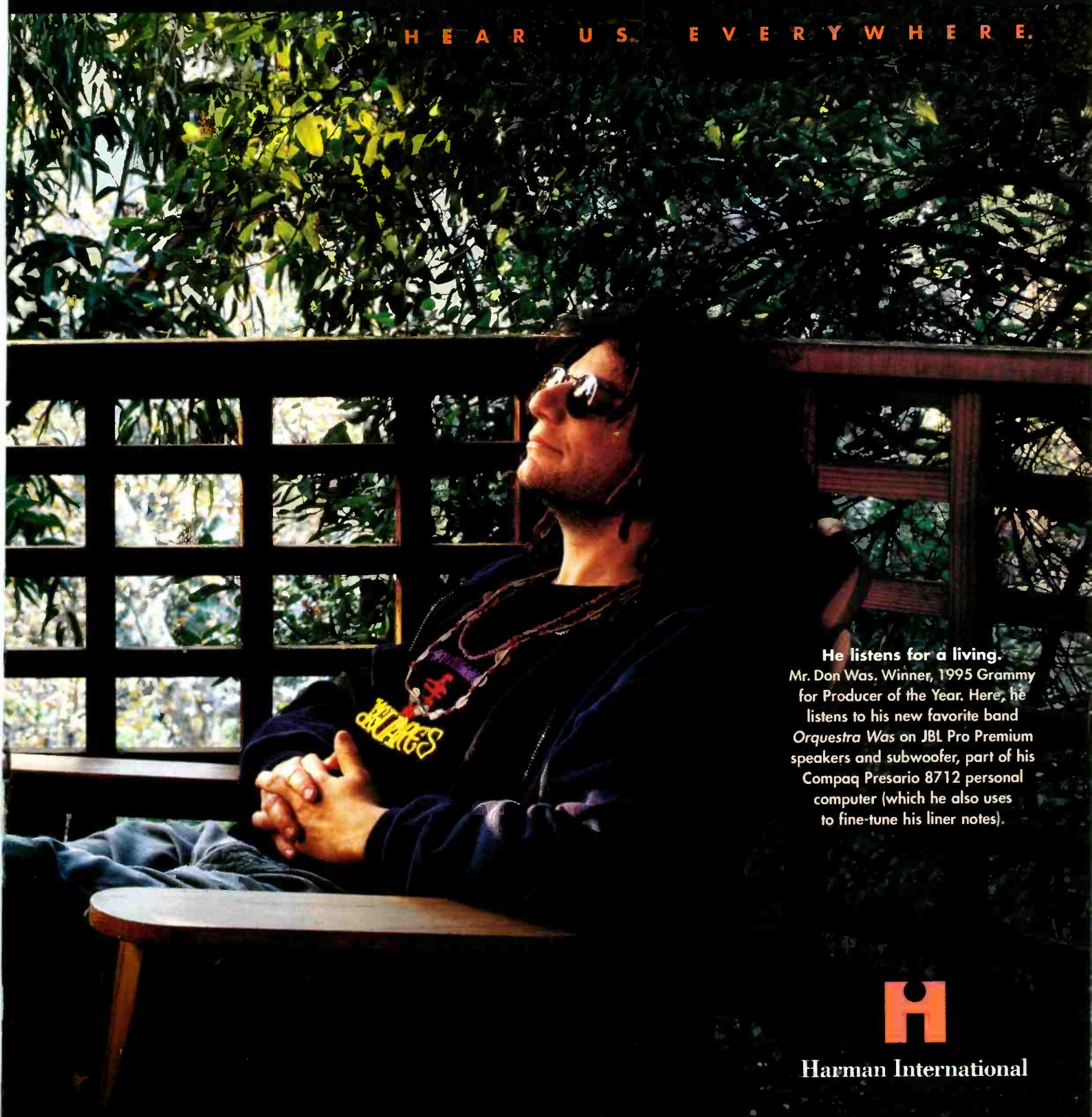

He listens for a living.
Mr. Don Was, Winner, 1995 Grammy for Producer of the Year. Here, he listens to his new favorite band *Orquestra Was* on JBL Pro Premium speakers and subwoofer, part of his Compaq Presario 8712 personal computer (which he also uses to fine-tune his liner notes).

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CIRCLE NO. 11 ON READER SERVICE CARD

FEBRUARY 1997 VOL. 81, NO. 2

AUDIO

THE EQUIPMENT AUTHORITY

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The Audit Bureau

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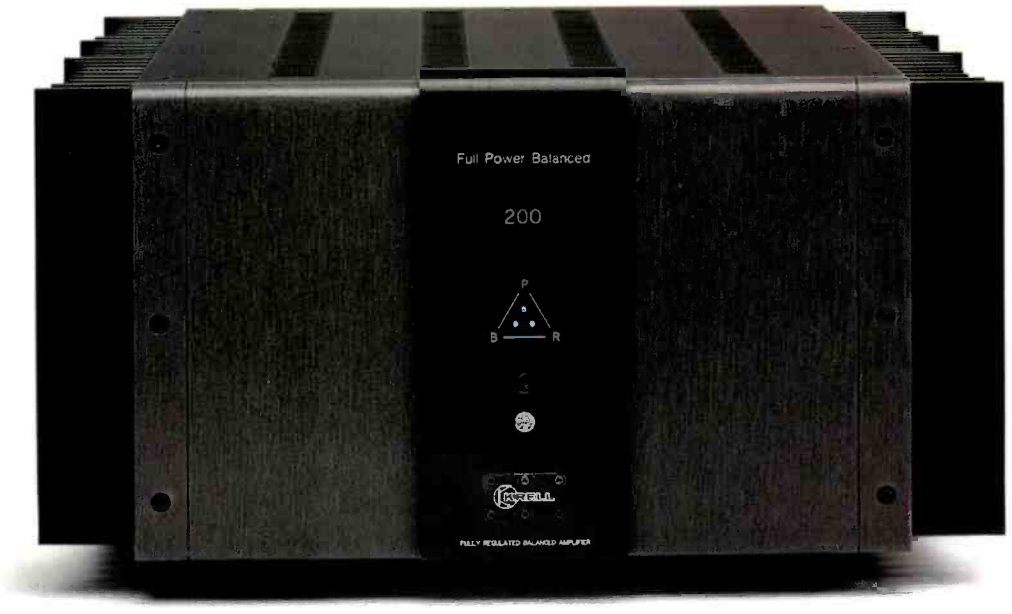
ADS Subwoofer, *page 14*

THE FULL POWER BALANCED 200



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FAST FORE-WORD

Every fall, the Audio Engineering Society holds its North American convention, which has two basic components. One is an exhibition of equipment from the various participating manufacturers of pro audio gear, ranging from elaborate mixing consoles for recording studios to loudspeaker systems for sound reinforcement. Since pro audio is predominantly about sound production, rather than *re*production, the equipment tends to be correspondingly, and rather refreshingly, free-wheeling relative to the typical consumer goodies.

The exhibit hall had a charmingly split personality this year. On one side, the tech spiraled ever higher—advanced sound-editing software, DVD authoring systems, 24-bit A/D converters—while it took a distinctly retro turn on the other, with more tube gear in evidence than I can recall having seen before. My favorite item, however, was a little solid-state box from Aardvark, designed to give digital recordings the sound character of analog tape without the added noise (and inconvenience) of a trip through a real analog recorder. The AardScape, as it's called, emulates analog tape saturation; it's even adjustable, so you're not stuck with just one level or quality of "saturation."

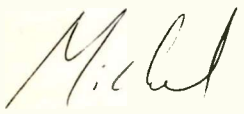
The other half of the convention consists of workshops and presentations of research papers. Not surprisingly, a major topic this year was audio for DVD, both with and without video. Perhaps the best overview was a workshop on the first day, chaired by Tom Holman and featuring a half-dozen people heavily involved in DVD mastering. DVD is substantially more complex than any previous audio or audio/video format, requiring that multiple data streams—fixed-data-rate compressed audio (possibly in several languages), variable-data-rate compressed video, subtitles, and other ancillary data (including branching options)—be merged accurately and with precise synchronization. The purpose of the workshop was to acquaint attendees with the intricacies of getting everything right the first time.

Two very encouraging pieces of information surfaced during this workshop. One is that Warner, Universal, and Sony—all represented on the panel—were deep into DVD mastering even at the time of the convention, in early November. The other is that the audio options for DVD-Movie, as it is known formally, are surprisingly rich. Dolby Digital (AC-3) will be the standard audio coding system for movies on DVD, but the specification also provides numerous linear PCM alternatives for discs containing less (or no) video—ranging from two 24-bit, 96-kHz channels to six 16-bit, 48-kHz channels. The eventual DVD-Audio standard will provide additional capabilities—possibilities include provisions for more channels, lossless compression, longer words and higher sampling rates in the multichannel modes, and "Rosetta stone" data on such things as the loudness of the original performance and the acoustics of the recording site. But a great deal can be done within the DVD-Movie spec, which already represents a signficant advance in audio capability over the decade-old CD standard.

The convention's anticlimax, at least for me, was Pacific Microsonics' paper on its HDCD process. It seems to boil down to this: Initial conversion to digital is a very clean, 24-bit (19-bit actual resolution), 88.2-kHz process with subtractive dither. The resulting signal is then decimated to the CD sampling rate of 44.1 kHz via a digital filter whose coefficients are varied automatically according to signal content, in a manner that Pacific Microsonics says optimizes sound quality. These changes are tracked in a control code buried in the system's pseudo-random dither noise, which triggers complementary filter changes in HDCD decoders.

In reducing the signal to 16-bit, however, users of the encoding system also have the option to apply as much as 6 dB of peak limiting to signals that would otherwise clip and as much as 7.5 dB of upward compression to signals that range below –45 dBFS. As with the filter variations, these processes are tracked by codes embedded in the dither, enabling accurate restoration of dynamic range by HDCD decoders.

But what about undecoded playback? There's quite a bit of music that could be recorded with both processes turned full up and still never activate either. In that case, they won't make any difference. On the other hand, some music will emerge from undecoded playback with its dynamic range compromised. If that's okay with the artist and producer, it's their choice. I am disturbed, however, that Pacific Microsonics claims improved *fidelity* from HDCD encoding, including the dynamic-range manipulation, not only with proper decoding but also *without* decoding. Seems like a contradiction to me, and it leads me once again to ask, does whatever benefit the process might afford those who own HDCD decoders justify the loss to the much greater number who don't?



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V.TV, April/May 1996

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Widescreen Review, April 1996

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*V.TV, April/May, 1996

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CIRCLE NO. 20 ON READER SERVICE CARD

LETTERS

Redressing Greenberg

Dear Editor:

Something's amiss when ol' Aunt Corey Greenberg becomes the gatekeeper for "good" rock 'n' roll ("Front Row," October 1996), telling us to disdain "boring" mass-produced rock lite in favor of the canonical standards he unlocked in the vaults of Norton Records.

Sure, there's quite a bit of junk out there. But for Greenberg to set up a hierarchy of taste for music that is, by definition, anarchic and classless is an off-target move to lower Aesthetica. Good rock 'n' roll appeals to prurient interests and relies on reproductive rhythms as much as artistic ones. In other words, rock's *vulgar*! We love you, Corey, but we're talkin' mongrel rather than Russian wolfhound here. Let the "old farts" (remember them?) deal with taxonomies of taste—instead, put on Joe Ely, The SubDudes, or Joan Osborne's live version of "Right Hand Man" and remember that good rock 'n' roll is everywhere, not just consigned to esoteric dust bins.

Greg Comnes
Tampa, Fla.

Horns? You're Darn Tootin'

Dear Editor:

In his October 1996 "Mondo Audio," Ken Kessler takes a stab at horn-loaded loudspeakers. He remarks that owners of tube equipment, of single-ended amps in particular, are the only ones who have any use for horns. The implication is that the high efficiency of horns is, in and of itself, the only useful thing about them and that they are not inherently a hi-fi product.

No doubt about it, if you only have a 12-watt amp, a sensitivity of 102 dB is a dandy thing to have. However, if you drive a well-designed set of horns with a modern mid- to high-powered amplifier, you will discover other qualities Kessler doesn't tell us about, such as startling transients, bowling-ball bass, and vocalists breathing down your neck.

I'm not making this up. The idea behind horns is simple but effective. By mechanically amplifying the sounds coming from the cone, you needn't drive it nearly as hard. You also couple the air in the room to the air in front of the cone more effectively. It makes for presence you wouldn't believe.

I didn't begin building horns until many years after my love/hate affair with tube amplifiers was over. And I'm not running low power. The amp I use is a 325-watt/channel MOS-FET. It's hooked up to a set of folded three-way corner jobs the size of washing machines.

It's a good thing I live in a cinder-block structure. I've dimmed house lights and shifted the gears of cooling fans with this "1930s cinema rig," as Kessler puts it. The horns have not disappointed.

Horns are no longer in fashion, because they are big. Period. And that's a shame, because today's program material sounds so good on them. I have never understood why, as the signal gets cleaner and its dynamic range becomes wider, speakers become smaller and more anemic. Don't even get me started on home theater; *real* theaters use horns.

Nowadays, people spend hundreds of dollars on cable in the name of recovering all the signal, only to send it to shoebox-size speakers. Then they use a subwoofer, which is tantamount to slapping a patch on a hole. I've heard these systems. The bass certainly goes down low, but it is rubbery and fake—disembodied. And half the time, none of the levels are matched right. No wonder these systems are in a continual state of "upgrade"! You really want to upgrade? Go get a set of horns.

Matthew Holup
Spencer, Mass.

Repair and Cherish

Dear Editor:

I enjoyed Ken Kessler's "Mondo Audio" column in the November 1996 issue, in which he asks people to bury their old equipment and marry the new. Granted, there is some fantastic new stuff on the market, and sometimes I buy it. But I also relish the old equipment from the '60s, '70s, and '80s. (I guess my age is showing; I remember 78s.) For me, the progress of reproduced sound is a miracle of our age, and what has preceded us should not just be buried but cherished.

While it is true that some people may have unrealistic expectations about repairing equipment, I am amazed how few repairs most things need and how minor most repairs are. A lot of old equipment is still working as well as the day it was made. Talk about value!

Richard Bourain
Santa Barbara, Cal.

Frothing Over Foam

Dear Editor:

Your October 1996 "Audioclinic" had a question about replacing rotted speaker foam. I recently had to do this for the second time and am very pleased with the outcome.

I have an old pair of Dahlquist DQ10 speakers and had to replace the foam surround in one woofer about five years ago. I sent it back to Dahlquist; the job took several weeks, and it cost about what a new woofer would cost.

A few weeks ago, I found that the other woofer had developed the same problem. This time I contacted one of your advertisers, New Foam. They were very helpful on the phone. I sent the woofer out on a Tuesday, and it was back, fully repaired, the following week! New Foam's price was half of what I had paid previously. I recommend the company highly.

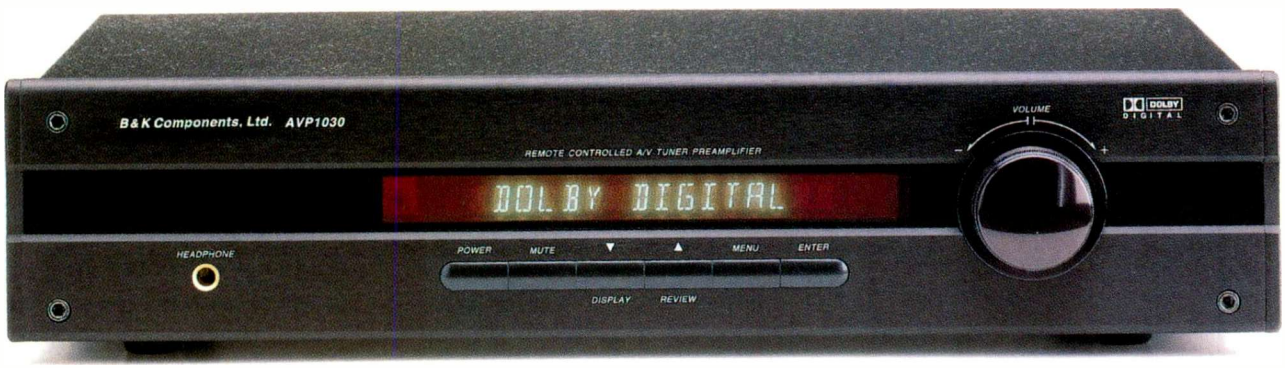
David Adler
Clark, N.J.

AdMIT It

Dear Editor:

Music Interface Technologies would like to respond to Dennis Colin's letter (December 1996) regarding our ad. We agree with Mr. Colin in his analysis of passive audio product advertising. With research facilities containing over $500,000 worth of sophisticated test and measurement equipment from such companies as Hewlett-Packard, Fluke, and Textronix, MIT prides itself on being a measurement-based technology leader in high-end audio. In fact, MIT supplies some leading high-end speaker companies with support for their passive component engineering needs in areas such as crossover design. As a company founded on scientific methods and engineering skill,

The Heart of a High-End Home Theater Mere Mortals Can Afford.



Nearly 15 years ago, B&K Components, Ltd. of Buffalo, NY, started out with an idea. If we produced wonderful-sounding components, and kept prices low, we knew we'd win a reputation for making High End audio affordable.

Critics took notice, "B&K offers exceptional sound at a remarkable value". We have won numerous "Best Buy" awards from leading hi-fi publications - coveted recognition that is only awarded to the very best models in each product category.

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Can I hear it?

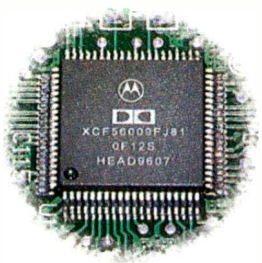
You bet you can! You don't need a critic's "golden ears". You need only normal ears and a love of music or movies. The superior sound quality of B&K is obvious, not subtle. With any style of music or film soundtrack - the harmonics just sound right. We bring out the beauty of music, and put you in the action.

Why are your prices so low?

We keep our circuits simple. Less is more. Fewer parts and shorter signal paths mean better sound. This allows us to buy the best parts at the best price.

But that is only part of the story.

Because the human ear is the ultimate –the only arbiter of sound quality, we regularly pull gear off the production line and listen to it. B&K's absolute dedication to sound quality is the reason so many have fallen in love with our components.



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Our products speak for themselves.

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

"B&K Components, Ltd. has become one of America's leading manufacturers of affordable, high-quality audio electronics...providing musical, reliable preamplifiers and power amplifiers within the budget of virtually any music lover." -Hi-Fi Heretic

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B&K is developing a family of consumer audio/video products based on the Motorola® 56000 Series 24-bit DSP processors. Chosen as an Alpha development site by Motorola for the 56000 Series, B&K contributes to the Motorola effort to design, develop, and test their newest state-of-the-art digital signal processors. B&K is leading the way with the first Dolby Digital® (AC3) preamp tuner/processor powered by the Motorola 56009 DSP processor, the AVP1030.

Please take the time to listen to B&K's components and judge for yourself. At B&K, high end A/V means high performance, not high price.

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CIRCLE NO. 2 ON READER SERVICE CARD

MIT also takes offense at many audio cable advertisements that make preposterous claims. Such ads cast an unfortunate shadow over the entire industry.

Mr. Colin's criticism is based on our differing definitions of efficiency. Some background on the technology and terminology represented in our graphs might be helpful. Two criteria are depicted in the graphs: Final Energy Component and Efficiency. These criteria follow from our fundamental discovery that musical energy is momentarily stored in the cable during its flow between audio components.

In its electrical form, a musical signal comprises voltage and current. Capacitors store energy in the form of voltage in their electrical fields, and inductors store energy in the form of current in their magnetic fields. These storage phenomena occur in cables because of the inductances and capacitances intrinsic to all cables.

Because of these storage phenomena, MIT views (we believe correctly) an audio cable as an electrical energy-storage device, and we refer to the total amount of energy stored in the cable as the Final Energy Component. The formulas relating inductance and current—and voltage and capacitance—to the amount of energy stored in each (given in joules) can be found in any basic electrical engineering or physics text.

The result is that a speaker, for example, receives two sources of musical energy during operation: that from the amplifier, which is directly coupled to the speaker, and that of the smaller amount of energy that is briefly stored in the magnetic and electrostatic fields of the cable and then supplied to the load.

When one works out the numbers, the amount of energy stored in a typical audio cable is on the order of microjoules. While this appears to be a small amount of energy, we have found that it has audible significance out of all proportion to its measured magnitude. Please note that, though in the graph of Final Energy Component the energy value of ordinary 12-gauge zip cord has been normalized to a maximum of 1 joule to better facilitate comparison, the relative values and curve shapes are correctly scaled for all compared cables.

Our ability to measure and quantify the energy storage and transfer characteristics of cables is a major breakthrough in high-end audio, because we have found that this is audibly significant in two ways. First, audio cables store energy in a nonlinear manner with respect to frequency. This is indicated by the top graph in our ad, Final Energy Component. Second, energy that is stored in audio cables is not always efficiently transported to the load, as indicated in the second graph in our ad, labeled Efficiency. Efficiency, like the Final Energy Component, is also not linear with respect to frequency.

Efficiency is measured and scaled in a bewildering variety of ways from one scientific or engineering field to another. In our graphs, efficiency relates to how much of the Final Energy Component is ultimately transported to the load as in-phase power. This means that some of the energy stored in a cable as voltage and current is released to the load with voltage and current out of correct (that is to say, original) phase. This condition results in the out-of-phase energy manifesting itself as noise. The graph of this behavior, apparently the source of Mr. Colin's criticism, indicates that Efficiency is found to be especially poor in ordinary audio cables at low frequencies, such as at 60 Hz.

To correct for these anomalies, MIT developed and patented Output Terminator technology. Our Output Terminators are passive networks placed near the ends of our audio cables. They serve to increase and linearize the Final Energy Component and to ensure efficient energy transportation to the load with less noise. The result is better bass, clearer midrange, smoother highs, and superior image focus and soundstaging when compared to "just cable."

It is important to recognize that the MIT Efficiency graph applies only to the energy that is stored in the cable and then released to the load. The Efficiency graph does not apply to the energy that is directly coupled to the load.

The efficiency improvement to which Mr. Colin seems to refer in his comment about rewiring his house is related to the directly coupled energy transfer. Mr. Colin can improve this efficiency through power-factor correction, a technique used in industrial applications and actually required by a power company in severe cases of low power factor. We can help Mr. Colin achieve an improvement in this area of energy transfer. Our patented Z-Circuitry, found in some of our Z-Series AC power-line conditioning products, provides power-factor correction while reducing noise on the AC line, an effect lauded by many critical listeners as being crucial to overall audio system performance.

MIT's Z-Circuitry and Output Terminator technologies are distinguished by the fact that the Z-Circuitry operates on the full AC potential, while the Output Terminator technology described in our ad operates only on the energy that is stored in, and then transported out of, the cable itself.

To illustrate this point using Mr. Colin's example, if he were to wire his home with MIT Terminator Interfaces, the graphs would apply only to the 60-Hz energy that is stored within the wiring. Because of the relatively small amounts of energy involved, as mentioned above, this would have a measurable but (unfortunately) negligible effect on his power bill.

We believe our definition of Efficiency is legitimate, however narrowly circumscribed, and we also believe that Efficiency is the best way to describe the phenomenon we have identified.

We apologize for any confusion resulting from our ad not containing a definition of Efficiency as we use the term, and we will attempt to clarify this in future ads. However, we stand by the scientific results presented in our ad.

Under our 30-day, no-risk purchase plan, anyone can experience the overall sound quality improvement that our Output Terminator technology makes. We invite Mr. Colin, and other music lovers, to try our MITerminator Interfaces under this risk-free plan. We are confident that most listeners will agree that the sonic benefits of our technology are genuine and that MIT's definition of Effiency is valid.

Bruce A. Brisson,
Director of Research and Development
Timothy A. Brisson,
Director of Engineering
Music Interface Technologies
Auburn, Cal.

Dozen Doesn't Do It

Dear Editor:

In the November 1996 "Spectrum," Ivan Berger discusses the inside-out coaxial speaker used in Eastern Acoustic Works' Model CP621 Phase Aligned Array speaker.

The Spectacular Sound of Paradigm® Reference!

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CIRCLE NO. 18 ON READER SERVICE CARD

In describing the design, Berger states that the six 5¼-inch woofers around the rim of the tweeter horn's flare combine "to provide the effective radiating diameter of a 21-inch woofer." This diameter seems awfully large. Could Berger mean a 12-inch woofer?

Tom Ace
San Francisco, Cal.

Author's Reply: No, I don't mean 12-inch. The area of the individual drivers does, indeed, add up to about 130 square inches, not that much larger than the 113 square inches of a 12-inch cone, or equivalent to about a 13-inch cone. But at bass frequencies, these drivers couple together to act like a driver the size of the total array. If the unit as a whole is 24 inches across, and each cone is about 1½ inches in from the edge, then the circle of cones does have a diameter of just about 21 inches. At higher frequencies, the drivers no longer couple but instead act as individual 5¼-inch midranges.—*I.B.*

Direct Stream Critical

Dear Editor:

I have two questions about John Eargle's "Currents" (October 1996), in which he discusses Sony's Direct Stream Digital (DSD) recording process.

First and foremost: Have people's ears changed? The last time I checked, most people's hearing stopped at roughly 16 kHz, so who gives a damn about response to 100 kHz?

Second, Eargle mentions a Schoeps microphone (a brand I've never heard of, despite 30 years as a stage musician) but does not mention the brands of the other equipment in the chain. Is there a reason why we're being kept in the dark about them?

Edward George French
Dallas, Tex.

Editor's Reply: Although it is true that most people cannot hear much beyond 16 kHz, an ideal sound system would have flat response up to the limits of the most acute listener's hearing, which would actually be somewhere slightly above 20 kHz. And while DSD's 100 kHz goes well beyond that, the system's bit capacity can be reallocated to get lower noise in the audio band, or more audio channels, instead of 100-kHz response. In practice, some of the extra response is bound to be traded off for quietness or extra channels most of the time.

Schoeps condenser microphones are more commonly used for recording than for stage performances, unless those performances are being recorded live. Eargle says that the mike preamps were made by Avalon, an Australian manufacturer. The signals from the preamps were fed directly to the recording system.—*I.B.*

Blind Ambition

Dear Editor:

After reading Peter Aczel's letter in the November 1996 issue, I have a few thoughts on the subject of A/B/X testing, arising from this question: If A/B/X testing is, as many listeners feel, inherently flawed, there should be a reason. But what would it be?

I have personally experienced the diminishment of audible differences that matching output levels introduces into sighted A/B comparisons and the further elimination of differences introduced by making the same test blind. It's quite an education for an open-minded audiophile to do matched-level blind comparisons for the first time. After reading and thinking about both sides of the debate for years, it occurred to me where the flaw in such comparisons may lie. It certainly doesn't lie in matching levels or any other of the methodologies mentioned by Mr. Aczel, save one: blind listening conditions.

The need to eliminate the "placebo effect" in critical listening is clear, but I have begun to question whether it can be done without diminishing perceptive ability. Consider that the placebo effect refers in medical research to the effect unconscious processes have on the body: that is, psychological cause, mechanistic effect. For such investigations, double-blind test protocol proves invaluable. But in listening tests, blind conditions have been used to eliminate delusional thoughts arising from the unconscious. This is accomplished by disallowing assimilation to the conscious (and hence, unconscious) of which component is being listened to. The question is: Can we do this without deleterious effect? Isn't perception a process as likely enhanced as it is damaged by the conscious/unconscious link? Isn't it self-evident that when any perceptual activity is at its most acute, unconscious processes invariably play an integral and enhancing role? Have we, in a well-intentioned attempt to eliminate the delusional component in critical listening, thrown the baby out with the bath water?

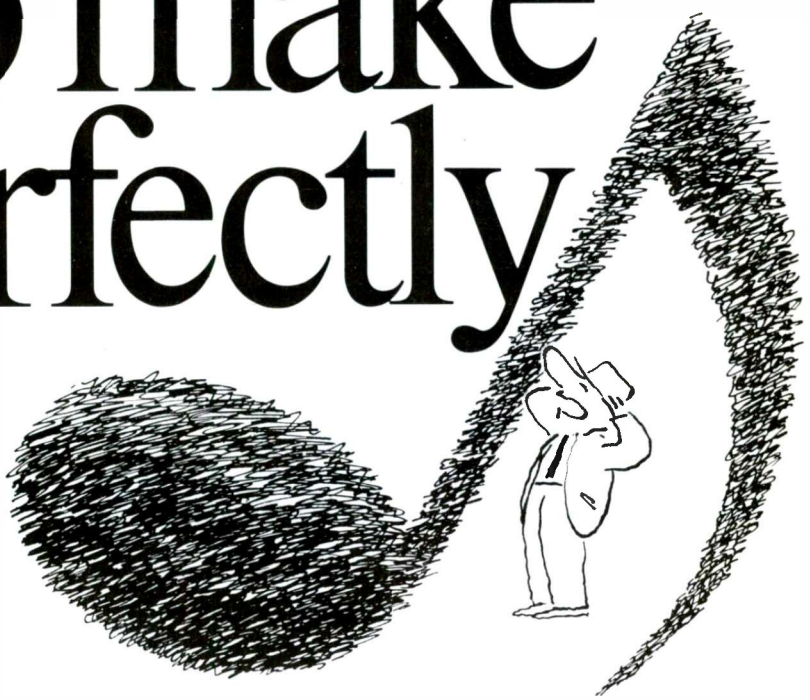
In simplest terms, perhaps hearing acuity is improved when we know what we're listening to. Critical perception of audible cues seems improved, possibly because of memory enhancement in long-term comparisons. (Diminishment to the effect of memory may explain why some listeners characterize blind tests as stressful and confusing.) If this is eventually shown to be true, we move backwards somewhat in our belief in rigorously established quality differences with blind comparison tests, since we then appreciate that there may be no precise way to differentiate negative and positive unconscious effects on perception. Even so, we wouldn't be back to square one; we know that A/B/X comparisons give more information than they mask. The magnitude of audible differences falling below the A/B/X detection threshold is comparatively small. But even these magnitudes might explain how the differences listeners nearly universally report disappear under blind conditions. The relative importance assigned to those differences in aesthetic terms would be back in the subjective realm and, of course, worthy of investigation and debate.

We should begin to question the assumption that blind comparison testing is predicated upon: that the inadequately termed "placebo effect" can have only negative impact on the activity of critical listening. Perhaps a few parallels might illustrate the general type and magnitude of the phenomena in question: fuzzy intelligence in recent powerful digital programs or, in audio, dither improving the audibility of very low-level signals in digital processing. Subtle, perhaps, but possibly important.

Dave King
New York, N.Y.

Editor's Reply: This is an issue we hope to explore in depth in the future. Briefly, for now: I know of no evidence that properly conducted blind listening tests obscure genuine sonic differences. Quite the contrary, in fact. Controlled comparisons of long-term, open listening versus blind listening suggest that the latter is actually a more sensitive (as well as more reliable) discriminator of such differences.—*M.R.*

Adcom would like to make this perfectly clear.



Regardless of how sophisticated your stereo and video system is, it may never achieve its full performance if plugged directly into an AC outlet. Raw and unprocessed AC power can severely diminish the clarity of audio signals and reduce the resolution of your video picture.

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—Lewis Lipnick, *Stereophile,* Vol. 11 No. 4, April 1988.

Recommended accessory in *Stereophile,* Vol. 12 No. 4, April 1989.

Line Protection: It Pays For Itself

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"Electronic equipment (especially digital audio gear) is vulnerable to both annoying and catastrophic power-line problems. Your stereo gear should have line spike and surge protection, with hash filters thrown in too. Line protection—you can pay a little for it now, or you can pay a lot for it later."

—Ken Pohlman, *AUDIO,* November 1987.

For a modest investment, the ADCOM ACE-515 enhances both audio and video clarity while protecting your equipment from damaging line voltage disturbances. Once again, ADCOM lives up to its reputation of offering superior performance at a reasonable cost. For complete technical data, please visit your Adcom dealer. You'll discover the ACE-515 is more than an accessory. It's a necessity.

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WHAT'S NEW

has both preamp-level and speaker-level inputs and incorporates an active compensation circuit and a level control. Crossover frequency is variable from 45 to 150 Hz. Rated frequency response is 17 to 120 Hz, ±3 dB, and peak output is rated at 116 dB SPL.

ADS POWERED SUBWOOFER

The SW500's shielded 12-inch driver has a 2-inch voice coil and operates in a fourth-order bandpass cabinet with a rear vent. The built-in 250-watt amp has both preamp-level and speaker-level inputs and incorporates an active compensation circuit and a level control. Crossover frequency is variable from 45 to 150 Hz. Rated frequency response is 17 to 120 Hz, ±3 dB, and peak output is rated at 116 dB SPL. The cabinet is available in cherry veneer or painted black oak, to match ADS MV-series tower speakers. Price: $1,500 each.
For literature, circle No. 100

NHT SPEAKER

The three-way 2.5i speaker, an upgraded version of NHT's 2.5, uses a 1-inch aluminum-dome tweeter, a 6½-inch midrange, and a side-mounted 8-inch polypropylene woofer with an oversized voice coil that is said to minimize distortion at low frequencies. The system also can be biamped, with the woofer driven by an external amp. Rated frequency range is 29 Hz to 25 kHz, and sensitivity is pegged at 86 dB. The slim enclosure, finished in high-gloss black laminate, measures 38 x 7 x 15½ inches. Price: $1,300 per pair.
For literature, circle No. 102

ENERGY SPEAKER

The Audissey A3+2's Asymmetrical Bipolar Radiation is said to present the spacious soundstage of a bipolar speaker yet retain the pinpoint imaging of a forward-radiating design. To do so, the front baffle has a 1-inch dome tweeter and two 5½-inch cone woofers; another 1-inch tweeter and 5½-inch woofer are on the rear baffle, but the rear-radiated full-range sound is reduced in level by 3 dB. Rated frequency response is 30 Hz to 25 kHz, ±3 dB. The rigid, braced tower measures 40¼ x 7½ x 13 inches and comes with high-gloss black top and bottom caps and spiked feet. Price: $1,200 per pair.
For literature, circle No. 101

Vandersteen Speaker

Like the Vandersteen Model 1B, which it replaces, the Model 1C uses a first-order crossover with both woofer and tweeter connected in positive polarity for better blending and resolution, a filled-polycone 8-inch woofer with 40-ounce magnet and die-cast basket, and a 1-inch critically damped metal-alloy dome tweeter. In the Model 1C, however, the woofer and tweeter are more tightly grouped, the driver alignment has been recalibrated for use with the optional Model 1 bases, and the crossover has a new circuit-board design and enhanced compensation circuitry. Rated frequency response (±3 dB) is 38 Hz to 22.5 kHz on axis, 38 Hz to 15.8 kHz 30° off axis; sensitivity is 90 dB, and impedance is 6.8 ohms, ±2 ohms. Price: $715 per pair; bases, $85 per pair.
For literature, circle No. 103

Make enough trouble and people always start talking

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

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

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

Carver Research Lightstar Reference Amplifier

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

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

Carver TFM-35x THX Amplifier

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

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

Carver AV-806x Multi-channel Amplifier

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

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

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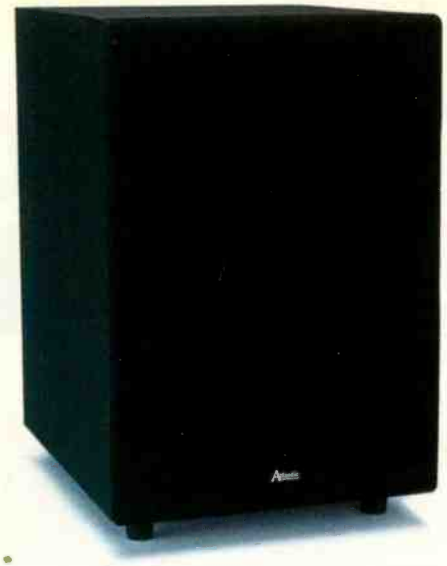
CIRCLE NO. 5 ON READER SERVICE CARD

WHAT'S NEW

Tribute S-Video Amp

The SA 1.3 amplifies and distributes S-video signals across distances previously thought impractical for uncompromised S-video signal transfer. Claimed to maintain S-video signal integrity through 500 feet of cable, the SA 1.3 has two S-video outputs with discrete amplifiers, independent controls for chroma and luminance gain, and broad- and narrow-band cable compensation. The unit works with S-video in NTSC, PAL, and SECAM standards and has a pair of composite video outputs for TVs that lack S-video connectors. Price: $650.
For literature, circle No. 104

Atlantic Technology Powered Subwoofer



The 8-inch long-throw driver in Atlantic Technology's 162 PBM subwoofer, powered by a built-in 75-watt amplifier, is said to produce high output levels throughout its operating range of 20 to 150 Hz. Taller and slimmer than typical competitors, the sealed system has low-level and speaker-level inputs and a steep, 24-dB/octave low-pass filter variable between 60 and 125 Hz. A signal-sensing circuit turns the sub on automatically and switches it to standby mode after 10 minutes of no signal: status is indicated by a dual-color LED. A phase-inversion switch and gain control enable easy room and system matching. Price: $299 each.
For literature, circle No. 106

Toshiba DVD Player

The SD-3006 plays DVDs and CDs. Its audio facilities include two pairs of analog outputs and a digital output for Dolby Digital (AC-3) or standard PCM signals. Other outputs include composite video and S-video, as well as a color-difference jack (a type of component-video output) to feed high-end line-scanning converters and displays. Programs can be viewed in standard 4:3 format, letterboxed (for large-screen and standard TVs), or in a special 16:9 anamorphic mode (for widescreen TVs). A parental control system enables you to lock out playback of DVDs by children on the basis of the films' MPAA ratings. The supplied universal remote control can command a TV set, VCR, and cable box in addition to the player. Price: $699.
For literature, circle No. 107

TANDBERG FM TUNER

Class-A circuitry is used for the audio section of the TPT 4031. Its front end has digitally controlled tuned circuits; the first RF amplification stage has dual-gate MOS-FETs. The tuner is remote controlled and has nonvolatile memories for 16 preset stations. Rated sensitivity for 50-dB quieting is 17.2 dBf in mono, 37.2 dBf in stereo; rated S/N is 82 dB in mono and 78 dB in stereo, and alternate-channel selectivity is greater than 100 dB. Price: $1,595.
For literature, circle No. 105

Yamaha A/V Receiver

The RX-V990 has five RCA jacks on its rear panel to accept the output of an accessory Dolby Digital (AC-3) decoder (or other 5.1-channel source) in addition to four audio-only and four A/V inputs, the latter equipped with S-video jacks. Two Cinema DSP modes are included for Dolby Pro Logic Surround sources, as are numerous hall ambience modes for music and music videos. The amp section delivers 100 watts each to the three front channels and 25 watts each to the surround channels. A learning remote and 40 random-access AM/FM station presets round out some of this receiver's features. Price: $999.
For literature, circle No. 108

The Faraday ring may look insignificant. But it's this tiny component that gives the A Series its huge dynamic range.

By counteracting rising impedance in the voice coil, it allows more power into the tweeter. And with more power going in, you get more power out.

Even the highest frequencies sing out loud and clear, making the A Series the ideal speakers for the faithful reproduction of today's digital music and film recordings.

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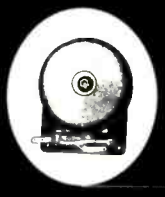
CELESTION

CIRCLE NO. 6 ON READER SERVICE CARD



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DVD VIDEO

CIRCLE NO. 24 ON READER SERVICE CARD

AUDIO CLINIC

JOSEPH GIOVANELLI

Getting More Volume

Q *How can I get more volume from my power amplifier and sub/sat system? If I buy another power amplifier and biamp the speakers, would that help? I want them to handle extremely loud rock and still sound good with quiet acoustic guitar music.*—Phil Wall, Renton, Wash.

A A speaker can produce only so much sound level without being damaged by excessive input power. Speakers tend to sound coarse and gritty as they near their output limit, or, on a sudden bass transient, the voice coils may produce a sharp snap as they hit the magnet structure (which may damage the coils). If you hear either of these symptoms, lower the volume; you cannot obtain more output.

Is the sub powered or passive? If the latter, then biamping the system—driving the subwoofer and the satellites with separate amplifiers and high-pass filtering the satellites—should result in higher sound levels because the satellites will be relieved of low-bass duties and will play louder and cleaner. But if you are already using a powered sub that has built-in low- and high-pass filters, there will be limits on how loud the system will play.

Perhaps your amplifier is too low-powered and you are pushing it into clipping, which may also result in audible distortion. The amplifier should have significant reserves of power to handle sudden dynamic peaks.

Achieving higher sound pressure levels may require larger, multidriver main speakers, a more powerful amplifier, or a second subwoofer. You should also consider trying horn-loaded speakers whose rated sensitivity is very high, 96 to 100 dB SPL. These can produce very high sound levels—albeit, perhaps, at some loss of musical accuracy—with very low distortion.

Foreign FM Connectors

Q *The plug on my 75-ohm FM antenna does not match the 75-ohm input jack on my receiver. The antenna plug has an internally threaded barrel with a hexagonal rim; the jack has a smooth barrel, like an oversize RCA plug, and a thin tube going down the middle. How can I connect them?*—G. F. McCarthy, Astoria, N.Y.

A Your receiver apparently has a European-style antenna jack. Luckily, Radio Shack has an adaptor (Catalog No. 278-265) that will solve your problem for $1.99.

Proper Storage of CDs

Q *Because of space limitations, I put two CDs in one jewel box, one on top of the other. If the upper CD's playing side is touching the label side of the CD below, is this bad? Storing discs "label to label" is not as convenient, but is it preferable? Can I extend this to storing three or four discs in one box?*—Anthony Hudaverdi, Santa Monica, Cal.

A I do not like the surfaces of CDs to touch, however they're stored—label to label or any other way. Stacking three or four CDs in a single jewel box is even worse: The holding spindles are not designed to secure that many discs, and scuffing can occur when such boxes are transported.

Packaging designers and record companies have become more creative lately, producing jewel boxes no thicker than a single case. Yet these boxes can accommodate two CDs that don't touch each other because of a hinged plastic panel that folds out to reveal the second disc. Two-disc sets from Ryko, Delos, and Time/Life Records are notable in this regard. I have not been successful in locating a source for spare two-disc boxes, but if sufficient demand arises, I'm sure they will be sold by themselves.

Distortion of Choral Passages

Q *I have a CD transport with a coaxial digital output and a CD changer with an optical (Toslink) digital output. These are connected to a Theta Digital jitter-reduction box and the latter to a mid-priced D/A converter. The system sounds fine except for audible distortion during loud choral passages (especially with female voices) and on some loud instrumental passages. The distortion sounds like a highly modulated LP played with an old noncompliant phono cartridge from the '50s. Cures have been suggested by everyone from a friend, who recommends AC power conditioners for the digital gear, to a high-end dealer who wishes me to part with most of my savings. The distortion is present through speakers as well as electrostatic headphones and is more noticeable with the CD changer's optical output than the transport's coaxial source.*—Eduardo A. Benet, Key Biscayne, Fla.

A The most likely explanations are that there is something wrong with your D/A converter that is causing it to distort (which should be reparable) or that the input circuits ahead of your preamplifier's volume control are overloading on high-level passages. Choral works are tricky to reproduce at best, and a little bit of overload will cause them to sound like mistracked LPs. DB Systems (Main St., Rindge Center, N.H. 03461; 603/899-5121) has output attenuators that can be inserted between your CD player or D/A converter and your preamplifier's input. You will likely need to attenuate the signal by 6 dB or more to solve this problem. You can prove that the distortion is the result of overload if your D/A converter has a headphone output: Listen through dynamic 'phones, not electrostatics, to see if you still hear the distortion.

If you determine that preamp overload is not the problem, try bypassing the jitter-reduction box and the outboard D/A converter entirely. Use the CD changer's internal converter, plugging it into your system directly. If you don't hear the distortion, then at least you have isolated the problem to the transport, the jitter reducer, or the outboard D/A converter.

Laserdisc Interference

Q *When playing laserdiscs, I often hear two guys talking with each other on ham radio; it comes through my center-channel speaker loud and clear. I never hear this interference when I'm playing other program sources. What can I do to eliminate it?*—Name withheld

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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.

Introducing The *Tower*™ Series By Henry Kloss.

Cambridge SoundWorks' new Tower series speakers combine musical accuracy, very natural tonal balance, precise stereo imaging and an incredibly dynamic presence – all without reinventing the laws of physics.

"The soundstage of the Towers was stable, deep, and richly three-dimensional...unfettered, solid bass to below 30Hz...an uncommon value." *Audio, Jan. 1997*

Our new *Tower* series of speakers was designed by Audio Hall of Fame member Henry Kloss (founder of AR, KLH & Advent). They have the wide range, precise stereo imaging and natural tonal balance of our acclaimed *Ensemble*® series – and add improvements in efficiency, dynamic range and "presence."

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Tower III is a two-way design using a wide-dispersion tweeter and a single 8" woofer. It combines high sensitivity and outstanding dynamic range with the natural, wide-range sound (including terrific bass) of a generously-proportioned cabinet. It has been carefully "voiced" by Henry Kloss for superb tonal balance and precise stereo imaging. These benefits come at a much lower cost than superficially similar models through a combination of Henry Kloss' design expertise, plus Cambridge SoundWorks' highly efficient direct-to-the-consumer sales policy. *Tower III* is the most affordable high-performance floor-standing speaker we know of.

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

Tower II by Henry Kloss™

Tower II is a three-way system substantially larger than *Tower III*. It has two 8" woofers, a 5 1/4" midrange, and a 1" soft-dome tweeter.

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

Tower II is finished in vinyl that simulates black ash or Vermont walnut. Bi-wire/bi-amp capable. **Factory-direct price: $999 pr.**

"Tower II can generate the gut-wrenching bass and do justice to a first-rate music system. To top it off, the price is right!"
Stereo Review

Tower by Henry Kloss™

The flagship of the series is the three-way, bipolar *Tower by Henry Kloss*. Bipolar dispersion helps eliminate the "point source" effect of direct-radiator speakers, and ensures a proper stereo effect in many listening positions.

Tower features two forward-facing 8" woofers; a forward-facing 5 1/4" midrange driver; a 1" soft-dome tweeter; and separate rearward-facing midrange and tweeter units identical to those used in front.

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

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CenterStage is a two-way, three-driver center channel speaker that complements our *Tower* speakers. Its bass reach is greater than most center speakers, and the dynamic range of its long-throw drivers handles the most demanding of soundtracks. Finished in black vinyl. **Factory-direct price: $349**

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CIRCLE NO. 3 ON READER SERVICE CARD

A Since the RF interference is present only when you play laserdiscs, it is entering your system via the player itself, the video or audio interconnects, or the AC line cord. The RF could even penetrate the player directly if it is not well shielded.

Disconnect the audio and video cables from the laserdisc player. If the player has a headphone jack, put on headphones and play a laserdisc at a time when you know the RF interference is present. If you hear the interference, you know the AC cord or the player itself is responsible. Assuming the AC cord is the culprit, coil up the excess and tuck it close to the player's chassis. That alone might solve the problem. If the RF persists, try adding ferrite beads or collars made for such a purpose to the line cord. Keep the cord as short as possible so that it becomes less of an antenna.

If no interference is heard through headphones, then the player and its AC cord are not at fault. Therefore, the problem must be the A/V cables. Reconnect them, and play a disc when the interference is present. Disconnect the video cable and see if you can still hear the interference. If you can't, you have isolated the source of the problem. You must use the shortest, best-shielded video cable possible. If there is any excess, coil it up and tuck it close to the player. You might have to place some ferrite beads on the cable, near the player. If you still hear the interference, then the audio cables are at fault. Again, use cables with the best shielding possible—real braid, not spirally wound shield. Because you hear the RF only in the center channel, it may be entering your system in equal amounts through the left and right audio cables; the Dolby Pro Logic decoder would then interpret it as a mono signal and route it to the center.

If the interference still persists after the aforementioned fixes, you may have to modify your amplifier or receiver by inserting RF chokes or ferrite beads. An RF choke can be placed at each input, wired right to the connector. The other end of the choke is connected to the point that was originally wired to the input connector. You will need a choke for each channel. Try a value of perhaps 0.5 millihenry as a start. I hope you won't have to use bypass capacitors because of possible high-frequency losses.

Before you embark on this, try moving the laserdisc player and receiver to a different location in the room or elsewhere in your home. Although this is inconvenient, you may find that the interference disappears. Last, try contacting the ham operators you're hearing; they likely live nearby (or you wouldn't be getting the interference). Most hams are very knowledgeable about RF troubles and will be more than happy to help you solve the problem.

Balanced vs. Unbalanced Circuitry

Q *What are the differences between balanced and unbalanced input circuits in power amps? What are they used for?*—Derek Collins, New Port Richey, Fla.

A Balanced circuits, found in some consumer audio components and most pro audio gear, will reduce hum that is picked up via the cables connected to the inputs. However, I don't believe balanced circuits are necessary in most consumer installations because interconnects are usually kept short and hum is low.

In an unbalanced circuit, one signal input connection is "hot" while the other is at ground potential. To hook up components having unbalanced connectors, you use a cable consisting of a hot center conductor surrounded by a shield, which connects to the chassis ground.

An unbalanced circuit's signal voltage alternates above and below ground potential in terms of its electrical polarity. Any hum that might penetrate the shield can induce hum voltage in the hot lead; that hum will be passed to the amplifier and speakers, where it may be audible.

In a balanced input circuit, the amplifier again has two leads that will accept signal, but in this case neither connection is grounded. Each connection is opposite in electrical polarity from its counterpart. A shielded cable is used, but with *two* center conductors, each connected to one of the input leads. The shield is again grounded, but it carries no signal. Any hum that penetrates the shield will induce a hum voltage into both center conductors, but the hum will have the same polarity in each conductor. However, in order for the hum to be passed to the amplifier, it would have to produce voltages with opposite polarities in the two center conductors. Inasmuch as this is not the case, the hum signals cancel at the amplifier input and no hum is heard.

Center-Channel Hiss

Q *I drive my center-channel speaker with a mono power amp because my Dolby Pro Logic receiver has only a preamp-level center-channel output. When I turn the volume fully down, I hear a "shhh" in the center speaker; if I increase the volume of the program, the hiss disappears. (I've verified that the connections are correct.) Friends tell me this occurs because my speaker (rated for 15 to 175 watts) is very efficient.*—Ferdi Mariano, via e-mail

A If your speaker's sensitivity *is* high, your friends are right. Your speaker is not causing the hiss, but you probably wouldn't hear it if the speaker weren't so efficient at translating the noise's presumably low voltage into sound. Check the speaker's manual (or, if it's still made, its listing in our Annual Equipment Directory in the October issue) for its sensitivity rating; a figure somewhat above 90 dB is high.

The hiss could be coming from your power amp, your receiver, or both. In any case, it's generated after your receiver's volume control, or you would not hear it with the volume turned down.

If your mono amp is an early solid-state design or a tube model whose tubes have gone blue and gassy, it's probably the culprit. Turn off your system and disconnect the receiver from the amp's input. If you still hear the hiss when you turn the system back on, it must be coming from the amp. If your receiver has preamp-out and main-in jacks, you can double-check this by routing the center signal through one of the receiver's amplifier channels to see if the hiss disappears.

If the hiss disappears when the receiver is disconnected from the amp, then it must come from the receiver. You *may* be able to reduce or eliminate it by turning the receiver's center-channel output up and your mono amp's input level control down. If there is no input level control, you must place one between the center-channel line output of the receiver and the power amplifier input. (Switchcraft makes such a device: a standard potentiometer circuit, suitably mounted in a box equipped with all necessary input and output connectors.) Alternatively, you can buy a fixed attenuator that drops the signal about 12 dB from DB Systems (Main Street, Rindge Center, N.H. 03461; 603/899-5121).

Adding Speakers to a Mini-System

Q *Can I connect additional speakers to a shelf system? I'm planning to buy a mini-system to save space and add additional speakers to get better sound.*—Eddie Chin, via e-mail

A The mini-system's modest amplifier may determine whether you can connect extra speakers. Mini-systems usually cannot handle loads of less than 6 or 8 ohms (check the owner's manual or spec sheet). If the system's existing speakers are rated at 8 ohms and you connect a second 8-ohm pair in parallel, the amplifier will see a combined load of 4 ohms, which could trigger overheating and protection-circuit shutdown.

However, you can connect a second pair of speakers in series with the first pair, which will keep the impedance high and won't stress the amplifier—so long as the amp has adequate power to drive both pairs. Many mini-systems have "mini" amplifiers, typically from 10 to 25 watts per channel, which will be ample for moderate listening levels but inadequate at a high volume level. If you choose speakers that have high rated sensitivity—say, 93 dB SPL or higher—you'll ease the demands on the low-powered amplifier. On the other hand, series connection of loudspeakers that are not identical will result in some (probably undesirable) alteration of frequency response.

Consider simply replacing the mini-system's existing speakers with high-quality compact models if you want to improve sound quality. Just be sure to check that the new speakers' minimum power requirement can be met by your mini-system's amplifier.

Improving Weak AM Reception

Q *I live about 50 or 60 miles from New York City and listen to its AM stations. I receive WABC and WCBS very well on all my radios, but WNYC comes in poorly. I would like to receive this station on a small pocket radio and on my hi-fi system. Is there a relatively inexpensive and simple way to do this?*—Richard Aaron, Sussex, N.J.

A The last I heard, WABC and WCBS, both flagship stations of large networks, had considerably more transmitter power than the nonprofit WNYC, which is why it does not come through as clearly.

The only device I know of that will boost your AM reception on a wide range of radios is the C. Crane Company's Select-A-Tenna, which can provide as much as 30 dB of signal boost. The basic model ($57.95) is a passive tuned loop in a plastic case about 11 inches in diameter. To use the unit, you place it near your radio's antenna loop, tune to the desired station, orient the radio for best reception, and then adjust the Select-A-Tenna's tuning knob for the loudest signal.

If your house has a steel frame or metallized insulation that keeps signals out, you can use Crane's Model M ($72.95), which includes a wire to feed out your window or tape to a windowpane.

If your tuner's antenna is not accessible but the tuner has terminals for an external AM antenna, try using the Hardwire Select-A-Tenna (also $72.95), which can be connected to those terminals. A special remote model, the Ferrite Select-A-Tenna ($86.95), couples to your tuner or AM radio from up to 6 feet away. For more information on these products, contact the C. Crane Co. (558 10th St., Fortuna, Cal. 95540; 800/522-8863; e-mail, ccraneco@aol.com). A

KEN KESSLER

THE NXT BIG THING

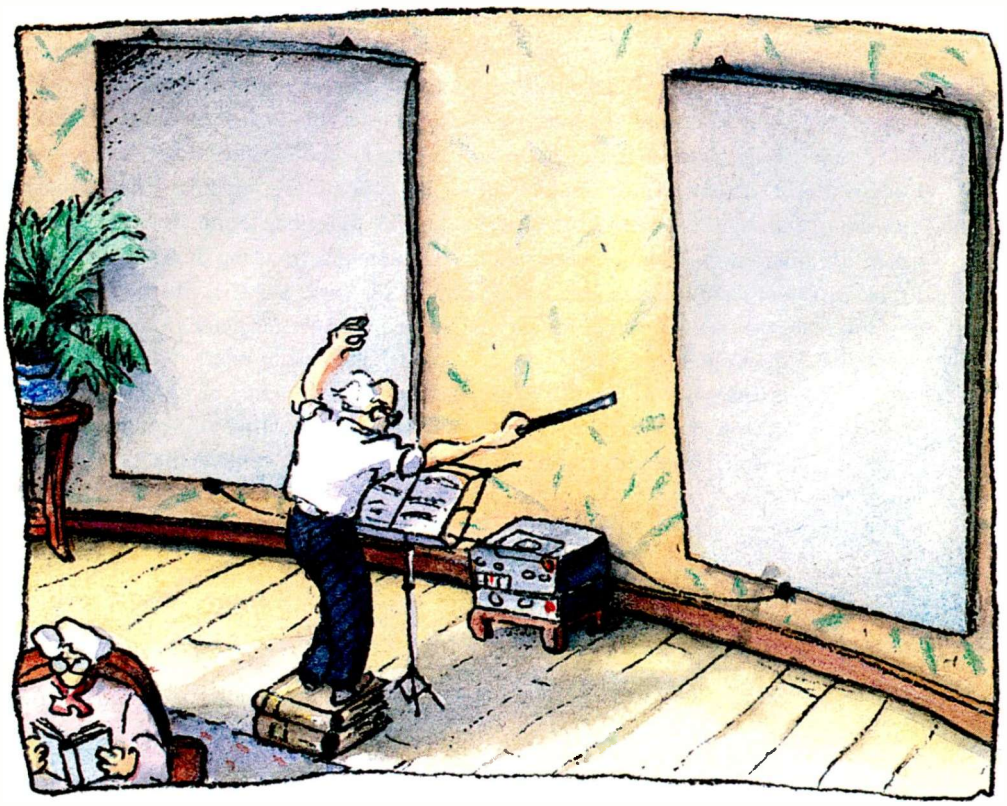

Illustration: Philippe Lechien

Rare are the occasions when a British hi-fi company makes the financial pages of the major newspapers. Rarer still are the times when British companies force the hands of American companies. But the Verity Group has done both, achieving what must be the audio equivalent of turning lead into gold: The development of a wall-mountable, flat-panel loudspeaker that works. Unlike electrostatics or other classic dipoles, it doesn't need space behind it, making it an interior decorator's dream speaker.

Verity Group, which has been mentioned in this column before, is the parent company of venerable British makers Quad, Wharfedale, Mission, and Roksan. Once it found itself the owner of a quartet of complementary brands, covering a wide range of budgets and tastes, the company realized that it could justify centralizing its design headquarters, just down the road from the main Mission factory. And one of the first projects to emanate from V-Labs, as the R&D center is known, is a design that transcends individual brand application: NXT, the technology that made Verity shares jump overnight. From 15 pence (25¢) on the morning of the announcement to 23 pence (38¢) by the end of that day, the price went up as high as 44 pence (74¢) in the aftermath of the announcement. The competition immediately started muttering the words "smoke" and "mirrors," while industry veterans recalled myriad launches at Consumer Electronics Shows of flat speakers disguised as paintings, which uniformly sucked.

WITH NXT, VERITY HAS ACHIEVED THE AUDIO EQUIVALENT OF TURNING LEAD INTO GOLD.

Only this time, it's for real. Wharfedale's managing director, Stan Curtis, while studying materials and technologies suitable for noise isolation in aircraft cockpits, saw an item in an electronics magazine concerning a distributed-mode loudspeaker (DML), an idea pioneered by the British Ministry of Defence's Defence Research Agency in 1994. Curtis and Henry Azima immediately recognized DML's potential, and Verity Group became the sole licensee. It took two years of research and development for the concept to evolve from the theoretical to the practical. Azima told me that, as of late November 1996, Verity had applied for 23 patents, with at least another 10 to follow.

Distributed-mode describes the principle under which the NXT loudspeaker operates. Unlike nearly all other viable speaker types, which work as pistons moving air (let's leave gases out of this discussion, okay?), DML uses and controls a flat panel's bending modes. A detailed explanation of how this all works is much more than I have room for here, but the upshot is a panel that can be manufactured from any number of materials, in thicknesses from about 3 to 20 millimeters and in sizes ranging from 25 square centimeters to 100 square meters. The panel can be driven from a single point by a moving-coil motor, as in conventional speakers, or by a piezoelectric motor. The trick lies in controlling the panel's resonant behav-

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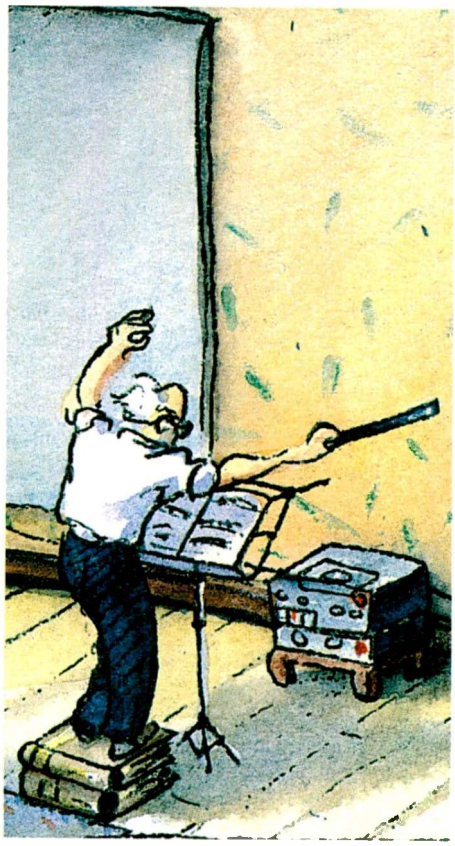
CIRCLE NO. 15 ON READER SERVICE CARD

ior. And it is the latter that required the most research.

The first thing the design team had to do was abandon its preconceptions, including the notions of using pistonic motion and electrostatic or electromagnetic principles. Indeed, DML meant embracing the antithesis of conventional, cabinet-mounted speaker design, in which any movement of the stiff enclosure panels is unwanted; DML does not even use an enclosure. The transducer creates bending waves in the panel, its behavior dependent on a list of characteristics outlined in the company's white paper: surface density, bending stiffness, the panel's geometry and surface area, the location of the drive point, the drive-unit type, the shear modulus of the core, internal damping, the method of mounting the panel, and other "interrelated factors." To quote the paper, "The correct blend of these parameters will specify a panel construction that will result in good distributed mode behavior. Should one get this wrong, the panel will of course radiate acoustic energy, but it will not be a loudspeaker anymore."



THE NXT SPEAKER IS BIPOLAR, RADIATING SOUND ACROSS ITS ENTIRE SURFACE.

Additionally, the NXT speaker is bipolar in operation (above a given frequency), radiating sound across its entire surface. Surprising benefits include diffuse sound radiation, with uniform directivity across the frequency band (thereby eliminating problems with off-axis seating, which normally suffers from irregularities in tonal balance), and, curiously, sound pressure levels that decrease linearly relative to the speaker location so that the sound appears to fill a room at a constant level. This is in contrast to conventional speakers, which adhere to an inverse-square law for power loss with increasing distance. Another bonus is that, should you eschew the divine option of wall-mounting an NXT speaker, its behavior in free space (given the front-plus-rear radiation) will provide an extra 3 dB of level, which is akin to doubling the power of your amp for free. Although this advantage is sacrificed when the speaker is wall-mounted, its performance is otherwise unhindered. Free-space operation, however, isn't the main point; making the panels disappear is. So you can probably see what's coming.

Given that an NXT speaker can be made from all sorts of materials, finished in a variety of ways, and be used with or without an enclosure, the possibilities are virtually endless. And Verity, being a sensible company, isn't going to let the audiophile community pee on its parade. In the best entrepreneurial spirit, the company is courting licensees from all fields. The first licensees, though, are three of its own: Mission, Quad, and Wharfedale. To manage this, the company created a new division, New Transducers Limited, with Henry Azima in the driver's seat. The hope is that it won't be long before companies outside the hi-fi industry check out NXT's potential applications, to wit:

Computers: Think about what a hassle it is extracting stereo sound of reasonable quality from your notebook computer. Now picture fold-out "wings" or even an entire notebook computer's lid made from an NXT speaker. And while you, I, and other computer users with audiophilic tendencies might go all the way and use "real" hi-fi systems for the audio portion of our computing, not everyone wants full-blown speakers or even Bose RoomMate/JBL Control 1/Rock Solid-sized mini-speakers flanking his monitor. Again, a fold-out "wing" could do the trick.

Home Cinema: Yep, an entire projection TV screen could be made from an NXT speaker simply by finishing it with an appropriately reflective coating. Bye-bye hard-to-hide center-channel speakers. And if you're one of those lucky souls who has the space for a 100-inch or larger screen in his viewing room, it could contain the front left and right speakers, too. Verity has already trademarked its center-channel/screen model as SoundVu. As for the left/right and surround speakers, well, NXT's dispersion is diffuse, making it ideal for cinema-style listening. No hot spot in the room—another dream come true.

Car Stereo: Why not make a car's entire parcel shelf or even its door panels from NXT? Parts of the dashboard? The headliner? The glove compartment's door? Hell, if you're the owner of a big MPV or a Winnebago, you could pack in enough speaker to drown the blast of any low-rider at full bore.

Custom-Installed Multiroom Systems: Sick of cutting holes in the wall to camouflage the speakers in the bathroom, kitchen, or dining room? NXT is an installer's dream. It's *made* to become part of the wall; you won't even know it's there. Verity has already designed ceiling tiles from NXT speakers, under the trademarked name of SonTile.

Professional Applications: Verity has identified such uses for NXT as audio notice boards in museums and at exhibitions, public address systems, airplane cabin PA systems (where space is always at a premium), you name it.

The list could go on forever. You know those silly greeting cards with synthesizer chips on 'em? NXT 'em. How about an NXT mini-speaker built into the lid of a portable CD player? Or boom boxes on diets, ultra-flat telephone handsets, higher-fidelity cellular phones, wild headphones, and "talking" briefcases? What hasn't yet been brought up, though, are high-end products.

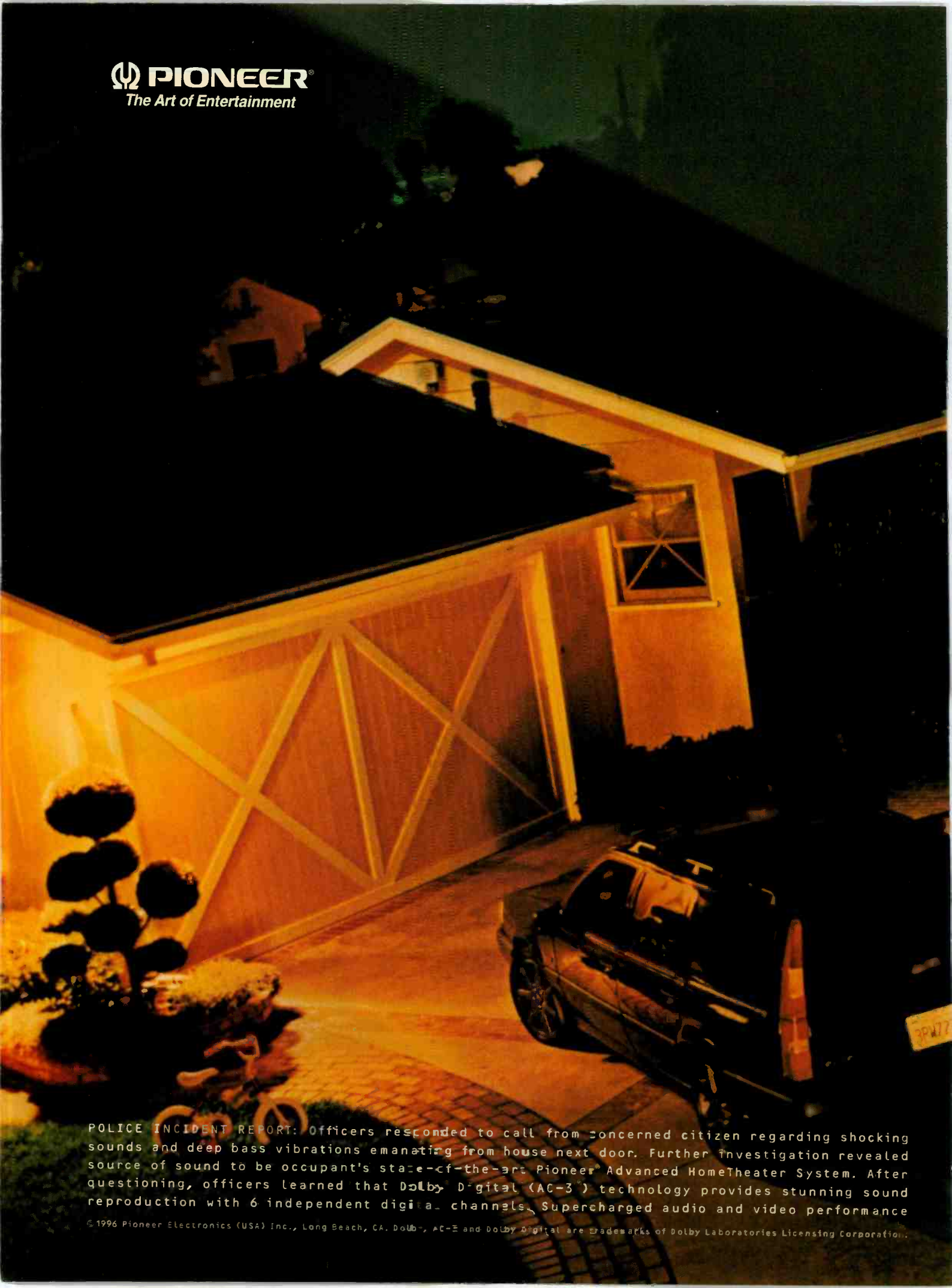
Azima dismisses mutterings about NXT's diffuse dispersion being ideal for home theater but lousy for hi-fi. Like any new technology, it needs refinement. Affordable, commercial NXT products aren't expected to be in stores before 1998, so it's still early. Azima pointed out that the practical operating range for an NXT panel is

PICTURE AN ENTIRE NOTEBOOK COMPUTER'S LID MADE FROM AN NXT SPEAKER.

100 Hz to 20 kHz, and you could get deeper bass by adding an enclosure or making hybrids with cone-type woofers. Because subwoofers came of age long ago, few would object to a couple of NXT panels being augmented by a subwoofer sitting in the same place that today's subwoofer resides.

With NXT, it looks like Verity has a winner on its hands. It created enough of a buzz to cause an American company that has a U.K. office to issue an announcement regarding its own "flat-panel speaker technology." Noise Cancellation Technologies—with offices in Stamford (Connecticut), in Cambridge (England), and in Tokyo—revealed that it had been working on a not totally dissimilar piezo-driven flat panel speaker for two years. The press release was accompanied by a list of colleagues, including automotive heavy hitters like Magneti Marelli (which makes the electrics for Ferrari) and the U.S.A.'s largest manufacturer of car headliners. And, sure enough, NCT's working prototype fills the ceiling of a Ford Mondeo, demonstrating what has been fetchingly named TDSS: Top Down Surround Sound. So it looks as if one hell of a battle is brewing.

Verity launched NXT to the U.K. press in September, in Tokyo in October, and in Germany in December. The American launch is planned for Las Vegas, at private showings during the Consumer Electronics Show this January. The company has never been more bullish. So maybe now it's safe for you to tell your nagging decorator/architect/spouse that the future is gonna be flat. A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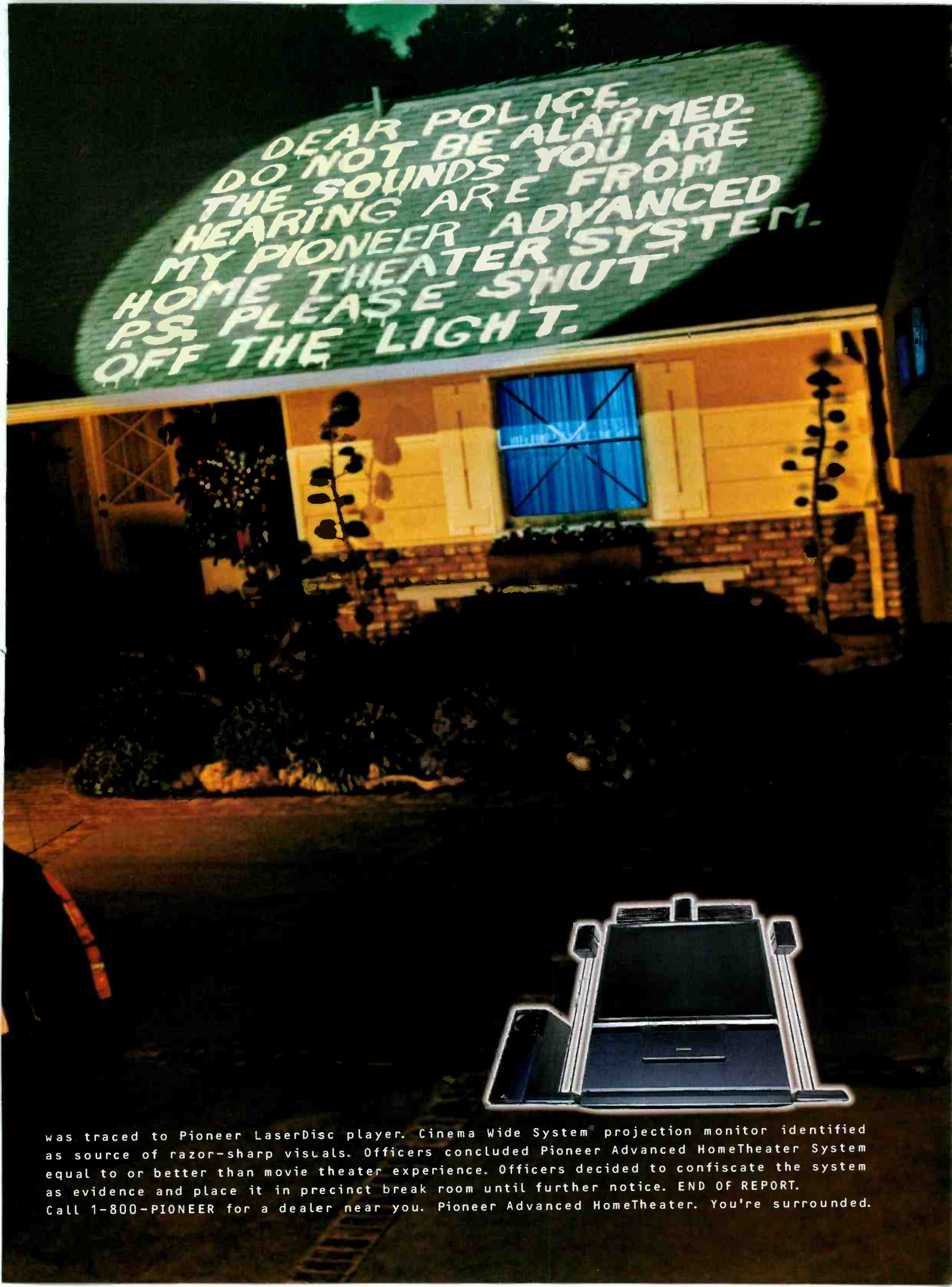

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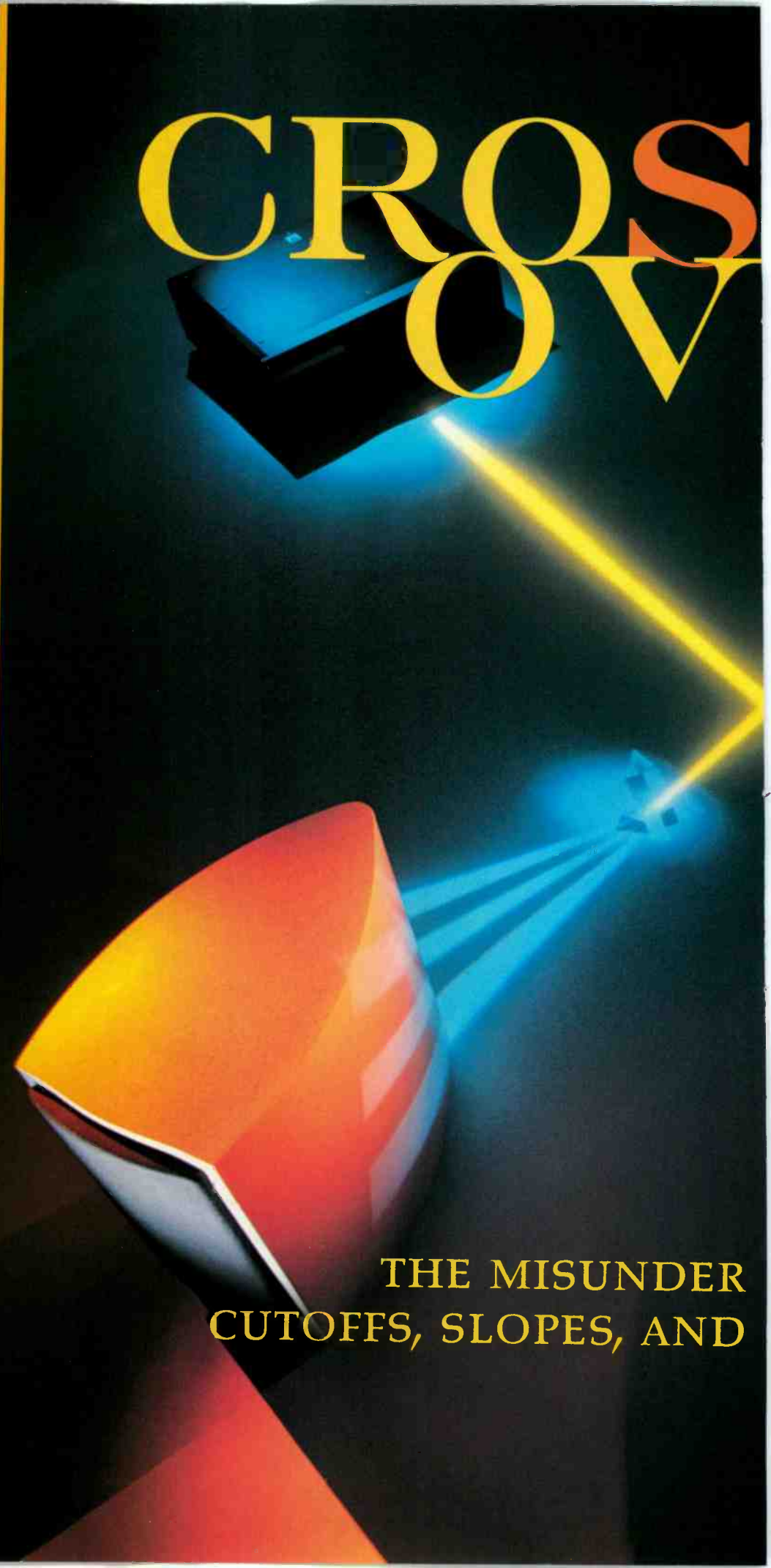


THE MISUNDER
CUTOFFS, SLOPES, AND

by Ken Kantor

If I were to give you 1,000-to-1 odds on a bet, you probably wouldn't take me up on it; it's quite a long shot. And designing something that can work over a range of 1,000 to 1 is a long shot, too: a motorcycle that can stay balanced at 1 mph and then zoom effortlessly to 1,000 mph, for example, or a pair of socks that will fit a 6-foot man, a small child, or a flea. Clearly, it's not easy for something to work over such a wide physical range. Yet that is exactly what a loudspeaker designer who's seeking a frequency range of 20 Hz to 20 kHz is trying to do: build a device that can massage the air in long, slow strokes and vibrate it 1,000 times faster, all at the same instant. If truth be told, it can barely be done at all. That's one reason why speakers remain the weakest link in an increasingly accurate audio chain. To ease the task, more often than not speaker designers decide that reproducing anything even close to the full range of audio frequencies requires two or more dedicated drivers, each assigned to a specific frequency range.

A 20-Hz tone has a wavelength in air of roughly 50 feet; even a tone as high as 100 Hz has a 10-foot wavelength. Thus, the kind of transducer, or driver, that will best radiate these long wavelengths must have a large surface area (so it will be relatively heavy) and a long excursion (because it must pump lots of air).

By contrast, a 10-kHz tone's wavelength is just over an inch, and 20 kHz is half that; the radiation of high frequencies thus requires a very nimble, lightweight transducer that can move rapidly and accurately. Moreover, the diaphragm must be small to avoid directional beaming of very high frequencies. The intrinsic contradictions in these design goals are obvious.

For the speaker designer, the decision to use multiple drivers is not one to be taken lightly. When you split up the audio spectrum before it reaches the loudspeaker or divide it up inside the speaker, it must be recombined in the air, which can cause interference between sound waves and other aberrations. Consequently, not all speaker designers choose this route. Indeed, there are excellent, albeit expensive, speakers that use a single, full-range radiator, typically a flat or planar diaphragm. Such speakers' sound can be very coherent and subjectively transparent, but often at the sacrifice of dynamic range and with some limitation in frequency response at the upper and lower extremes. As a result, the vast majority of hi-fi speakers on the market today have multiple drivers. The advantages of a multidriver speaker can be very compelling, and, with good engineering, the disadvantages can be minimized.

Ken Kantor is Vice President, Technology, for NHT loudspeakers in Benicia, California.

Photo: John Wilkes

A CROSSOVER IS AN ELECTRICAL CIRCUIT THAT SPLITS THE AUDIO SIGNAL INTO DIFFERENT BANDS, EACH OF WHICH IS SENT TO ITS OWN DRIVER.

Crossover Types

Now to the subject at hand: crossovers. A crossover is nothing more than an electrical circuit that splits the incoming audio signal into different frequency bands, each of which is sent to its own driver. Sometimes called a "network," a crossover can be made up of a tangle of resistors, capacitors, and inductor coils, or it may be simple and elegant, with few component parts. A crossover is at the heart of virtually every multidriver speaker, and there are two general types to consider: active and passive.

Active crossovers are electronic filters that reside in the signal chain between the preamp and power amp. They divide the line-level signal into different bands of frequencies and require each driver to have its own dedicated power amplifier. Such crossovers are both precise and easily adjustable (if desired) but are fairly complex and rather costly to implement. On the other hand, having individual amplifiers for each driver enables those amps to be tailored to the power limits and response ranges of their loads. Active crossovers are commonly found in powered speakers, better-quality subwoofers, and in large, professional sound-reinforcement speaker systems.

By far the most common type of crossover used in hi-fi speakers is the passive network, which is usually housed within the speaker's enclosure, either glued to the input terminals or mounted on its own p.c. board. This crossover type uses the frequency characteristics of passive components to create filters—for example, capacitors that progressively block lower frequencies and let the highs pass through (high-pass filters) or inductors (coils) that filter out highs and pass the lows (low-pass filters). Resistors—well, they resist them all. By using these parts in different combinations, the designer can tailor frequency response and driver output level very precisely.

In a simple example of a passive crossover (Fig. 1), placing a capacitor in series with the tweeter of a two-way speaker will prevent the bass frequencies from reaching the tweeter. A 2-microfarad (2-µF) capacitor might let only the highest frequencies in, while an 8-µF capacitor would extend the range of the tweeter down toward the midrange. (The 3.3-µF capacitor shown is a suitable value for this particular crossover design.)

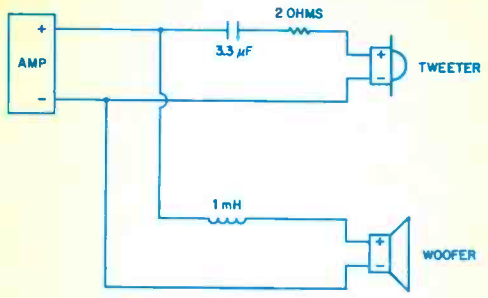


Fig. 1—A simple passive crossover network in a two-way speaker. The resistor reduces the tweeter output level to match that of the less efficient woofer.

A similar selection of inductors in series with the woofer would block high frequencies. A large inductor—say, a coil of 6 millihenries (6 mH)—would aggressively attenuate upper frequencies more than a smaller inductor, such as the 1-mH inductor used on the woofer in Fig. 1. (Incidentally, the rate of attenuation of high or low frequencies by a filter, be it aggressive or gradual, is called the crossover slope.) To complete the crossover's design, we might add a resistor in series with the tweeter to better match its level to the less efficient woofer.

Although this seems simple enough in theory, a crossover's resistors, capacitors, and inductors interact electrically in mathematically complex ways, both among themselves and with each driver's frequency-varying impedance. The result is that almost no desired response curve is easy to achieve, yet almost anything is possible! All you need is a big pile of parts, a soldering iron, a lot of time, and an effective computer modeling program. That's it.

Take a look at Fig. 2, however, which compares the frequency response of a theoretical high-pass filter to the actual response for the simple high-pass network we attached to the tweeter in Fig. 1. And this doesn't even include the tweeter's acoustical behavior.

Obvious and Unseen Crossover Duties

Most people are familiar in a general way with the role a crossover plays in dividing up a loudspeaker's frequency spectrum. Unquestionably, that is its single most important job, but it's not the only role it plays. Indeed, the crossover is thought by many contemporary designers to be as important as driver selection in determining a speaker's sound quality.

A crossover is, first and foremost, a kind of electrical filter, removing the unwanted signals from each driver and allowing the appropriate band of frequencies to pass through. Midrange and treble tones are blocked, and the remaining bass frequencies are sent to the woofer; bass and treble are excised from the midrange path; and bass and midrange frequencies are kept out of the tweeter. Not only is the crossover dividing up the spectrum appropriately, but unwanted frequencies—those that could damage a particular driver or cause it to distort—are also tamed.

Not long ago, this job of allocating frequency bands to their appropriate drivers was all that crossovers were considered good at doing. De-

signers sought to achieve crossover responses that looked like textbook filters, i.e., with flat passbands and simple, steady rolloffs. It was assumed that if the crossover did the best job it could and the driver did the best job it could, then their combined frequency response would be optimal. In fact, that seldom occurred

With computer simulation increasingly used in loudspeaker development, it became possible to predict and optimize the electrical and acoustical behavior of speakers more accurately and in more detail. As this approach evolved, it became obvious that a crossover network's electrical behavior could be tailored to complement a particular driver's acoustical response, at least to some extent. So today, engineers no longer aim for a theoretically perfect crossover response and ignore the driver's acoustical behavior. Instead, modern crossovers are designed with synergy between their electrical properties and drivers' acoustical characteristics. Thus, a speaker's total response is the result of the crossover's electrical traits and the drivers' natural acoustical responses. If, for example, a woofer excels in deep bass output but its upper-bass response sags a little, a crossover can be designed to correct the woofer's acoustical response. Typically, a computer does the grunt work of picking a crossover's general topology—the type of parts and roughly what values are required for each. After that, it's time to build it, measure the response, and listen.

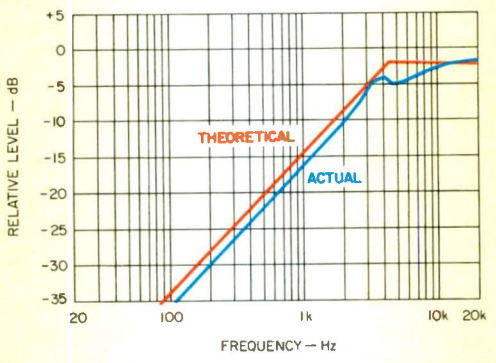


Fig. 2—Frequency response of a theoretical high-pass crossover, and of the actual high-pass filter in Fig. 1 with the tweeter connected.

EQ in Disguise

Okay, so you got the hint. The crossover can be an equalizer in disguise. If you are alarmed that an equalizer has crept into what you thought was your purist high-end system, well, you're right. Offhand, I can't think of a multidriver speaker less than a decade old that wasn't designed this way. It's unavoidable. Any way you try to do it, the crossover's electrical behavior is going to affect the driver's acoustical response. Why not be smart about it?

Even after the drivers are integrated as well as possible, the final stage of any loudspeaker development program is always a period of fine-tuning. No matter how carefully a system is planned on paper, its real-world performance requires a fair amount of tweaking, by ear and by microphone. This is often called "voicing" or "balancing" the system. How is this final tweaking done?

Drivers are almost impossible to modify quickly and repeatably. Moreover, a designer doesn't necessarily know if a change he's made in the lab will be carried over to the production line in the driver factory. And the enclosures take too much time to adjust once they are built; they are certainly not suited to the back-and-forth listening, five-changes-an-hour game. But the crossover is. Changing electrical parts is easy and predictable; the designer can even put a switch on the network to readily compare and decide between options.

So far, we've covered how crossovers slice up the audio spectrum to allocate chunks of it to multiple drivers, how they work electrically with the drivers to help the designer obtain a desired response, and how they are used in the final voicing of the finished system. But crossovers have one additional role that is critical to a speaker's final performance. The crossover's electrical circuits can modify signal delay and phase of the sound in each band so that the drivers' acoustical outputs will combine correctly in the listening room. By judiciously manipulating crossover phase response and properly selecting driver sizes and crossover points, the designer can alter a speaker's radiation pattern. Thus, he can control to some extent such perceptually important factors as imaging and direct-versus-reverberant spectral response.

Crossover Points

Now that we've covered the point of crossovers, let's move on to the crossover point. As you may know, this is the specific frequency at which the musical spectrum is split between drivers. Normally, it is stated as the frequency that is –3 dB (half the power output) for each of the two drivers in question, so that in theory, the two drivers' outputs will sum to produce flat response in the region where they overlap.

What you may not know is that published crossover frequencies are usually only vague approximations. With an actual loudspeaker, stating a precise crossover point tends to involve quite a bit of guesswork. Real-world filter responses zig and zag, and the frequency that is –3 dB for the midrange low-pass filter might fall far from the –3 dB point of the tweeter's high-pass. Combining the drivers' acoustical responses makes this even more complex, since response overlap will vary with the drivers' individual locations on the speaker baffle as well as with listener position. Experienced designers know that the effective response of the crossover, including the crossover points and slopes, is a combined function of the crossover network's electrical response and the drivers' acoustical response.

So designers work to make the system perform properly, then pick a frequency that seems like a reasonable approximation of the effective crossover point to list in the owner's manual or spec sheet. Nevertheless, the published crossover points can be informative. For example, pushing them down can be advantageous sonically, as lower crossover frequencies make wavelengths in the transition region longer and thus less likely to suffer from off-axis aberrations. I like to see a midrange or mid/woofer cross over to the tweeter in the vicinity of 2.5 to 3.5 kHz. A transition from midrange to woofer ideally should be at 250 Hz or below, and from woofer to a true subwoofer at about half that frequency. Avoiding crossovers in the range from 300 Hz to 2 kHz is a good idea, because the ear is very sensitive to anomalies in this region, especially on voice reproduction. On the other hand,

As computer use increased, it became obvious that a crossover could be tailored to complement the response of a driver.

greater power handling is obtained by pushing crossover points upwards. This tends to direct more energy to the larger, more robust drivers. In a system optimized for output power rather than refined sound quality, you will probably find higher crossover frequencies than my choices. Bear in mind that these opinions are generalizations. Every situation is a bit different, and there aren't even any standards for measuring and specifying crossover points.

Slippery Slopes

The second important specification for a crossover is its slope. This parameter, expressed in decibels per octave, indicates how rapid the cutoff is beyond the specified crossover frequency, i.e., how quickly the response is attenuated beyond the crossover point. Typically, the slope is described as first order (6 dB per octave), second order (12 dB per octave), and so forth. Higher-order crossovers, which have steeper slopes, will improve power handling and reduce driver overlap, yielding cleaner polar response. Any driver misbehavior at frequency extremes is also cleaned up. Lower-order crossovers produce more gradual slopes and better transient response. Choose your poison—depending on philosophy, system goals, and driver quality. Some designers are convinced that speakers with first-order crossovers offer sonic benefits that outweigh associated problems with radiation pattern and driver overlap, even though true first-order response is maintained only at frequencies near the crossover point. Other designers espouse very high-order networks and intentionally place crossover coils so that they will interact with each other and thereby achieve ultra-steep slopes, similar to those of tuner IF filters.

Just as with crossover points, however, slopes can be difficult to define accurately. Slope changes with frequency, as a result of the network's interaction with both a driver's impedance and its acoustical response. Many novice designers develop crossovers they believe are, say, first order, only to discover that they actually behave more like second- or third-order systems because of the acoustical slopes of the driver responses. Similarly, a slope may start off quickly yet not provide as much attenuation as expected far from the cutoff point. Fashions come and go, and opinions are often polarized, but over the years, no one approach has proved universally superior in terms of sound quality.

Odd-numbered crossover orders—first, third, fifth, and so on—offer the theoretical benefit of correct, in-phase summation of two drivers' output at the transition frequency. But things in the real world are not so cut and dried. For example, because drivers are located at different positions on the speaker baffle, their outputs can never blend perfectly at all listener locations. The resulting spatial pattern of energy peaks and nulls is called lobing. One partial solution is to place drivers as close together as possible on the speaker baffle—particularly at high-frequency crossover points, where wavelengths are short. Another is to apply more sophisticated filters to the signal, which compensate for the aforementioned acoustical anomalies.

Easily the most well-known advanced crossover technique is the Linkwitz-Riley approach. This method is a means of calculating crossover filter response to optimize the summation of two drivers' on-axis acoustical output while minimizing off-axis errors. Here is Siegfried Linkwitz, of Audio Artistry, Inc., on crossover design:

> In the '70s, it was common practice to place tweeter, midrange and woofer drivers at various locations on the front panel of a loudspeaker. When I asked a speaker manufacturer how they came up with their driver arrangement, I was told that it was based on what sounded best. This somewhat ambiguous design practice led me to investigate the influence of driver positioning and crossover circuitry upon sound radiation. In collaboration with my colleague, Russ Riley of Hewlett-Packard, I eventually came up with the now well-known Linkwitz-Riley crossover. Up to this time, the influence of driver placement and crossover-circuit selection upon the polar radiation pattern of a loudspeaker had not been appreciated.
>
> When you have, for example, a two-way speaker, then there is always a frequency region where you have sound coming to you both from the tweeter and the woofer. Depending upon your listening position, your distance from the tweeter might be different from the distance to the woofer. Such difference causes a relative phase shift between the acoustic waves coming to you from the two drivers and affects how well the two waves add or cancel. In addition, the electrical crossover network introduces phase shift of the amplifier signal going to each driver. Correspondingly, there are also wave cancellations, which could occur at angles not far from the listening axis if the driver spacing is large.
>
> We were looking for a crossover filter function that would give the maximum addition of sound waves from the two drivers when listened to on-axis and where the output would never be larger at any other angle.

Linkwitz's comments touch on many fundamentals of modern crossover design. The art and science of multiway loudspeaker design has progressed far beyond a simplistic division of lows, mids, and highs. Designers must consider both on- and off-axis response if a speaker is to sound properly neutral, which is not a trivial balancing act. Factor in the usual requirements for great stereo imaging, high power handling, and a broad sweet spot, and you begin to see just how crucial a speaker crossover design is in determining the sound you hear. A

A CROSSOVER CASE STUDY

The NHT VT-1.2 is a three-way speaker developed for home theater use. Figure B1 shows the frequency responses of its tweeter, one of its two midranges, its woofer, and the enclosure's port without any crossover in place. It is obvious that while each driver has a good response in its intended region of operation, the midrange driver and the woofer, in particular, have responses that deteriorate beyond their passbands. Also, there is much overlap of spectrum coverage between the drivers. Though quite typical of even the best drivers, these problems would lead to poor imaging, distortion and tonal coloration if they found their way into a finished product.

Figure B2 shows the electrical response of the crossover network developed for the VT-1.2. Crossover points are specified at 120 Hz and 2.2 kHz, with a combination of first- and second-order electrical slopes. These curves attenuate out-of-band information, match the driver output levels, and correct for some minor deviations in driver frequency response (such as a slight bump in the midrange response just below 2 kHz). Not seen, but still important, are the high levels of distortion that would be present if low frequencies reached the midrange drivers and the tweeter.

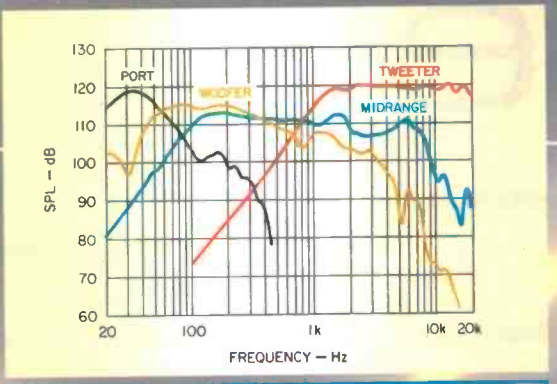


Fig. B1—Near-field frequency responses of the NHT VT-1.2's port and drivers without any crossover in place.

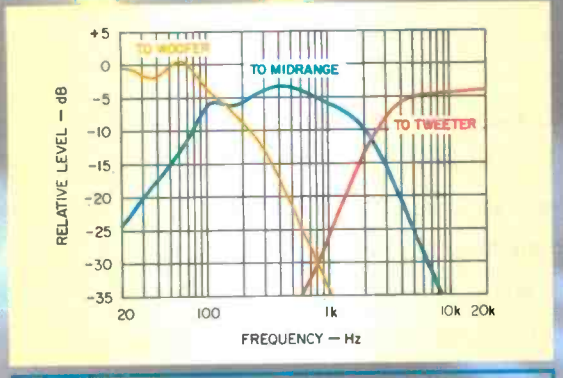


Fig. B2—Electrical response of the crossover network designed for the VT-1.2. The speaker's crossover points are specified at 120 Hz and 2.2 kHz, with first- and second-order electrical slopes, respectively.

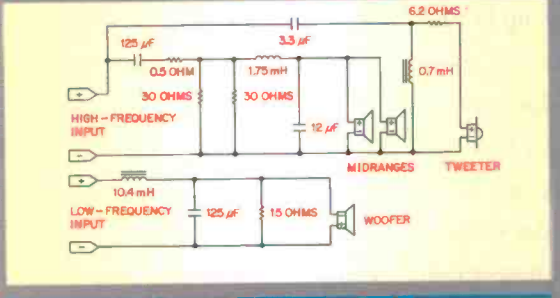


Fig. B3—Electrical circuit used in the VT-1.2's crossover to achieve the desired frequency response. The speaker is biampable, so two sets of input terminals are shown.

Figure B3 illustrates the electrical circuit used to achieve the desired response curves. (Note that this system is biampable, so two sets of input terminals are shown. Also, the woofer is wired out of phase, to compensate acoustically for phase shifts introduced in the various parts of the crossover network; the final output of all drivers will sum in phase.) For a good three-way loudspeaker, this is not a complex network. Among the advantages of working with good raw drivers, ones developed specifically for the application, is that a simpler crossover can be used. This not only saves cost, it also reduces the electrical impedance the audio signal encounters between the amplifier and the drivers, raising sensitivity and improving transient-response damping.

Figure B4 shows the VT-1.2's total system frequency response, measured at 1 meter, in a room. Perfect? No way. But it's a far cry from the raw driver responses, thanks to the crossover. *K.K.*

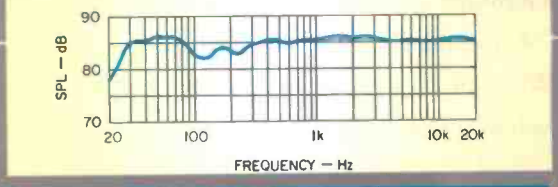


Fig. B4—Total system frequency response of the VT-1.2 speaker, measured at 1 meter in a room.

Peter McGrath

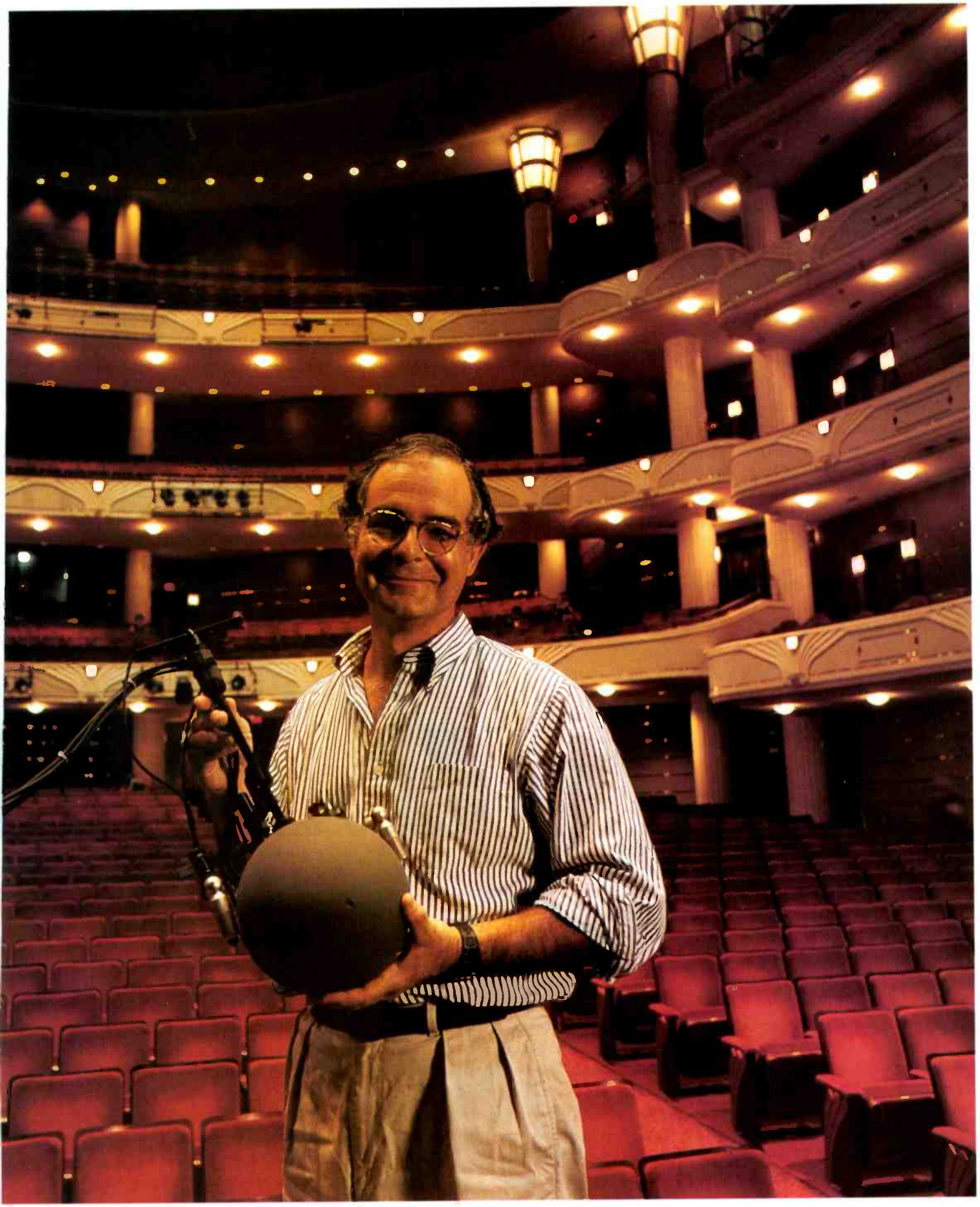
Putting Sound in FOCUS

Peter McGrath has viewed—and heard—the high-fidelity industry from several perspectives. An audio enthusiast for as long as he can remember, he served an apprenticeship in hi-fi equipment retailing during graduate school and then went on to operate his own successful audio store. At the same time, he learned recording engineering, now a focal point of his career, and more recently took on the sales and marketing responsibilities for a loudspeaker company.

Born in 1948, McGrath grew up in Panama, where his paternal grandfather, an American engineer, had been killed while working on the Canal. His father became a successful entrepreneur there, and an uncle rose to the top office of that nation's Roman Catholic church. (McGrath jokingly traces his evangelical zeal to the Archbishop.) Young McGrath attended American schools in the Canal Zone before moving to the United States, where he attended the University of Notre Dame. Later, at the Illinois Institute of Technology in Chicago, he earned an M.S. in photography from the Institute of Design. While in the Windy City, he was intensely involved in the operations of The Audiophile, a veritable crucible of early high-end audio retailing. Then, in the early '70s, after moving to south Florida (where he still lives), he opened his own store, Sound Components. From its sales floor, he preached the high-end gospel to customers in what was then heathen territory.

Not long after arriving in Florida, McGrath began learning the recording engineer's art, and in 1979, he and Julian Kreeger, a Miami attorney with lofty connections in the classical music world, founded Audiofon Records. Along with doing a great deal of local recording for the Florida Philharmonic, the New World Symphony, and others, McGrath has since served as recording engineer for 36 Audiofon projects as well as about 75 for other companies, including nearly 30 for Harmonia Mundi. He recently allied himself with Eggleston Works Loudspeakers, both as a shareholder and as the company's sales manager, where he finds a pleasing artistic symmetry in the fact that he met the speaker designer William Eggleston through the young man's father, also named William, a well-known photographer and longtime audio hobbyist. **D.L.**

by David Lander



PHOTOGRAPH: ©1996, SCHERLEY BUSCH

Mark Levinson was instrumental in getting your recording career started. When was that?

Around 1975 or '76. Mark made it very clear that in order to become a master in the business of music reproduction, to really be an authority in high-end audio, I had to learn the recording side of the equation. He struck an analogy: How can you know if a photograph is a good print unless you know everything involved in the making of the negative and understand the whole chain? I'd always had an interest in becoming involved with musicians and music, and recording seemed to be the best possible way that someone with my background could do that. So in the mid-'70s I started going up to New Haven and was privy to a lot of the recording activities Mark was involved in. I ultimately wound up buying a Stellavox tape recorder. Mark arranged for me to get some B & K microphones and his early microphone preamps and recording equipment. Then I pretty much went off on my own and started using these tools.

Can you relate your approach to recording sound to the stance you took when recording visual images?

In many ways, the approach—which is to use the best possible tools with the least amount of technical intervention—is very similar. The type of photography I was interested in was nonmanipulative, which sometimes meant going to such extremes as printing the black borders of the 35-millimeter frame to show definitively that you'd not even cropped the photograph.

Those borders around photographs have become ubiquitous in magazine and advertising design in recent years. So today's art directors are borrowing something that noncommercial photographers used a long time ago.

They're applying a concept that started a lot earlier with people like Robert Frank, Lee Friedlander, and my teacher, Gary Winogrand, who was a major influence on me. What Gary did was teach a fundamental respect for the power of the medium. Imagine him standing there making the following statement: "I would never presume to think that what goes on in here [and he'd point at his head] could ever be as interesting as what goes on out *there* [and he'd point away from his head]." For him, that was one reason why you don't manipulate an image.

So there you were in Chicago at the Institute of Design, where Bauhaus veterans Mies van der Rohe and the sculptor Moholy-Nagy once taught and where the less-is-more aesthetic remained a cornerstone. School, however, was one of two realms of involvement for you then. Tell us about the other.

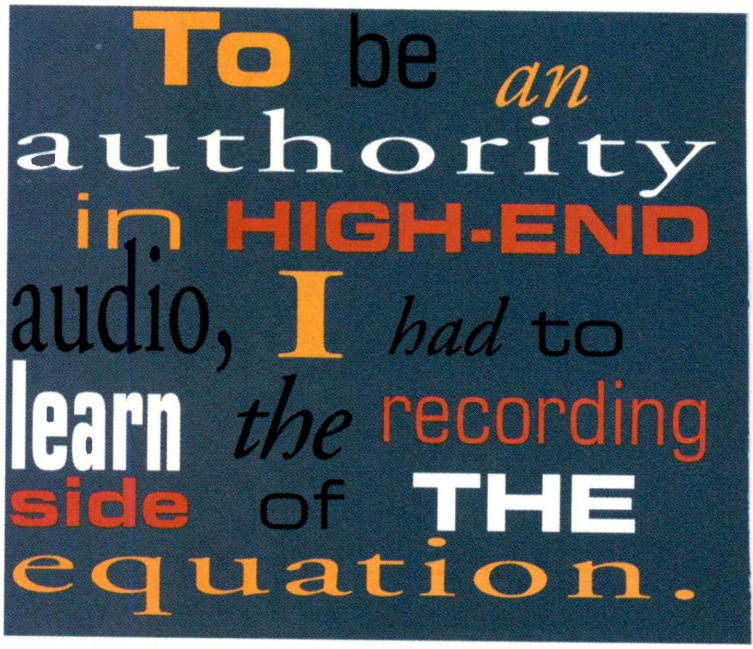
I was working in an audio store, The Audiophile, which was owned by two gentlemen who had doctorates in musicology, Jerry Roberts and David Shooks. What they taught me about audio was that it is meaningless if it doesn't convey you to the world of musical sound.

The Audiophile was a seminal high-end dealership. Where in Chicago was it?

At 8 East Erie Street. It later came to be known as Victor's Stereo, and now it's one of the Audio Consultants stores. To my knowledge we were the first Audio Research dealer—the first to be taken on and the first to be terminated [*laughs*]. We were the first to sell the original Magneplanar Tympani loudspeaker. As a company, we were involved with the distribution of many brands that have since fallen by the wayside but also many that became major staples. For example, we were the first people importing and distributing Linn Sondek turntables and Stax headphones. There were Quad electrostatic loudspeakers, Spendor and Rogers speakers, Decca phono cartridges from England, and Grace cartridges from Japan. It was very much the infancy of high end, a fun time.

After working for The Audiophile from 1969 through 1972, you moved to Miami to complete your master's thesis. Why did you choose Miami?

It was a place I had visited almost every summer as a child, the port of entry for Americans from Panama visiting this country. Coming from a place like Chicago, where the light was generally drab, I fell in love with the constant intensity of the south Florida light. It seemed the logical place. When I came down here, I realized that there was no store even remotely comparable to what I had experienced in Chicago. Through a financial gift from my family, I was able to start one. I opened the business in late '73. I continued photographing, and the business grew.



How did you meet your Audiofon partner, Julian Kreeger?

A guy wandered into my store with something broken, and I didn't want to deal with him because I hadn't sold it [*laughs*]. He turned out to be an attorney, and the more I got to know him, the more I realized he knew everybody in the classical music world. I told him that I really wanted to explore the possibility of more involvement with recording. Julian said it didn't make a lot of sense to put forth all of this effort on local talent when he knew a number of very significant musicians who, for a variety of reasons, were being neglected by recording companies. He thought it would be wonderful to see if we could document what

those musicians were doing, that it might have significant merit. This struck me as a wonderful idea, so we formed a company.

The first artist you worked with was Leonard Shure, an American-born pianist who died in February 1995. He had been a pupil of Artur Schnabel and became his teaching assistant before returning to America after the Nazis came to power. Shure, like Schnabel, did a lot of teaching, and he's said to have been difficult at times. What was he like to record?

Leonard remains in my mind a really extraordinary man, a fabulous musician to work with. My understanding of Beethoven matured while working with him. He has indelibly printed on my mind what great music-making can be.

Many people think that the jewels of the Audiofon catalog are its piano recordings. You've also worked with the pianists Earl Wild, Lazar Berman, Ivan Davis, David Bar-Illan, and Seymour Lipkin.

Seymour Lipkin is now head of the piano program at Juilliard and is having a major revival. He's currently performing the entire Beethoven sonata cycle. We recently released his "Hammerklavier," and many people who have had the opportunity to hear it regard it as one of the better ones on record. And we're currently involved with two absolutely wonderful Russian pianists, 27-year-old Valentina Lisitsa and her husband, Alexei Kuznetsoff.

You've recorded Lisitsa in the Ural Mountains playing Shostakovich with the Ekaterinburg Philharmonic under the legendary Boston Opera conductor Sarah Caldwell. You've recorded her and Kuznetsoff as a duo and have released a pair of solo Lisitsa albums. Her CD covers show a face like Goldie Hawn's. Play the discs, and you hear hands like Glenn Gould's. As someone—Ira Gershwin, I believe—once said about Art Tatum, she should be arrested for speeding.

[*Laughs.*] In the many years that I've had the pleasure of working with pianists, I've never encountered a player quite like this. In four days of recording Valentina and her husband, there was never once a sheet of music in the hall. They were phenomenally well prepared. I've never heard anyone who could pedal, who could get the nuance and color out of the left hand combined with pedal technique quite like she does. She's a relatively small person, yet she seems to be capable of devouring the Steinway. The power and dynamics she can get out of that instrument surpass anything else I've ever experienced, with the single possible exception of Lazar Berman, and you could fit three Valentina Lisitsas inside of him.

What's your ultimate goal in recording?

One of Gary Winogrand's strongest statements was that a really great photograph is one that renders you speechless. What I've strived to achieve in my recordings is the excitement of the event. I'm trying to re-create the emotion and excitement conveyed when someone like Valentina is playing Liszt or of Leonard reaching the Olympian heights of the finale of Beethoven's Opus 110. It's not necessarily the performance I'm trying to re-create but that intellectual and emotional feeling you get when you're really involved in the music. I think it's a tired cliché to say that you're trying to capture the sound of the original event, because it's terribly naive to think there's that much correspondence. One of the most seductive aspects of a photograph is that it's trying to describe reality when, in point of fact, it has little to do with reality.

A photograph is in two dimensions; it may be black and white; it's separated from the context. What becomes obvious is that it has a reality unto itself. Through the photographic process, the artist has created a new reality, which has its own merit. In many ways, one can view the process of making a recording that way. The final product has a life of its own.

Julian Kreeger was the producer on all the recordings in the Audiofon catalog. How does he compare with the other producers you've worked with?

He's not dogmatic. On the contrary, he's very free-spirited. He loves to gamble on the possibility that anything can happen. I've worked with producers who scrutinize and cover every note in a score. With Julian it's sort of free-form. Some of the most magical things you could ever imagine have evolved from this method. I mean, we're making recordings that are really performances. . .

. . .to the extent, in the case of your Valentina Lisitsa solo CDs, that the results are completely unedited. There are also performances on your Leonard Shure recordings that you made in just single takes. How often does that sort of thing happen in the recording world?

I think it's fairly rare unless, of course, the recordings are of live concerts. Even that can be questionable, because there's a lot of touch-up editing with post-concert takes to fill in gaps. Ours are truly recordings that are full performances. The philosophy behind that is to give, in the context of a recording, something that most closely approximates the real concert experience. And I think it engenders in the performer a certain kind of risk-taking that would not happen otherwise.

Let's talk about microphone technique. How do you determine placement?

The methodology is very simple. Julian, the artist, and I come back to my living room—in the old days, we came back to the store—and we listen to all the different experiments in terms of where I positioned the mikes. Then I make a selection that meets my requirements and keeps everyone else happy.

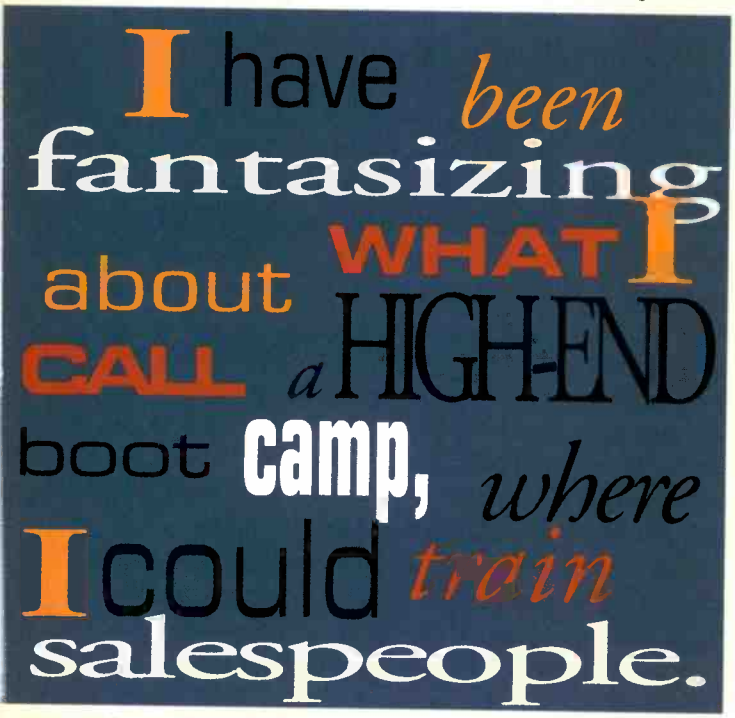
You use one method for recording orchestral music and chamber performances, but you prefer another setup for soloists.

The way I now approach a symphony orchestra evolved out of a specific microphone that really has enabled me to rethink how you can deal with the size, scope, beauty, and dynamics—particularly in a good hall. The mike is the Schoeps KFM-6, which was introduced to me by Jerry Bruck in about 1991. He sent me the prototype after Schoeps sent it to him and he played with it. The KFM-6 is spherical, about the size of a bowling ball, with two omnis in it. I've not been able to get it to work to my ultimate satisfaction on a piano, but, boy, does it do a

job on an orchestra. Incidentally, that was the mike I used to make the first recording of the Anonymous Four for Harmonia Mundi.

Jerry is the Schoeps distributor for the United States.

And also a very, very fine recording engineer. And one of the great teachers, a man of infinite patience. He has been and continues to be one of the great mentors, not only for me but, I would say, for most of the people who consider themselves purist recording engineers.



What mike setup do you use for piano recording?

I'm pretty much sticking to the same miking technique that I developed back in the '70s, a pair of spaced omnis. Back then it was the B & K 4133, later the Schoeps MKII-S. In some of our latest releases, we've gone back to that original B & K microphone, which is still startlingly beautiful. But for orchestral music or concert events involving chamber music, I'm pretty much committed to the KFM-6 with, when necessary, additional mikes. On Harmonia Mundi's Mahler First with the Florida Philharmonic, I used six additional mikes for added detail and color.

Has all your recording been two-channel?

It has been up until very recently, but I've decided, for this entire season, to record the Florida Philharmonic in four-channel. I believe that the time has come. In order to start documenting this orchestra for future technology, I need to do that. Jerry has evolved a technique I have used, one which I believe is the most beautiful way to replicate an acoustical sound field, employing the KFM-6 with a pair of figure-of-eights in what we call a dual M-S [middle-side] matrix. We have one M-S pair looking at the right rear versus right front and another matrix pair looking at the left rear versus left front.

What associated equipment are you using?

A Nagra-D digital recorder with the Prism 24-bit A/D converter or sometimes other converters instead or in addition, whichever makes sense. I use, and have used exclusively, Transparent cable.

You spent more than two decades in audio retailing before leaving it about three years ago. What advice do you have for people interested in getting the best sound for their money?

Be as honest and as straightforward with the dealer as you can. If you have a specific objective, name it. Don't beat around the bush, don't play games. Typically, people are fearful that the dealer is out to take advantage of them. But the minute you start playing games, that invites the dealer to start playing games with you, and no one is served. At its best, buying a stereo system is really buying a passport. It's a doorway into another world. I'm on the boards of both the Florida Philharmonic and the New World Symphony. At one point, most of the Florida Philharmonic board members were former customers of mine. Not that I sold them equipment after they became board members. Rather, their involvement with hi-fi opened the door to music for them. That's the potential this medium has. Right now, hi-fi is the best way to learn about music. Going to concerts is not the experience a lot of people think it should be. I'm not suggesting you give up going to concerts, but many halls are not proper showcases. Either they're too large, have too much mechanical noise, or are filled with discourteous audiences who don't stay quiet. No one knows that more than I do, because on my tapes I've immortalized every hack and cough. I see people cringe when you have the most exquisite trailing cadenza in a Mozart concerto and this tubercular ward lets loose.

What are your plans for the future?

Three things. I'm hoping to further my involvement in the local recording scene. I'm hoping to build the name of Eggleston; I'm dedicated to seeing this speaker company grow. I'm also hoping to spend more time making commercial recordings. I'm open to recording acoustic music for anyone.

At Sound Components you became southern Florida's high-end pioneer. Do you think you might get back into retailing?

At this time I have no desire to get back to retail—although, in traveling around for Eggleston and seeing high-end stores and what I believe is lacking in them, I have been fantasizing about what I call a high-end boot camp, where I could train people. I did it at Sound Components. David Shooks and Jerry Roberts engendered in me the fundamental aesthetic of what hi-fi's about: to create a musical experience. You glean tremendous wealth from these little machines that glow or these transistors that run hot. These boxes may look ugly in your room, but they create this emotional experience. It really is magic.

How much does a person have to spend for magic? Sound Components specialized in very expensive equipment.

During my last years there, we sold just about everything. And there were some awfully good components available in the so-called mid-fi realm that really did make beautiful sounds. A pair of small planar speakers with a high-current receiver is still a sublime musical experience. A

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EQUIPMENT **PROFILE**

EDWARD J. FOSTER

KENWOOD KC-Z1 A/V TUNER/PREAMP

Nothing tickles a jaded reviewer's fancy like an original product, one that points in a new direction and seems certain to be imitated. The Kenwood KC-Z1, alias the Kenwood Stage 3 Controller, is such a seminal product. You could call the KC-Z1 a tuner/preamp because it's certainly that. You could call it a Dolby Pro Logic/THX Home Cinema processor, for it fulfills those functions too. And you could call it a Dolby Digital (AC-3) processor, because it's that as well—with inputs both for the straight digital AC-3 outputs from sources such as DVD and for the RF-modulated AC-3 outputs from laserdisc players.

But what makes the KC-Z1 innovative is its TouchPanel controller, which is 2 inches thick, just under 5 inches high, and 6¾ inches wide. Centered on its front is a 3¼ x 3¾-inch backlit LCD touch screen. When the controller is docked to the KC-Z1, it obscures the main panel's buttons and knob and becomes the system control panel, communicating with the KC-Z1 via five electrical contacts that also keep its internal battery charged. When you remove it, the TouchPanel communicates with the KC-Z1 via radio frequency (RF) rather than infrared signals; as a result, it can control the KC-Z1 from another room—within a 100-foot range, according to Kenwood. What's more, the RF communication is two-way, so the TouchPanel's display always shows the KC-Z1's operating status, even if you've changed that status from the front panel.

NOTHING TICKLES A REVIEWER'S FANCY LIKE A PRODUCT THAT POINTS IN A NEW DIRECTION.

Removing the TouchPanel leaves a front panel with basic controls for setting volume, selecting a source, muting, and turning the KC-Z1 on and off. In fact, there are two on/off switches: "Remote Power" toggles between "Standby" (which lets you turn the KC-Z1 on from the TouchPanel) and "On"; "Main Power" turns the Kenwood off completely. At the lower right, under an overhang, are four LEDs: a two-color (red/green) "Battery Charge" indicator for the TouchPanel, a green indicator that lights when a Dolby Digital signal is present, a "THX" indicator that does likewise when Home THX enhancement has been chosen, and a "REF/Peak Level" indicator that flashes green when a source's output level attains THX or Dolby reference level and flashes red when a signal overloads the controller's input circuitry.

The front panel also has a "Page" button that beeps the TouchPanel to help you find it if it's mislaid. That's more important than you might think, because you really need the TouchPanel for full control. It alone enables you to operate the tuner, set sound modes (tone controls, surround, and a good bit more, as we'll see later), and select signals for recording. It can be used as a universal remote to control virtually any audio or video component, and it can set up commands to be carried out at programmed times.

Photo: Bill Kouirinis

Volume and muting are controlled by three mechanical buttons on the TouchPanel's case; everything else is controlled by touching different areas of its LCD screen. When you first insert the TouchPanel's

Dimensions: 17⅜ in. W x 6¼ in. H x 17⅜ in. D (44 cm x 15.9 cm x 44 cm).
Weight: 27 lbs. (12.2 kg).
Price: $2,800.
Company Address: 2201 East Dominguez St., Long Beach, Cal. 90801; 800/536-9663; http://www.kenwoodusa.com
For literature, circle No. 90

Photos: Michael Groen

WITH MORE THAN 70 REAR-PANEL CONNECTORS, THE KC-Z1 LOOKS READY FOR ANYTHING.

rechargeable battery, you must calibrate the screen to ensure that the touch points map properly. This is done by touching targets that move around the screen. Once the screen is mapped, you're off and running.

At the bottom of the TouchPanel's screen are five permanent icons: "Power" turns the KC-Z1 on and off, "Main" lets you listen to and control all components in your system, "Sound" gives you control over the way the system sounds, "Presets" enables you to save multiple control settings for instant recall, and "Help" tells you how the TouchPanel's pads work in its different screens.

The "Main" menu displays icons for every component in your audio or A/V system. To choose a program source, you simply touch its icon. The icon for the active source has a dark background; the other icons' backgrounds are light. Touchpads at the right of the screen access various submenus: "Speaker VOL." for multiroom systems, "Tape 2 Monitor," "Accessories" (for activating up to six accessory devices, such as fans or lights, via learned infrared codes), "Alarm Set" (to activate system presets at times you select), "Setup," and "Record." Some of these submenus are single-layered; others are nested deeply.

With the "Setup" menu's "System" submenu, you can set the system clock, get a tutorial of system operations, enter security codes so that no one can tamper with your settings, adjust screen contrast, recalibrate the touch screen, and change the frequency of the RF link between the KC-Z1 and the TouchPanel if there's interference. You can also select how quickly the TouchPanel's battery-saver will turn off the LCD display and how often the KC-Z1 sends status updates to the panel.

You use the "Component" submenu to add and remove program sources from the system. It brings up 11 icons, one for each source input. The icons for components that you've told the KC-Z1 you're going to use have dark backgrounds; the unused ones have light backgrounds. Touching an icon puts that source in the accepted list (so it will appear on the "Main" screen). You can then set that source's input level (from 0 to –6 dB) and set up the TouchPanel to control it.

Kenwood components that are compatible with the company's SL16 control system can be set up with a single touch; for other remote-controllable components, you use an on-screen keypad to enter a control code from a seven-page list in the KC-Z1's clearly written owner's manual. (The manual is in two volumes, one for setup and the other for operation.) After that, you can control the selected component from the TouchPanel. The KC-Z1 will send the appropriate control signals to Kenwood SL16 components via "System Control" jacks on the KC-Z1's rear panel and send infrared signals to other components via repeaters that you can position facing the components you want to control. One repeater is supplied with the KC-Z1; the rear panel has connections for two more.

The "Sound" pad on the "Setup" menu displays a diagram of a home theater system: a TV screen, a viewer, and five speakers plus a subwoofer. Active speakers are indicated by a dark background and inactive speakers by a light background. Touching a speaker icon calls up a submenu with which you can set its level (the test-tone generator is controlled from this submenu) and delay. All but the left and right front speaker menus carry "Speaker Size" pads. The menus for center and surround speakers

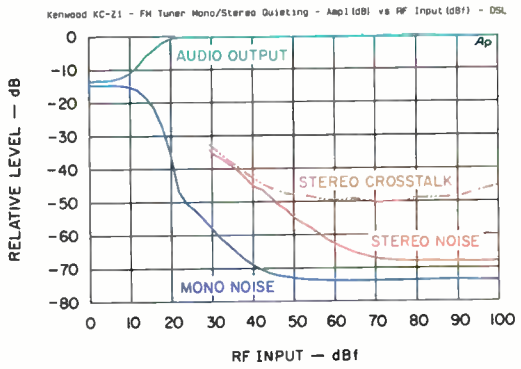


Fig. 1—Quieting characteristics and separation, FM tuner section.

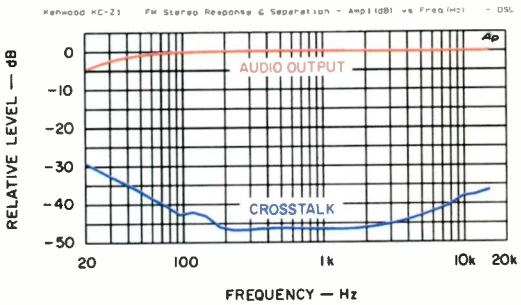


Fig. 2—Frequency response and crosstalk, FM tuner.

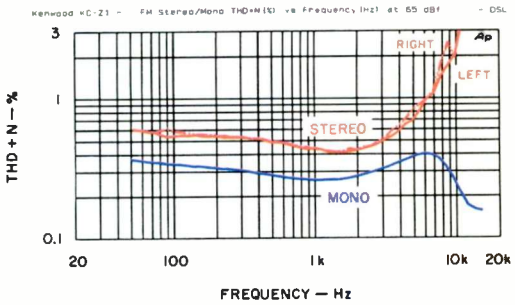


Fig. 3—THD + N vs. frequency, FM tuner.

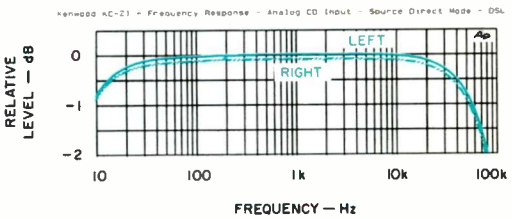


Fig. 4—Frequency response from CD analog input in "Source Direct" mode.

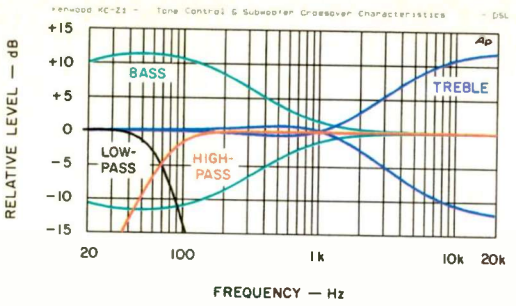


Fig. 5—Tone-control range and response of subwoofer crossover.

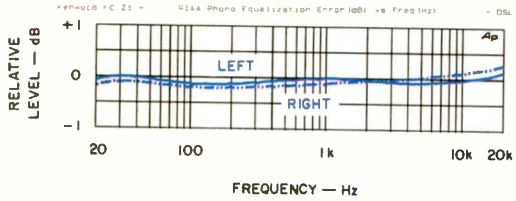


Fig. 6—RIAA phono equalization accuracy.

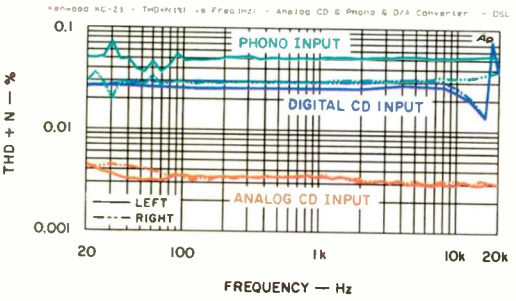


Fig. 7—THD + N vs. frequency.

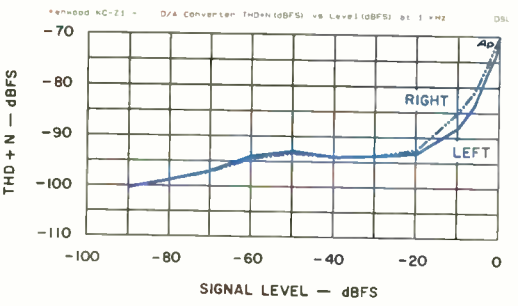


Fig. 8—THD + N vs. level, D/A converter section.

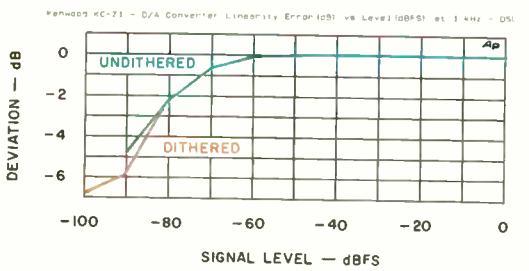


Fig. 9—Deviation from linearity, D/A converter.

offer a choice of "None," "Small/THX," or "Normal"; the "Subwoofer" menu choices are "Normal" and "None." Accompanying the diagram on the "Sound Setup" menu's first level are controls for the KC-Z1's DSP acoustical ambience simulations: "Wall" (with a choice of soft, medium, or hard simulated wall textures), "Room Size" (small, medium, or large), and a five-step "Effect Level" adjustment.

Pressing the printed "Sound" touch point, at the bottom of the "Main" screen, brings up another system diagram. This one has controls for mode selection ("Source Direct," stereo, mono, Dolby 3 Stereo, Dolby AC-3, and Dolby Pro Logic) and processing options ("THX Cinema," "DSP Logic," or "None"). In each mode, the system diagram shows the currently active speakers as solid boxes with shadowed outlines and the inactive speakers as boxes with broken lines. From this screen you can set each speaker's level and delay, turn a subwoofer-channel bass limiter on and off, and set the allowable peak level at a point that won't overload your subwoofer. Another submenu lets you choose analog, digital coaxial, digital optical, or RF inputs but only where appropriate—"RF," for example, is an option only for the laserdisc input.

Also on the "Sound" menu are pads to operate the bass and treble controls and adjust DSP settings. A "Midnight" submenu lets you turn on medium or high dynamic compression for late-night listening; in Dolby Digital mode it offers "Dialog Normalization," which keeps dialog (but not music and sound effects) at a constant level from disc to disc.

When you select a remote-controllable program source from the "Main" menu, the TouchPanel's screen displays appropriate controls, including track selectors for CD, tuning pads for the built-in tuner, and an alphanumeric pad for entering station frequencies or disc titles. Because the TouchPanel's graphics vary with the program source, you see only the controls you need. That, to me, is its essential beauty.

The TouchPanel's two potential problems, that you might lose its vital control capabilities by misplacing it or that its batteries might discharge, are solved on the KC-Z1's front panel by the "Page" locator and a compartment that houses and charges a spare battery. A "Battery Charge" LED to the left of the charging compartment glows red when a battery is charging and green when it's fully charged.

The TouchPanel detaches for use as a remote.

THE ESSENTIAL BEAUTY OF THE TOUCHPANEL MENUS IS THAT THEY SHOW ONLY THE CONTROLS YOU NEED.

You may well need that extra battery. Although a full charge is supposed to last for 4 or 5 hours of continuous use (longer in normal use), with the LCD display "sleeping" when not needed, the battery does run down if you leave the TouchPanel undocked for long periods of time. The battery is a Duracell DR-17 that can be recharged about 250 times; recharging takes 2 to 4 hours.

At the lower left of the KC-Z1's main panel, next to the "Main Power" switch, is a small panel that slides open to reveal the "Video 3" input's S-video connector and gold-plated composite-video and audio RCA jacks. All other connections are on the rear panel. The 70-odd analog and digital connectors here reflect the KC-Z1's capabilities. There are 10 sets of analog inputs alone, not to mention the "Video 3" connectors on the front and the built-in tuner. That should be sufficient to satisfy the

wishes of the most enthusiastic audio/video aficionado.

There are analog audio recording outputs for two tape decks, a MiniDisc deck, and "Video 1" and "Video 2," so you can record with as many as three audio decks and two video decks, depending on what you've selected from the TouchPanel.

The laserdisc input and all three video inputs have composite and S-video jacks, as do the "Video 1" and "Video 2" recording outputs and the output for a video monitor. The TV, "Cable/SAT," and CD inputs have just audio and composite-video jacks. The provision of video for the CD input is perhaps in anticipation of DVD players, which will also reproduce audio CDs. One might argue that an S-video input is at least as appropriate for a DVD player and a DBS receiver as for a VCR or laserdisc player.

The laserdisc input has three "AC-3" connectors for Dolby Digital Surround. One jack accepts the raw RF signals from the AC-3 outputs on laserdisc players. The other two, one optical and one coaxial, will accept ordinary stereo PCM signals or Dolby Digital bitstreams from sources that supply the bitstream directly, such as DVD players. This arrangement lets the laserdisc input serve as an S-video-equipped DVD connection. Dolby Digital signals from a cable or satellite decoder are expected to be in digital form and enter via the AC-3 "Cable/SAT" coaxial or optical connector. Coaxial and optical digital connections for the CD input and for the MiniDisc input and recording output are also provided.

The coaxial digital inputs and eight output RCAs (six for home theater plus a pair to send audio to a second room) on the back panel are gold-plated; the rest are base metal. In addition to the six output RCAs, a DB-25 connector can be used to feed all six channels to a similarly equipped multichannel power amp through a single cable. Rounding out the complement are the two SL16 "System Control" jacks, connectors for the three infrared repeaters, wire clamps for an AM antenna, an F connector for a 75-ohm FM antenna, and three switched convenience outlets (200 watts maximum total power).

Measurements

I've stopped expecting great performance from the FM tuner sections of A/V receivers and tuner/preamps; since the yen soared, tuner sections have hit the skids. So, by current standards, the KC-Z1's tuner is comparatively good in most respects.

As Fig. 1 reveals, the FM tuner section's 50-dB-quieting sensitivity (23.8 dBf in mono, 44.4 dBf in stereo) is par for the course today, even though tuners were routinely 6 dB more sensitive a few years back. Ultimate quieting is admirable, almost 74 dB in mono and better than 68 dB in stereo with a signal strength of 75 dBf or more. Both of these measurements (and the noise plots of Fig. 1) were taken on an unweighted, albeit band-limited, basis.

As you can see in Fig. 2, channel separation (about 38 dB or more over the important audio range) is good, too, but FM frequency response droops substantially in the bass (–1 dB at 50 Hz, –2.5 dB at 30 Hz, and about –4.75 dB at 20 Hz).

Total harmonic distortion plus noise (THD + N, Fig. 3) is probably somewhat better than average for today's tuner sections, though I can remember when 0.25% distortion at 1 kHz in mono (almost twice that in stereo) was nothing to write home about.

Capture ratio (see "Measured Data") was good, and selectivity was reasonably decent, which suggests that the KC-Z1 will acquit itself well in the presence of multipath. Had the AM rejection been better than 35.9 dB, however, I'd feel a lot more confident of that assertion. Image rejection was rather poor, which probably won't concern you much unless you live near an airport. Stereo FM pilot and subcarrier rejection were okay but no great shakes.

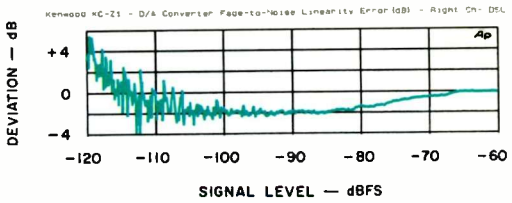


Fig. 10—Fade-to-noise test, D/A converter.

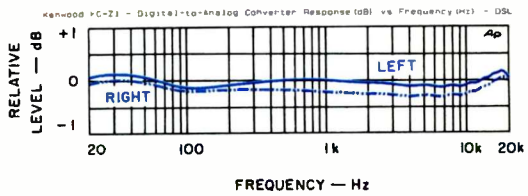
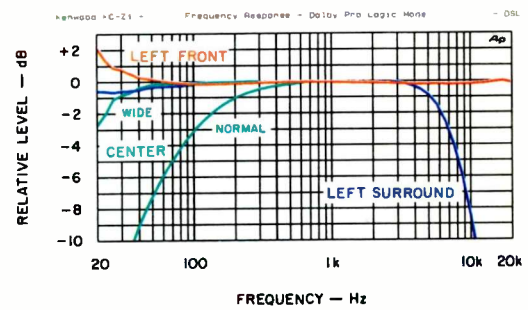


Fig. 11—Frequency response, D/A converter.



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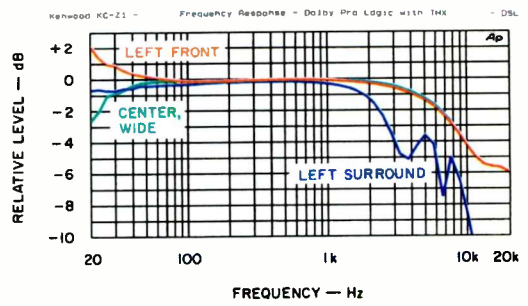


B

Fig. 12—Frequency response in Dolby Pro Logic mode (A) and with THX Cinema enhancement (B).

Turning to the preamp section's analog inputs, I measured frequency response through the analog CD input in "Source Direct" mode and also in regular mode. Figure 4 shows the Kenwood's response only in "Source Direct." (There was little difference with the tone controls engaged and set to "Flat.") The response is +0, –0.25 dB from 20 Hz to 20 kHz (within the limits of measurement error), and the –3 dB points are below 10 Hz and at about 100 kHz. Fine performance!

Figure 5 illustrates the integral subwoofer crossover's characteristics and the maximum range of the bass and treble controls. The tone controls shelve the bass below about 150 Hz and the treble above 10 kHz. Their ranges are symmetrical, just over ±10 dB at 100 Hz and 10 kHz. The subwoofer crossovers occur close to the

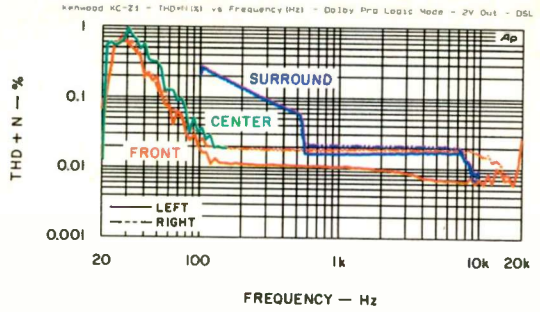


Fig. 13—THD + N vs. frequency, Dolby Pro Logic mode.

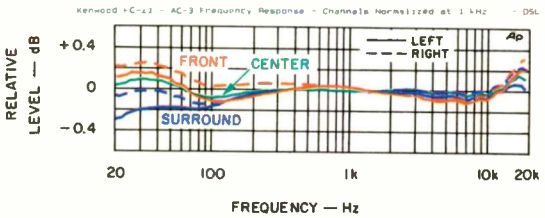


Fig. 14—Frequency response, Dolby Digital mode.

Home THX-specified frequencies and have the THX-required slopes, 12 dB/octave on the high-pass filter and 24 dB/octave on the low-pass.

The KC-Z1's RIAA phono equalization error (Fig. 6) is fairly small; phono response fits within a 0.5-dB window. However, the phono input impedance could not be modeled by a classic parallel combination of resistance and capacitance, which could affect a cartridge's frequency response. Sensitivity was fine for a moving-magnet cartridge, and S/N for this input (and for the analog CD input) was very good.

On the downside, the phono and CD analog inputs overloaded at precariously low levels. The overload point varied with volume setting, abruptly tripling as I lowered the volume setting from +7 to +6. Because overload determines the maximum output level available from these inputs, I omitted output voltage at clipping from "Measured Data." (However, the KC-Z1 can deliver more than adequate output to drive any power amplifier to distraction!)

The KC-Z1's THD + N at 2 volts out and 12 dB of voltage gain (Fig. 7) is less than 0.005% across the band for the CD analog input. It's less than 0.075% (probably more noise than distortion) for the MM phono input. Third-octave noise spectra (not shown) seemed fairly ordinary; the noise rose at 3 dB/octave (modified by the RIAA equalization in the phono spectrum) over most of the audio band. There were a few power-line related components, mainly at 60 and 180 Hz. A trace of power-supply hum appeared at 120 Hz in the CD plot, but it was negligible.

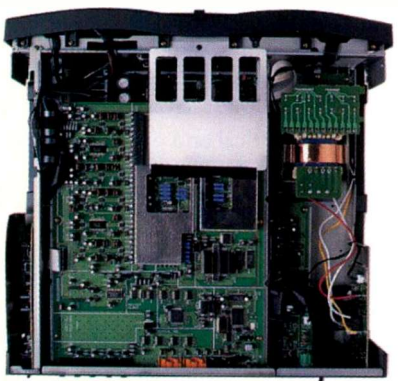
The THD + N plots in Fig. 7 also include measurements made on the main-channel D/A converters for signals from the digital CD input. I was surprised to find the D/A converter distortion so high. The numbers themselves aren't all that bad (less than 0.074% from 20 Hz to 20 kHz), but that's about 20 times worse than the performance of the KC-Z1's analog circuitry and far worse than is typical of today's DACs. The DAC's THD + N versus level at 1 kHz (Fig. 8) tells a similar story. Distortion over the top 10 dB of the range is much worse than normal, which forced me to use an expanded vertical scale to accommodate the data. As the graph indicates, however, distortion is pretty low from –20 dBFS down.

The DAC's 1-kHz linearity curves (Fig. 9) are likewise reminiscent of bygone days. Again, I had to expand the vertical scale to accommodate the converter's substantial low-level nonlinearity (almost 5 dB at –90 dBFS and almost 7 dB at –100 dBFS). Based on this data, I expected the results for the fade-to-noise test would be quite poor; strangely, however, they're quite good. Figure 10 shows the plot taken on the right channel; the left was a trifle better. I repeated the linearity and fade tests several times and came up with consistent results, but I'm at a loss to explain why such similar tests yield such different data.

The frequency response of the DAC and its attendant circuitry (Fig. 11) is not dead flat, as such curves usually are these days, but it's reasonably good. Worst case, it's +0.26, –0.11 dB from 20 Hz to 20 kHz.

The DAC's A-weighted noise was a low –107 dBFS. Spectrum analysis revealed no sign of sampling-frequency leakage and extremely low power-line-related hum. Quantization noise (more important than A-weighted noise) and dynamic range (measured in accordance with EIAJ standards) were also admirable. Channel separation was decent (better than 55 dB) but about 10 dB poorer than separation for the analog CD input.

Frequency response for the KC-Z1's Dolby Pro Logic decoder section is shown in Fig. 12: Fig. 12A is for plain-vanilla Pro Logic, while Fig. 12B was made with the Kenwood's THX Cinema enhancement. (I omitted the "Center, Normal" curve in Fig. 12B because it adds nothing to the curve in Fig. 12A.) On the whole, the response curves are exemplary. Center response in the "Wide" (full-bandwidth) mode droops a couple of dB at 20 Hz, but this is counteracted by a rise in main-channel response at this point. Apparently there's some crossfeed from the center to the main channels



ROB ROY'S OUTDOOR SOUNDS WERE GREAT IN PRO LOGIC BUT SPECTACULAR IN DOLBY DIGITAL.

in the low bass even when using what Kenwood labels the "Normal" speaker setting (i.e., a full-size speaker) for the center and surround channels. (What's now called "Normal" used to be called "Center Wide," meaning wide bandwidth). Because of the shift from center to main in the deep bass, in "Measured Data" I included the response in these channels from 35 Hz to 20 kHz rather than from 20 Hz. With a "Small/THX" center speaker (a mode more typically referred to as "Center Normal"), the center channel's –3 dB point was near the 100-Hz target.

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MEASURED DATA

PREAMP SECTION

THD + N at 2 V Output, 20 Hz to 20 kHz: CD input, less than 0.0046%; MM phono input, less than 0.0733%.

Output Impedance: 150 ohms.

Frequency Response: Tone controls bypassed, 20 Hz to 20 kHz, +0, –0.27 dB (–3 dB below 10 Hz and at 103 kHz); tone controls at detent, 20 Hz to 20 kHz, +0, –0.25 dB (–3 dB below 10 Hz and at 98.2 kHz).

Tone-Control Range: Bass, +10.7 and –10.9 dB at 100 Hz; treble, +10.6 and –10.8 dB at 10 kHz.

Subwoofer Crossover: High-pass, –3 dB at 82 Hz and –6 dB at 62 Hz (nominal 12-dB/octave slope); low-pass, –3 dB at 66 Hz and –6 dB at 81 Hz (nominal 24-dB/octave slope).

RIAA Equalization Error, 20 Hz to 20 kHz: +0.4, –0.11 dB.

Sensitivity for 0.5 V Output: CD input, 108 mV; MM phono input, 1.27 mV at 0-dB attenuation and 2.53 mV at –6 dB attenuation.

A-Weighted S/N re 0.5 V Output: CD input, 97.7 dB; MM phono input, 85 dB.

Input Impedance: CD input, 47 kilohms; MM phono input, 48 kilohms resistive (see text).

Input Overload (1% THD at 1 kHz): CD input, 2.24 V for volume settings of +7 or above and 6.75 V for settings below +6; MM phono input with 0-dB attenuation, 26.8 mV for volume settings of +7 or above and 80.5 mV for settings below +6; MM phono input with 6-dB attenuation, 130 mV for volume settings at or below +6 and 42 mV for setting of +16.

Channel Separation: Greater than 64.7 dB, 100 Hz to 10 kHz.

Channel Balance: ±0.04 dB, "Source Direct" mode.

Recording Output Level: CD input, 490 mV for 0.5 V input; MM phono input, 410 mV for 5 mV input at 1 kHz; FM tuner, 560 mV for 100% modulation at 1 kHz.

Recording Output Impedance: 405 ohms.

FM TUNER SECTION

50-dB Quieting Sensitivity: Mono, 23.8 dBf; stereo, 44.4 dBf.

S/N Ratio at 65-dBf RF Input: Mono, 73.4 dB; stereo, 65.5 dB.

Stereo Frequency Response: 20 Hz to 15 kHz, +0.18, –4.77 dB.

Channel Balance: ±0.03 dB.

Channel Separation, 100 Hz to 10 kHz: Left to right, greater than 38.2 dB; right to left, greater than 37.9 dB.

THD + N at 65 dBf for 100% Modulation: Mono, 0.35% at 100 Hz, 0.26% at 1 kHz, and 0.4% at 6 kHz; stereo, 0.57% at 100 Hz, 0.44% at 1 kHz, and 0.97% at 6 kHz.

Capture Ratio at 45 dBf: 1.0 dB.

Selectivity: Adjacent-channel, 3 dB; alternate-channel, 56.8 dB.

Image Rejection: 53.7 dB.

AM Rejection: 35.9 dB.

Stereo Pilot Rejection: 33.6 dB.

Stereo Subcarrier Rejection: 49.4 dB.

DOLBY PRO LOGIC MODE

THD + N at 2 V Output, 100 Hz to 20 kHz: Main channels, less than 0.028%; center channel, less than 0.032%; surround channel, less than 0.27%.

Frequency Response: Main channels, 35 Hz to 20 kHz, +0.6, –0.14 dB (–3 dB below 10 Hz and at 23.05 kHz); center channel, "Wide" mode, 35 Hz to 20 kHz, +0.08, –0.7 dB (–3 dB below 10 Hz and at 23.05 kHz); center channel, "Normal" mode, 104 Hz to 23.05 kHz, +0.09, –3 dB; surround channel, below 10 Hz to 6.9 kHz, +0, –3 dB.

A-Weighted Noise: Main channels, –92.3 dBV; center channel, "Wide" mode, –96.8 dBV; surround channel, –97.8 dBV.

Channel Separation at 1 kHz: 59.3 dB or greater.

DOLBY DIGITAL (AC-3) MODE

Channel Balance: 0.47 dB or better.

Frequency Response, 20 Hz to 19 kHz: Main channels, +0.28, –0.11 dB; center channel, +0.17, –0.09 dB; surround channels, +0.23, –0.14 dB.

THD + N at 0 dBFS: Main channels, 0.061% at 1 kHz; center channel, 0.068% at 1 kHz; surround channels, 0.072% at 1 kHz; LFE channel, 11.4% at 30 Hz (see text).

Channel Separation at 1 kHz: Between main channels, 73.6 dB or greater; all other channel combinations, 84.5 dB or greater.

D/A CONVERTER SECTION

Frequency Response: 20 Hz to 20 kHz, +0.26, –0.11 dB.

THD + N at 0 dBFS: Less than 0.074%, 20 Hz to 20 kHz.

THD + N at 1 kHz: Below –71 dBFS from 0 to –90 dBFS and below –93.1 dBFS from –30 to –90 dBFS.

Maximum Linearity Error: Undithered signal, 4.9 dB to –90 dBFS; dithered signal, 6.9 dB to –100 dBFS.

A-Weighted S/N: 107 dB re 0 dBFS for infinity-zero signal.

Quantization Noise: –91.7 dBFS.

Dynamic Range: Unweighted, 93.9 dB; A-weighted, 95.4 dB.

Channel Separation: Greater than 55.6 dB, 125 Hz to 16 kHz.

The KC-Z1's THD + N versus frequency with Dolby Pro Logic (Fig. 13) is very good, as these things go. In the front channels, distortion maxes out at about 0.03% over the range from 100 Hz to 20 kHz. In the surround channel, it's barely more than that from 600 Hz to 7 kHz and remains less than 0.27% down to 100 Hz.

The A-weighted noise was excellent in Dolby Pro Logic mode, around –97 dBV in the center and surround channels and, oddly, a bit worse (–92.3 dBV) in the main channels. Separation at 1 kHz ranged from 59.3 dB (surround to right front) to 87 dB between center and surround. Overall, it averaged nearly 65 dB, which is first-rate.

I measured Dolby Digital Surround operation with a Yamaha CDV-W901 laserdisc player and the Dolby Labs test disc. The response curves are shown in Fig. 14. Worst case, they're within +0.23, –0.11 dB from 20 Hz to beyond 19 kHz. All channel levels matched within 0.5 dB, which is fairly good.

Continued on page 53

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EQUIPMENT PROFILE

EDWARD M. LONG

M&K SOUND MX-150THX POWERED SUBWOOFER

Subwoofers are certainly not new, but the growth of home theater has made them almost a necessity. The high levels of low-frequency energy prevalent in movie soundtracks require loudspeakers that can move large volumes of air to produce powerful bass. To accomplish this formidable task, a woofer must have a large radiating area, long excursion, or both. Because surround requires at least four or five loudspeaker systems, the trend is to use small satellite speakers, which usually have limited low-frequency capability, along with a subwoofer to help reproduce the low bass.

Miller & Kreisel Sound, more familiarly known as M&K, began making subwoofers back in 1974. It all started when Walter Becker, of the musical group Steely Dan, and recording engineer Roger Nichols went to Jonas Miller's Beverly Hills hi-fi store and asked Ken Kreisel to design speakers for their recording studio. The system he developed included a subwoofer, the BE-1, fed from an external 12-dB/octave crossover. Jonas Miller's store carried Quad electrostatic and Magneplanar dipolar loudspeakers, which sounded excellent but lacked solid bass. The BE-1 subwoofer added the missing bass and helped Miller (the "M" of M&K) sell so many of the panel speaker systems that other Quad and Magneplanar dealers soon started carrying the BE-1. Almost 23 years later, M&K still makes subwoofers, as well as a variety of small satellite speakers.

The MX-150THX was designed to reproduce sounds below 80 Hz, and it meets the Home THX standards set out by Lucasfilm. Like all current M&K subwoofers, it has a built-in amplifier. This amp is rated at 150 watts, and its p.c. board is attached to an input plate at the rear of the subwoofer enclosure. The amplifier's heat sink is on the outside of the plate; it measures 5½ x 5½ inches and has thirteen 2-inch-deep fins. The power transformer and power-supply board are on the inside of the sealed enclosure's rear panel. The amp's rated input impedance is 15 kilohms, high enough for two MX-150THX subwoofers to be connected to the same output of a preamp or surround processor.

The MX-150THX houses two 12-inch woofers, with roughly the same effective cone area as a single 15-inch driver. One woofer is mounted conventionally, behind the cabinet's front panel, but the other is below and outside the enclosure, facing up into it. The bottom of the enclosure's sealed section is raised about 6 inches to keep this driver's frame and magnet off the floor. An 11½ x 4-inch opening on the enclosure's lower front enables the sound from the bottom woofer to blend with that of the front woofer. With one driver facing into the chamber and the other facing out, the woofers can operate push-pull: Their cones move together, either away from the sealed chamber or in toward it. With the woofers' voice coils moving in opposite directions, any distortions caused by nonlinearities in the drivers' motors tend to cancel out.

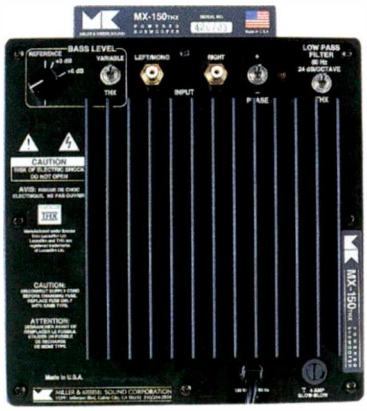
Rated Room Response: 20 to 125 Hz, ±3 dB.
Dimensions: 15¼ in. W x 23 in. H x 19⅜ in. D (38.7 cm x 58.4 cm x 49.8 cm).
Weight: 74 lbs. (33.6 kg).
Price: $1,195.
Company Address: 10391 Jefferson Blvd., Culver City, Cal. 90232; 310/204-2854; fax, 310/202-8782.
For literature, circle No. 91

Photos: Len LaGrua

The sealed chamber is filled with a Dacron-like material; a wire screen keeps it from pressing against the cone of the bottom driver. Four small feet are on the bottom of the cabinet, and M&K supplies four threaded spikes that can be screwed into sockets to couple the subwoofer more tightly to carpeted floors. The removable grille, covered with a black stretch cloth, has four pins that mate with sockets on the front of the cabinet.

The rear plate has three toggle switches, gold-plated left and right input phono jacks, and a variable level control.

The variable level control has markings for "Reference," +3 dB, and +6 dB. The "Reference" position refers to the sensitivity required by Lucasfilm's Home THX specification. I found that a simpler way to set that



THE BUILT-IN AMP'S HIGH IMPEDANCE LETS YOU CONNECT TWO MX-150THX SUBS TO THE SAME OUTPUT.

level is to flick the adjacent toggle switch from "Variable" to "THX," which bypasses the control and fixes the input at the THX sensitivity.

A "Phase" switch can be used to invert the subwoofer's output polarity to help the MX-150THX's sound blend better with that of your other speakers. I'd prefer to see this switch marked "Polarity," because phase is frequency-dependent whereas polarity is not; the switch makes the whole range of bass frequencies either positive or negative.

The last toggle switch activates an 80-Hz, 24-dB/octave, low-pass filter or, in the "THX" position, bypasses this filter, sending the input directly to the subwoofer's internal amp. The "THX" position should be used when you have a surround processor that has a THX subwoofer output, which will include the necessary 80-Hz filter.

Because the MX-150THX is designed specifically to the Home THX specification, the cutoff frequency of its low-pass filter is not variable. However, it can be used with satellite speakers that roll off naturally at 12 dB/octave below 80 Hz; M&K makes some that do. For use with speakers that lack this rolloff and with processors that don't incorporate high-pass crossover filters, the company makes two versions of a passive, high-impedance, 12-dB/octave, 80-Hz high-pass filter, the two-channel HP-80-2 ($175) and the three-channel HP-80-3 ($195). Another optional accessory, the RM-1 remote level control ($50), enables you to vary the subwoofer's output from your listening position. The instructions supplied with the MX-150THX, the HP-80 filters, and the RM-1 remote are clearly written, and the wiring diagrams are easy to follow.

Measurements

I always have a listening panel audition the audio equipment I review. But before I bring the panel in, I make a series of tests to verify that the component is operating properly and to enable me to correlate the panel members' comments from the listening sessions with the component's measured performance.

I made the tests for Figs. 1 through 5 outdoors, with a B&K 4133 condenser microphone on the ground and 1 meter from the front of the M&K MX-150THX subwoofer. The test for Fig. 6, which measured only electrical responses, was made in my lab.

Figure 1 shows the M&K subwoofer's output with its filter switch in the low-pass and "THX" positions. The "THX" curve, made without a low-pass filter, reveals a rising response from about 70 Hz to a little above 200 Hz. This rising response probably accounts for the fact that the subwoofer's internal 24-dB/octave, 80-Hz low-pass filter rolls the acoustical output off at only about 18 dB/octave above 80 to 100 Hz. This is still a steep rate of attenuation, however, and the panel members made no comments indicating that they could localize sound from the MX-150THX.

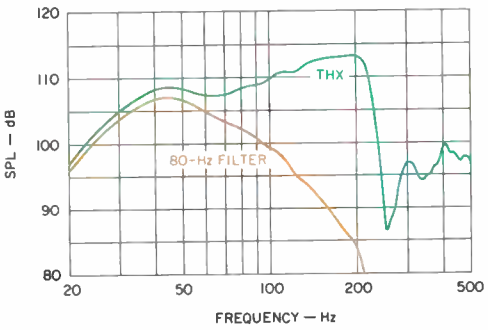


Fig. 1—Frequency response, 80-Hz low-pass filter disabled ("THX" mode) and enabled.

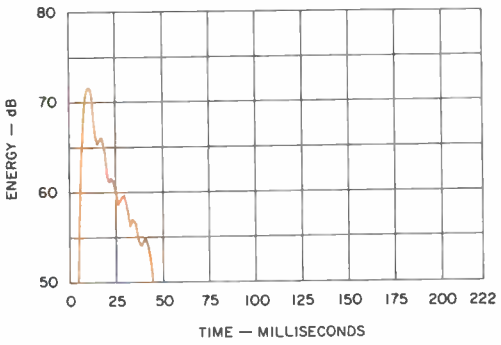


Fig. 2—Energy-time curve, low-pass filter enabled.

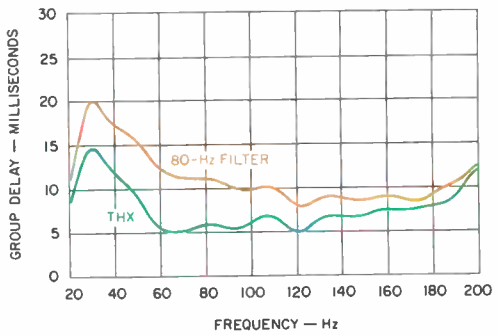


Fig. 3—Group delay, low-pass filter disabled ("THX" mode) and enabled.

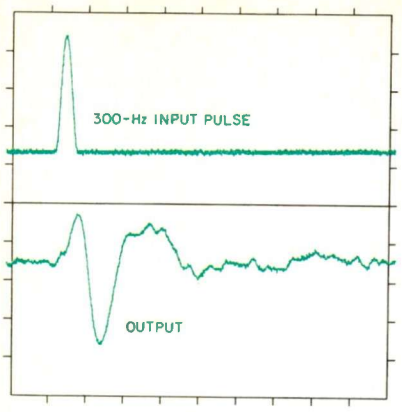


Fig. 4—Impulse response.

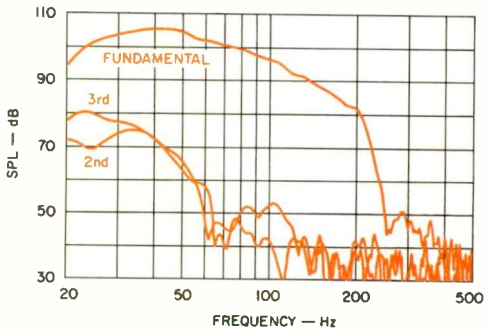


Fig. 5—Harmonic distortion vs. frequency.

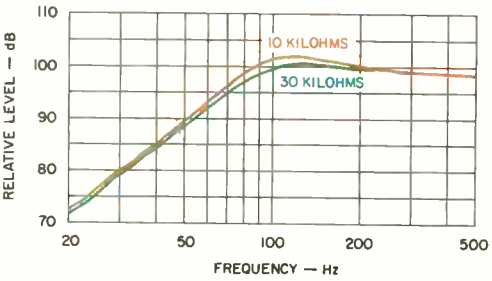


Fig. 6—Frequency response of optional HP-80 high-pass filter for lowest and highest impedance settings with load of more than 30 kilohms.

Rear panels of optional HP-80-2 (top) and HP-80-3 high-pass filters.

The subwoofer's energy-versus-time response (Fig. 2), taken with the M&K's 80-Hz low-pass filter switched in, is excellent. The MX-150THX has almost perfect output down to at least 25 Hz. Its output is tight, and there's very little delayed energy.

Figure 3 shows group delay. If you subtract the 3-millisecond delay caused by the 1-meter microphone distance, the curve taken with the "THX" setting indicates that the 12-inch woofers' natural delay is about 2 milliseconds at 65 Hz and 11 milliseconds at 30 Hz; with the 80-Hz filter, the delay at these frequencies increases to 11 and 17 milliseconds, respectively. This is normal behavior: The lower the cutoff frequency of a low-pass filter, the longer its delay will be. These curves can help you position the MX-150THX for the best sonic blend between it and your front speakers. Good satellite speakers should delay the sound no more than about 1 millisecond, plus roughly 1 millisecond for every foot of distance between them and your listening position. Because the MX-150THX's delay is longer, its sound should blend in better if you place this subwoofer closer to you than your front loudspeakers are. (That the M&K's sound is hard to localize also helps.) Whether it blends into the room's decor or traffic pattern in that position is another matter, and close-in placement won't always be feasible. Also, when you move the MX-150THX around to find a good location, remember to try both positions of the "Phase" switch.

As a sealed-box design, the MX-150THX doesn't use tuned ports or passive radiators—techniques that I have come to call "assisted resonance." Its impulse response (Fig. 4) indicates that the subwoofer is well damped; transient response is better than that of assisted-resonance speakers I have tested. The MX-150THX's initial positive output is followed by even greater output in the negative direction; this clearly demonstrates why experimenting with the "Phase" switch is important. (In my setup, negative polarity yielded better performance.)

The MX-150THX's harmonic distortion is shown in Fig. 5. With an output of 104 dB SPL at 30 Hz, third-harmonic distortion is 4.5% and second-harmonic is 3.2%. For an output of 106 dB SPL at 40 Hz, the distortion levels are each 2%, which is very good, and distortion at higher frequencies is even lower. The unusual push-pull arrangement of the M&K's two 12-inch woofers makes its second-harmonic distortion lower than that of most subwoofers that have either a single driver or two conventionally mounted drivers.

The 12-dB/octave rolloff of the optional HP-80 passive high-pass filter is seen in Fig. 6. (You can place either version of this filter before the power amplifier that drives your front loudspeakers.) Each HP-80 filter has a three-position switch for matching its output to input impedances of 10 to 20, 20 to 30, or 30 to 100 kilohms. My test setup's input impedance is higher than 30 kilohms, which explains why the response around 100 Hz in Fig. 6 is flatter with the 30-kilohm setting than with the 10-kilohm setting. M&K suggests using the highest position if you don't know your power amplifier's input impedance.

DOWN TO 25 Hz, THE M&K'S OUTPUT IS TIGHT, WITH LITTLE DELAYED ENERGY.

Use and Listening Tests

Before bringing in my listening panel, I listened to the M&K MX-150THX with large loudspeakers whose sensitivity is 97 dB SPL at 1 meter with a 1-watt input; the subwoofer had no trouble matching these speakers at levels up to 115 dB SPL. (I didn't listen at this level until I was at the end of my preliminary tests, to avoid a temporary shift in my hearing threshold.) I heard no nasty effects at high levels; the M&K is well designed in this regard.

The panel's listening sessions were conducted over a period of about two weeks

with each person listening alone to a variety of CDs and videotapes. For these evaluations, I hooked up some small satellite loudspeakers whose sensitivity is 87 dB SPL. For comparison, I used an 18-inch sealed subwoofer with special electronics that enable it to operate from 80 Hz down to 30 Hz, ±1 dB.

The panel's comments about the MX-150THX's sound on "My Funny Valentine," from the Lynne Arriale Trio's *The Eyes Have It* (dmp CD-502), were: "tuneful bass fiddle," "deep bass very close to reference," and "bass notes are distinct [and] like reference." For Freddie Hubbard's "Lover Man" on *Back to Birdland* (RealTime RT-3005, recorded by Ken Kreisel), the panel's impressions were very similar. Additional comments were made about the excellent deep bass power of both the MX-150THX and the comparison subwoofer.

Panelists also praised the M&K's performance on "Ride of the Valkyries," from *Double Forte* (Delos DE 3175), an organ recording by David Higgs and Todd Wilson that John Eargle engineered and produced. This recording has a terrific sense of space and ambience while maintaining great clarity—a difficult feat, to say the least! Another recording that manages to combine powerful bass, spaciousness, and clarity is Arthur Wills' "The Vikings," performed by the Dallas Wind Symphony under Frederick Fennell on *HDCD Sampler, Vol. 2* (Reference Recordings RR-905CD, engineered by Keith Johnson). This disc's wide dynamic range gave both the MX-150THX and the comparison subwoofer their most strenuous workouts, and it was the only recording where the panel could hear differences between these subs, albeit only at high levels. Comments were: "bass drum has greater impact on reference system," "high-level bass cleaner on reference system," and "MX-150THX and reference system are close except for bass drum at high level." (Bear in mind that the comparison subwoofer costs substantially more than the very reasonably priced MX-150THX.) The panel members all liked the M&K's extended bass when they were watching action movies.

I have to rate the MX-150THX high for performance and value. Congratulations to M&K Sound for producing an excellent subwoofer. A

KENWOOD, *continued from page 48*

I didn't measure the response of the low-frequency effects (LFE) channel because it clipped severely at 0 dBFS (distortion was more than 11%) even with the KC-Z1's subwoofer level set to minimum. Distortion at 1 kHz and 0 dBFS on the other channels was fairly good, no more than 0.072%. Channel separation at 1 kHz ranged from a low of 73.6 dB between right and left front to a maximum of 96.6 dB between right front and right surround. For the most part, separation was on the order of 90 dB, far more than anyone needs but impressive nevertheless.

Use and Listening Tests

Although the KC-Z1 performed decently overall in my lab, I'm more impressed with its operational convenience than with the technical refinement of its circuitry. As the lab tests indicate, the Kenwood is not up to snuff in several respects, notably in its D/A converters, Dolby Digital LFE channel, and phono preamp (the least of my concerns).

To see whether I could hear these effects, I set the KC-Z1 up in my home theater, using the Yamaha CDV-W901 laserdisc player as a source. I connected the Yamaha's AC-3 RF link and its stereo feed to the Kenwood's laserdisc input, and I coupled the Yamaha's digital output via a Toslink to the Kenwood's CD optical input. This arrangement should have let me compare Dolby Digital with Dolby Pro Logic, by toggling between the respective modes of the KC-Z1's laserdisc input, and compare the Kenwood's DAC with the one in the Yamaha player, by toggling between laserdisc and CD inputs. Matters proved not quite so simple, however. Like most microprocessor-controlled gear, the KC-Z1 mutes for several seconds when modes or sources are changed, and I couldn't match levels exactly. Therefore, my comparison was not as precise as I would have liked. Nonetheless, I was able to draw a few conclusions.

On music, I preferred the sound of the laserdisc player's D/A section to the Kenwood's. Thomas Labé's Steinway D (*Transcendental Bach*, Dorian Discovery DIS-80117) had more "air" when I used the analog link than the digital link, and the bell-like quality of his playing and the ambience of the Troy Savings Bank Music Hall were more convincing with the Yamaha's converters than with the KC-Z1's. When I switched to the CD input (and thus to the KC-Z1's internal DACs), the sound hardened noticeably and the notes' reverberant tails seemed rather truncated. To be fair, in the absence of direct comparisons I think many people would be quite satisfied with the KC-Z1's DACs.

I had no cause for complaint with the KC-Z1's home theater performance. Movie soundtracks seem to be fairly immune to minor technical imperfections in playback systems (and those of the KC-Z1 do qualify as minor). Perhaps that's because of the way the soundtracks are mixed; perhaps it's because the viewer/listener becomes so involved in the visual action that he's less aware of subtle sonic details. In any event, I thoroughly enjoyed the KC-Z1 in my home theater, especially when using Dolby Digital mode. Side and rear sound effects were far more precisely placed and more stable and believable in this mode than in Pro Logic. The outdoor sounds (wind, rustling grass, etc.) and the sword fight in the first 30 minutes of *Rob Roy*, for example, were great in Pro Logic but spectacular in Dolby Digital. The opening tornado in *Twister* was incredible. Interestingly, I was unaware of distortion in the Dolby Digital LFE channel, either because it didn't occur at the levels present on the LFE channels of the discs I used or because it was sonically benign.

COMPLETE AND FLEXIBLE, KENWOOD'S KC-Z1 IS A COMPONENT TO BE RECKONED WITH.

Minor foibles notwithstanding, the Kenwood KC-Z1 is a component to be reckoned with. It's remarkably complete and flexible in application, and to call its TouchPanel innovative is the understatement of the year. No longer must you enter your home theater armed with a remote in each hand; no longer need you fumble with a billion-button "universal." The Kenwood KC-Z1's TouchPanel nudges you, it guides you. It's a universal remote made to be used by humans! A

EQUIPMENT **PROFILE**

DANIEL KUMIN

MARANTZ CD-17 CD PLAYER

In its 15 years of existence, the Compact Disc format has seen dozens of variations in player layout and function. These have run the gamut from the ridiculous (the three-disc "robot-arm" changer in a shelf system of a few years ago springs to mind) to the extreme (such as three-piece players—with power supply, transport, and D/A converter in separate chassis—costing as much as a family sedan). Yet the one-box, single-disc player remains one of the most popular options. This may reflect no more than consumer habit and expectation, but it could also have something to do with an inherent perfection of design.

YOU COULD SPEND TWO OR THREE TIMES THE MONEY AND NOT GET BETTER SOUND.

Marantz's CD-17 is an apt case study. It is simple and elegant, and its operation is self-evident. This is the latest CD design from one of the oldest names in audio, a firm that is a subsidiary of the format's co-developer, Philips. Marantz characterizes the new player, which occupies the next-to-top slot in the company's lineup, as an effort to "design a CD player without compromises. . .[that is still] within reach of the vast majority of music lovers."

In keeping with Marantz's high-end goals for this player, the CD-17 is exceptionally restrained on the outside. The low-profile black fascia presents just seven buttons, a centralized display, and the disc drawer. The buttons control power, open/close, play, pause, stop, and backward and forward track-skip. All other functions are accessible only via the supplied remote control. On the rear panel are gold-plated RCA jacks for stereo analog output, a single coaxial S/P DIF digital port, and a nickel-plated jack pair for Marantz's intercomponent, unified-remote system. (Presumably, at this level of audio sophistication we need not fear that the new owner might plug these jacks into a power amplifier, which would doubtless yield a nasty surprise.)

Under the hood, the CD-17 reveals construction quality several cuts above that of "mass-market" brands. The player is assembled on a heavier-gauge steel pan than I see on most under-$1,000 designs, with all-metal bolt-on side, front, and back assemblies. A beefy power transformer accounts for a good portion of the CD-17's very substantial weight. However, another few pounds are added by two-layer, metal subpanels bolted to each side, underneath the extruded-aluminum exterior panels; these could probably be argued as "anti-resonance" components, but that won't stop my wondering if they are there as much simply to add heft.

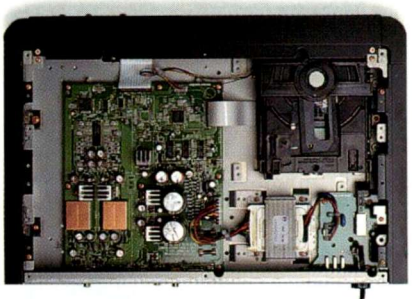
Whatever the reason, construction and component quality appear well above average throughout. The CD-17's sheet-metal craft is outstanding, and its internal goings-on appear no less carefully managed. The single main circuit board is only about 8 inches square (like many CD players, the CD-17 could easily fit a smaller chassis). The only visible jumpers are the ribbon connectors to the disc drive and display and a heavy wiring harness to the rather substantial power-supply section. That supply, which resides behind the drive mechanism, appears quite thoroughly filtered and regulated.

The CD-17 employs Philips's top-shelf CD-7 and DAC-7 digital-to-analog conversion components as well as 20-bit digital fil-

Dimensions: 18¼ in. W x 3⅜ in. H x 12½ in. D (46.5 cm x 8.4 cm x 30.5 cm).
Weight: 17 lbs. (7.7 kg).
Price: $1,199.
Company Address: 440 Medinah Rd., Roselle, Ill. 60172; 630/307-3100.
For literature, circle No. 92

Photos: Michael Groen

tering and an all-discrete analog output stage. The transport is the Philips CDM-12 mechanism, a compact plastic and metal assembly, extensively sprung, that incorporates a three-beam laser, pickup-sensor optics, and integral servo and demodulator/decoder electronics. Mechanical clamping is part of the assembly; the linear-tracking sled rises to meet the disc, though this doesn't add significant mass to the rotating disc.



THE CD-17'S CONSTRUCTION QUALITY IS SEVERAL CUTS ABOVE THE NORM.

Philips hardware manages the digital interface and conversion steps, with the exception of an NPC third-order noise-shaping digital filter IC. D/A conversion is via Philips's TDA1547, the Dutch firm's latest Bitstream "1-bit" device; in this case the chip carries dual converters in a complementary topology to further reduce conversion errors.

Following the digital hardware, the design is said to be all-discrete, via hyper-dynamic amplifier module (HDAM) analog stages. These are two modestly potted modules, about a half-inch high, covered by classy copper casings embossed with the Marantz logo. What's in there is anybody's guess; Marantz says the contents are discrete J-FET line-amp circuits. Each channel appears to be locally, independently regulated and supply-filtered and to be followed by a discrete-transistor output pair just ahead of the output jacks.

Measurements

The Marantz CD-17 was a pleasure to test. That's far from universal for CD players, where odd behavior and head-scratching results are relatively common, especially at the very low distortion and noise levels of today's digital audio. To verify Marantz's specifications, I used a 20-kHz "brick-wall" filter in the measurement loop. Philips recommends this for all its Bitstream devices, to limit the influence of ultrasonic noise—which, as a consequence of the Bitstream system's noise shaping, is relatively high. I confirmed this and used the very steep brick-wall filter option of the Audio Precision System One analyzer for all tests in which distortion-plus-noise was a factor. The results so derived were impressive: Technically, digital audio is getting exceptionally good all around, and the CD-17 is a superb demonstration.

Frequency response, seen in Fig. 1 (note the expanded vertical scale), is very flat overall; the general deviation is less than 0.1 dB. However, there's a channel imbalance of about 0.16 dB. The filter response ripple visible in the top two octaves is only about 0.1 dB, peak to peak, and can be considered inconsequential.

The CD-17's total harmonic distortion plus noise (THD + N) at 0 dBFS (Fig. 2) closely matches Marantz's spec (0.0015% at 1 kHz) and remains extremely low over the entire band, not even reaching 0.01%. The generally rising trend suggests the influence of residual noise; removing the brick-wall filter and retesting THD + N caused the curves (not shown) to jump an order of magnitude, peaking at about 0.1% at 18 kHz. Using the remote's volume control to dial in a 20-dB cut induced about the same degradation of THD + N, which indicates that this should be done only for convenience—no surprise there.

Figure 3 shows THD + N versus recorded level at 1 kHz; the curves' relative flatness up to 0 dBFS speaks well of the analog output stage's linearity and dynamic range. Figure 4 offers superimposed spectral plots of residual noise and distortion, for an "infinity-zero" silent track and for a –60 dB tone. The most notable feature is the –79 dB noise hump at about 130 kHz, which appears related to noise shaping (3 x f_S equals 132.3 kHz). The overall noise suppression in the audio band is very good, and the ulti-

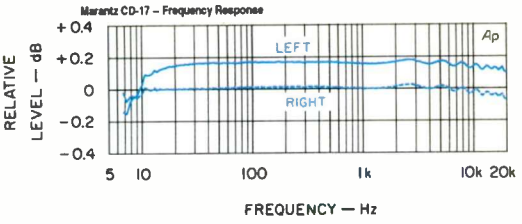


Fig. 1—Frequency response.

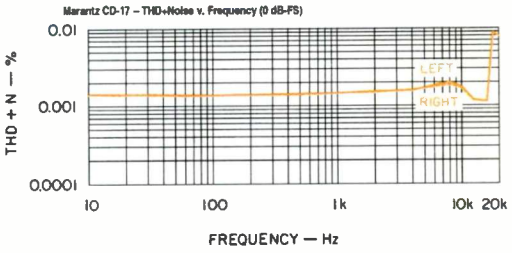


Fig. 2—THD + N vs. frequency at 0 dBFS.

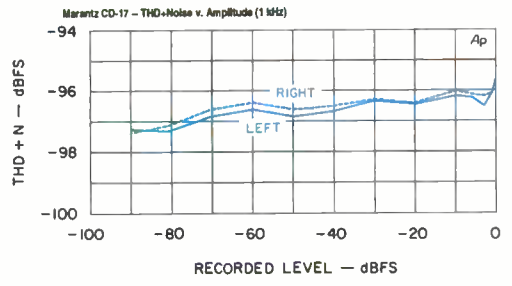


Fig. 3—THD + N vs. level at 1 kHz.

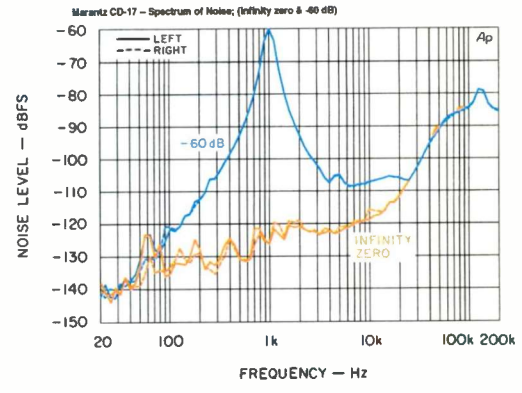


Fig. 4—Spectrum analyses for an "infinity-zero" signal and a 1-kHz tone at –60 dBFS.

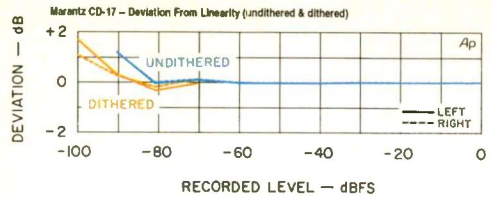


Fig. 5—Deviation from linearity at 1 kHz.

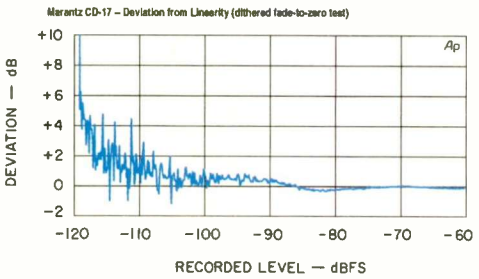


Fig. 6—Fade-to-noise test, dithered 500-Hz tone.

The CD-17's front panel is very clean; most functions are controlled from the 30-key remote.

mate low-frequency suppression is more than very good. The absence of any power-line harmonics higher than –124 dB (at 60 Hz) puts hum altogether out of the picture. The only thing the –60 dB curve reveals that might at a stretch be called a distortion product is at 5 kHz (the fifth harmonic; the second through fourth harmonics are, of course, buried in the filter's skirts).

Signal-to-noise ratio was about 108 dB, A-weighted, in each channel—very good indeed. Dynamic range (using the A-weighted system of measuring residual noise for a –60 dB tone and adding 60 dB to the result) was nearly 100 dB—outstanding.

Philips's Bitstream high-speed, noise-shaping DACs have supplied accurate, cost-effective D/A conversion for many years now, and those in the CD-17 are the latest example. Figure 5 shows deviation from linearity for undithered 1-kHz tones from 0 to –90 dBFS and dithered tones from –70 to –100 dBFS. Any player that delivers better than 2-dB accuracy down to –100 dBFS gets my attention, and the Marantz kept it with Fig. 6, the fade-to-noise test with a dithered, 500-Hz tone. In this instance, accuracy is arguably within 1 dB to nearly –110 dBFS—superb. The results for only one channel are presented here; the two channels' curves were extremely well matched at all points, which is far from common.

In the thump-on-the-case test, the CD-17 rated a horizontal-knock A+ and a vertical-mode A–. Either way, I had to slug the player pretty solidly or drop one side from an inch or so to induce a skip. (This does not necessarily have anything to do with susceptibility to audio-frequency vibrations, but it's a test every shopper should perform.) On the Pierre Vernay test disc (PV.788031/32), which contains deliberate defects, the Marantz tracked 1.5-millimeter dropouts flawlessly and successfully negotiated 2-millimeter blanks without skipping but with an occasional sharp "snap"—wow!

Use and Listening Tests

Operating the Marantz CD-17 proved mostly intuitive. Since the front panel offers just basic controls, day-to-day operation will typically be from the remote, which, unfortunately, is a bit uninspired ergonomically. Its 30 identical keys are all black, all small, and all closely spaced. The keys are intelligently laid out, with the main transport controls offset by a different background.

To the CD-17's front-panel controls, the remote adds audible fast search (two-speed, of the hold-down variety); disc-, track-, and A-B repeat modes; automatic music search (does anyone out there ever use this?); and 30-track random-access programming. You can also perform delete programming to skip one or two hated tracks on an otherwise well-liked disc, a sort of programming that some music lovers might actually find occasionally useful. The remote delivers easy-chair volume control, too, which will be a convenience to those whose preamps, amplifiers, or receivers lack remote control. Though I did not hear any clear effects of using it (at –20 dB or so), my lab tests did show that it compromises dynamic range and increases distortion a bit, so it is best reserved as an occasional convenience.

The remote also has keys to select elapsed or remaining track time, remaining disc time, and random play. The CD-17's "Edit" function is a rather simple and potentially very handy tape-recording aid; it quickly divides a disc's tracks into two groups for recording onto 90-, 60-, or 46-minute tapes—or any other duration you key in. With a Marantz (or compatible) tape deck and the intercomponent remote-communication hookup, the CD-17 will perform synchro recording. It does not, however, offer Philips's handy Favorite Track Selection (FTS) memory to retain your programmed sequences disc by disc from session to session.

MEASURED DATA

Line Output Level, 0 dBFS: 2.37 volts (left channel).
Channel Balance: Right channel 0.16 dB below left.
Line Output Impedance: 195 ohms.
Frequency Response: +0.17, –0.07 dB, 20 Hz to 20 kHz.
Channel Separation: Greater than 102 dB, 125 Hz to 16 kHz.
THD + N at 0 dBFS: Less than 0.009% from 20 Hz to 20 kHz, 0.0014% at 1 kHz.
Maximum Linearity Error: Undithered recording, +1.22 dB at –90 dBFS; dithered recording, +1.75 dB at –100 dBFS.
A-Weighted S/N: 107.9 dB.
Quantization Noise: –96.4 dBFS.
Dynamic Range: Unweighted, 97 dB; A-weighted, 98.9 dB.

I lived with the CD-17 as my main player for nearly two months, doing extensive listening on my "big" system (B&W 803 Matrix Series 2 speakers, Parasound HCA-2003 amp, and Citation 7.0 preamp) and on the system in my home studio (modified Dyna Stereo 70 power amp and NHT SuperOne two-ways in near-field position). I formed a couple of consistent opinions about the Marantz, which impressed me as a very effective player that should be able to keep up in virtually any system.

Continued on page 63

Our reputation stands behind it.

The Bose® Wave® radio is no ordinary radio. Behind it stands a 30-year reputation for building superior music systems and speakers that produce full, rich sound. But how do you get Bose quality sound from a small radio?

Technology that redefines radio.

The solution is our patented acoustic waveguide speaker technology. This technology is so advanced, it earned its creators the prestigious "Inventor of the Year" award. Much as a flute strengthens a breath of air to fill an entire concert hall, the waveguide produces room-filling sound from a small enclosure.

Even the critics were impressed. *Popular Science* called the Wave radio "a sonic marvel." *Radio World* called it "...a genuine breakthrough in improved sound quality." Turn it on and listen for yourself — you'll understand why many owners actually use their Wave radio as their primary music system. Yet the Wave radio measures just 4.5″ H × 14″ W × 8″ D, small enough to fit on a kitchen counter, bedroom nightstand, almost anywhere.

Remote-controlled convenience.

The easy-to-use Wave radio comes with a credit card-sized remote control that lets you operate the radio from across a room. You can pre-set six AM and six FM stations and switch between them at the touch of a button. Or listen to your favorite recordings by connecting the radio to your CD or cassette player, TV, or VCR. There's even a dual alarm feature.

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The Wave radio is available for $349 directly from Bose, the most respected name in sound. And now our installment payment plan lets you make six monthly payments, interest free. For information and to learn about our in-home trial and satisfaction guarantee, call 1-800-845-BOSE, ext. R3965, or return the coupon.

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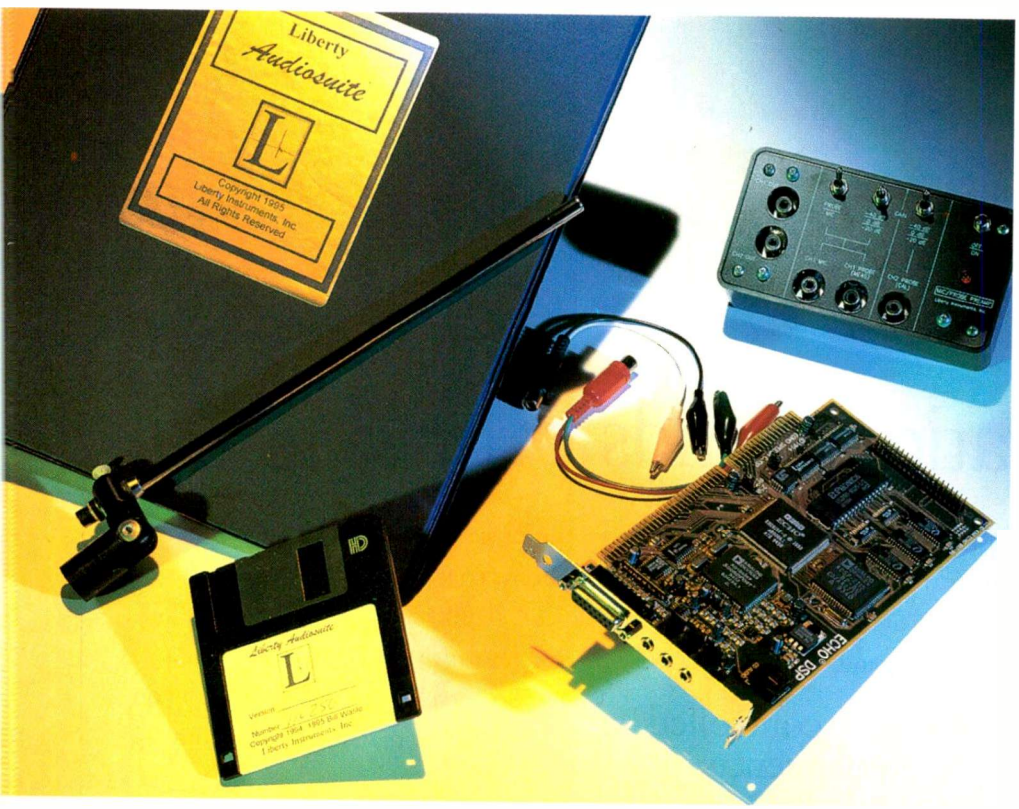
EQUIPMENT PROFILE

BASCOM H. KING

LIBERTY AUDIOSUITE 2.0 COMPUTERIZED MEASUREMENT SYSTEM



Before we had computers, audio testing required a lab full of instruments. The personal computer made audio and acoustic testing far more convenient and affordable. The Liberty Audiosuite (abbreviated LAUD) belongs to the second generation of these PC-based acoustical and audio measuring systems.

The first generation comprises the Crown TEF, LMS, MLSSA, and SYSid systems. (The Audio Precision system, though of this generation, makes different tests.) Each of these uses proprietary digital hardware—peripheral cards to mount in a PC for MLSSA, SYSid, and LMS and, for the TEF, a separate box that communicates by cable to an interface card in a PC.

The second generation offers more measurement features for less money. This new generation began with Liberty Instruments' IMP, a $275 kit that the company called "a poor man's MLSSA." The IMP was followed by CLIO, from Audiomatica in Italy, which cost about $1,300 with microphone and preamplifier. The Liberty Audiosuite, with similar features, is only $788.50 including a calibrated microphone and mike preamp! What's more, its component parts (software, PC sound card, mike/probe preamp, and calibrated mike) are available separately if you have applicable hardware or do not need the full system.

LIBERTY INSTRUMENTS' AUDIOSUITE CAN TURN YOUR PC INTO AN AUDIO TEST SYSTEM.

The Audiosuite 2.0 performs a very wide range of tests, so many that the manual describes it as five separate instruments: an MLS/FFT analyzer, a sine-wave analyzer, a digital oscilloscope, a spectrum analyzer, and a harmonic-distortion analyzer.

The dual-channel MLS/FFT analyzer uses maximum-length-sequence (MLS) pseudo-random noise or impulse signals to make time-domain measurements, which can then be translated into frequency-domain measurements via fast Fourier transforms (FFTs). Impulse-based measurements take less time than those involving sine-wave sweeps or discrete sine-wave frequencies but are more sensitive to noise corruption. With a computer at its disposal, the Audiosuite can get around this by averaging multiple tests, but doing so dissipates much of the speed advantage. The MLS technique, according to Liberty's manual, "mathematically squeezes the equivalent of thousands of test-and-average sequences into one. . . [converting the results] to an equivalent pulse response. . . ."

You can get some pretty sophisticated tests with the MLS instrument. These include "3-D" waterfall plots of spectral decay over time, energy-time curves (ETCs), and power cepstra (an anagram, not a misspelling, of "spectra") for analyzing signal reflections (such as those from speaker grilles).

The sine-wave analyzer, also dual-channel, is used for more conventional audio measurements and for tests requiring noise immunity at very low frequencies. The Audiosuite can measure both magnitude and phase in its gated or continuous mode. Instead of a continuous sweep, the generator changes frequency in discrete steps. You can use it to make measurements at various frequency points of your choice or in logarithmic or linear frequency increments.

The MLS/FFT and sine-wave modes can each be used for network and impedance analysis and for testing loudspeakers and room acoustics. Results can be smoothed; you have a choice of octave, half-octave, third-octave, sixth-octave, or twelfth-octave averaging. You can use MLS analysis to mark off time limits for some sine-wave measurements—of a speaker's direct re-

Photos: Michael Groen

SOFTWARE SPECIFICATIONS

Digital Resolution: 16 bits.

Sampling Rates: 5.5125 to 48 kHz, in 14 steps.

Usable Frequency Range: 2 Hz to 45% of sampling rate.

FFT Sizes: Maximum Length Sequence (MLS), 256 to 16,384 samples; spectrum analysis, 256 to 8,192 samples.

MLS Lengths: 4,095 and 16,383 samples.

Real-Time Analyzer Resolution: ⅓ octave, 20 Hz to 20 kHz; ⅙ octave, 25 Hz to 20 kHz.

Frequency Resolution: Sampling rate divided by FFT size.

Input Gain Range: Without optional preamp, up to 22.5 dB in 1.5-dB steps; with preamp, up to 62.5 dB.

Harmonic-Distortion Measurement: THD for second through ninth harmonics; displays two harmonics per sweep; phase analysis of distortion products.

Output Signals: Sine waves, square waves, white noise, and pink noise.

Oscilloscope Capabilities: Dual-channel; triggerable; up to 21-kHz bandwidth; 16-bit input sampling.

Hardware and Software Requirements: PC with 386 or later processor and internal or external math co-processor, 8 megabytes of RAM, VGA or SVGA monitor, mouse, and DSP sound card meeting Personal Sound Architecture specifications; DOS 5 or higher (with mouse driver) or Windows 3.1 or 95.

PREAMP AND MICROPHONE SPECIFICATIONS

Microphone Calibration: Correction data supplied to 21 kHz.

Input Impedance: Probe inputs, 2.2 kilohms; mike input, 2.2 kilohms with 2.5-volt microphone-bias supply.

Gain at 0-dB setting: Probe inputs, 0 dB; mike input, 54 dB maximum.

Probe Input Attenuation: 0, –20, or –40 dB for input levels up to 1, 10, or 100 peak volts at probes.

Prices: Complete system, $788.50; software and manual, $369; upgrade from Version 1 software, $100; preamp, $99; calibrated microphone, $129 (capsule and calibration data only, $23); Echo DSP sound card for ISA bus, $179; probes, $12.50 per pair.

Company Address: 6572 Gretel Court, Middletown, Ohio 45044; phone and fax, 513/755-0252; http://www. libinst.com

For literature, circle No. 93

sponse while ignoring room reflections, for example. A speaker's frequency response and complex impedance can be plotted on the same screen, and several Thiele-Small parameters can be measured directly.

The system's dual-channel, triggerable digital oscilloscope mode has a display bandwidth of about 21 kHz, which is suitable for most audio phenomena. This mode uses 16-bit input sampling and is accompanied by an adjustable sine-wave/square-wave generator.

The Audiosuite's spectrum analyzer has two operating modes. One is FFT-based spectrum analysis with pink or white noise; in this mode, it can display data with a log or linear frequency scale and can average power responses from several microphone positions. The other mode is third- or sixth-octave real-time analysis (RTA) with constant-percentage bandwidth. You can average multiple RTA measurements and apply standard A-, B-, or C-weighting to the data; you can cascade (multiply) curves to reveal, for example, how an equalization curve would work with a speaker; and you can normalize (divide) curves to show only the differences between them.

The harmonic-distortion analyzer mode can plot the second to ninth harmonics individually (resolvable down to 0.04% or less) as well as total harmonic distortion (THD). The program has intelligent routines for selecting sampling rate and sample size. These routines help you minimize measurement times while preserving sensitivity to low-level distortion products down to 0.04% or less. The Audiosuite can also show the phase relationship between the fundamental signal and the distortion products.

When distortion is low, it's hard to see on the fundamental waveform, and showing the distortion components separately gives you little intuitive understanding of the distortion's character. This is where the analyzer's unique Distortion Visualizer comes into play. With it, you can magnify (or diminish) the distortion in a displayed sine wave while maintaining the distortion products' level and phase relationships. This helps you see the types of distortion produced by the component you're testing.

All of this is complex enough to justify the 140-page instruction manual, so the Audiosuite 2.0 also has built-in Easy Scripts. These include guided and automated test procedures for commonly needed measurements that make it easy to get useful results with minimal experience. The built-in help menus are quite extensive, too. And if a manufacturer wants to use the Audiosuite for production quality control, he can set pass/fail limits that reveal at a glance whether the component under test is acceptable or not.

The data you acquire with the Audiosuite can be printed out to IBM/Epson-compatible dot-matrix and HP LaserJet II-compatible laser or inkjet printers. The measurements can be saved as bitmap (.BMP) files, as ASCII files for use with other programs, or in compressed file formats that only the Liberty Audiosuite can read. The program requires only DOS, but it is compatible with Windows 3.1 and Windows 95.

THE AUDIOSUITE PERFORMS SO MANY TESTS THAT THE MANUAL DESCRIBES IT AS FIVE SEPARATE INSTRUMENTS.

The preamp accepts the microphone and probe connections.

Aside from the PC itself, the Audiosuite's main hardware requirement is a sound card, to generate test signals and digitize in-

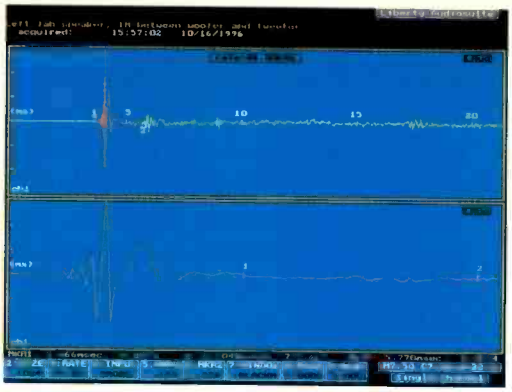


Fig. 1—MLS impulse response of a two-way loudspeaker over 21 milliseconds (top) and 2.1 milliseconds (bottom).

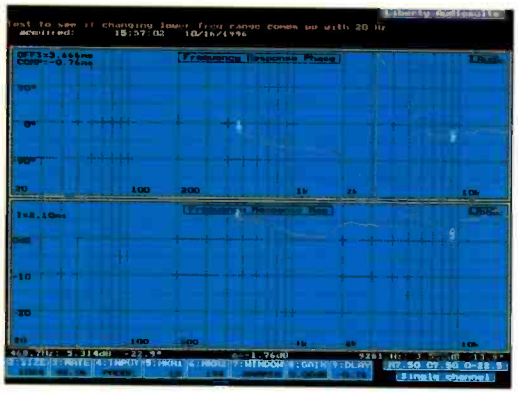


Fig. 2—Phase response (top) and frequency response (bottom), derived from time-windowed MLS impulse at bottom of Fig. 1.

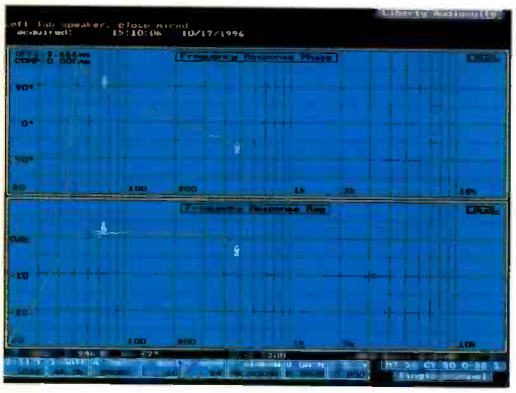


Fig. 3—Low-frequency phase response (top) and frequency response (bottom), measured in the woofer's near field with a sine-wave signal stepped from 20 to 480 Hz.

put signals. This card must be designed in accordance with the Personal Sound Architecture (PSA) specification, which calls for an Analog Devices ADSP2115 DSP chip, special control ASICs (application-specific integrated circuits), and on-board memory. Such cards are made by Adaptec, Cardinal, Echo, Orchid, Paradise, and Wearnes. Because these sound cards are still relatively uncommon, Liberty offers the Echo DSP card as an accessory.

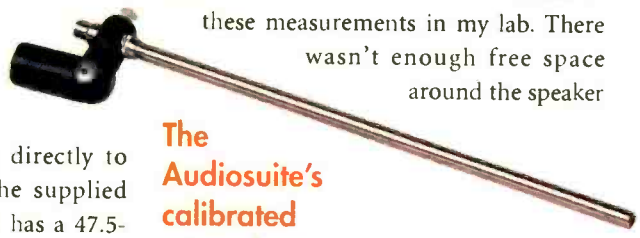
The Echo DSP sound card has mike and line inputs, but Liberty Instruments strongly recommends you use its battery-powered mike/probe preamp, which provides gain as well as switchable attenuation (0, –20, and –40 dB) to protect the sound card from high-level signals or DC. The preamplifier has two input channels, one for a microphone or test probe and the other for a second probe or a reference signal. Toggle switches select between the probe and mike inputs, set the attenuator, and turn battery power on and off. The preamp's inputs and outputs are phono plugs; you should not connect high-level signals, such as power amp outputs, directly to them. Instead, use the supplied probes, each of which has a 47.5-kilohm resistor in line with its hot clip-lead. (The Audiosuite's manual also tells how to build your own probes.) You'll need a shielded cable that has two phono plugs at one end and a stereo mini-plug at the other to connect the preamp to the sound card. Liberty Instruments does not supply such a cable, nor does it supply the single phono cable for connecting the mike to the mike preamp. Both cable types are easy to find, although I think the company should supply them.

The nifty microphone's electret capsule is in a thin, foot-long metal tube. A female phono connector is at the end farthest from the microphone element; an adaptor to fit standard microphone stands is included.

I installed Audiosuite 2.0 on my "measurement" computer, a 486 DX33 IBM PC clone with a 100-megabyte hard drive; this machine has LMS, CLIO, and Crown TEF software on it. Installing the Audiosuite went easily enough. Liberty Instruments says the program requires 8 megabytes of RAM, but this is somewhat conservative; it ran fine on my test PC, which has only 4 megabytes. Liberty cautions, however, that the Audiosuite may not run on some 4-megabyte PCs. The first time you run the program, a tone and an on-screen message will indicate that the configuration file cannot be found. You must therefore create a configuration file for your computer; one of the program's Easy Scripts will lead you through the process. After that, you probably won't need to do this again.

The graphs in this review are all direct reproductions of the 2.0's screens. Data about the signals in the windows is in the line just below the windows, keyed to the on-screen cursors. The boxes at the bottom of each screen show test-system settings.

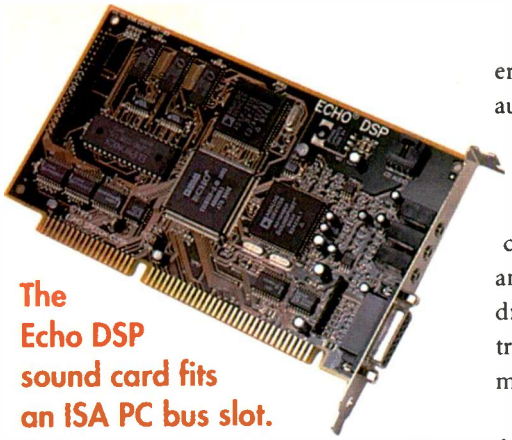
Figures 1 through 3 illustrate how Liberty's Audiosuite 2.0 can be used to make 1-meter, quasi-anechoic speaker measurements without an anechoic chamber. I made these measurements in my lab. There wasn't enough free space around the speaker and mike to get the best results, so these tests show what you can accomplish with Audiosuite in a less than ideal environment.



The Audiosuite's calibrated microphone.

TIME-WINDOWING LETS YOU MAKE TESTS THAT WOULD OTHERWISE REQUIRE AN ANECHOIC CHAMBER.

My first step was to measure a speaker's MLS response (Fig. 1). The top window includes about 21 milliseconds of the captured MLS impulse response, which lets in



The Echo DSP sound card fits an ISA PC bus slot.

AUDIOSUITE 2.0 LETS YOU ADD, SUBTRACT, MULTIPLY, DIVIDE, AND SMOOTH CURVES.

some echoes along with the speaker's direct signal. The curve in the bottom window is a portion of that impulse, restricted to about 2.1 milliseconds in order to include only the direct signal and exclude room reflections. (The portion selected for the bottom windows is marked off by cursors on the top window's curve.) Note that the pre-ringing just before the actual impulse response was generated by the Audiosuite's finite-impulse response (FIR) filter, not by the speaker.

In Fig. 2, we see an FFT analysis of this time-windowed portion of the MLS response; phase response is in the top window, and frequency (amplitude) response is in the bottom one. As can be gleaned from the phase response, the two-way speaker in my lab exhibits considerable phase shift, some 360°, in the region of the crossover from woofer to tweeter; this indicates a difference between the arrival times of the woofer's and tweeter's outputs. Figure 2's low-frequency limit is only about 470 Hz. This is a function of the length of the transformed time record; the longer the time record, the lower in frequency the transformed response can legitimately go.

To assess the frequency range below 470 Hz, I put the mike close to the speaker's woofer and used the Audiosuite's sine-wave mode to take measurements in steps from 20 to 480 Hz (Fig. 3). Had I wished, I could have merged the curves of Figs. 2 and 3 into a wide-range composite covering the speaker's performance over the whole audio range. (This is routinely, and legitimately, done by speaker reviewers.) This is just one of the ways the Audiosuite's merge facility can add, subtract, multiply, and divide curve data; it can even draw curves to help smooth the transition between curves that it is merging.

Figure 4 is an FFT analysis of the full 21-millisecond impulse response seen in Fig. 1. This longer time window gives us a much lower frequency limit than we saw in Fig. 2, about 50 Hz. Because this longer time window does not exclude room reflections, the curve is more complicated than the quasi-anechoic frequency response in Fig. 2. Nevertheless, you can still make out the basic shape of the Fig. 2 response curve.

What matters in audio testing is usually not the tested component's output, which includes the signal fed to it, but what the component is doing to that signal. I therefore made many of my measurements with the test signals fed to the Audiosuite preamp's "CAL" (reference) input as well as to the component I was testing. In Figs. 1 through 4, I fed the Audiosuite's generator output to the "CAL" input and ran the Audiosuite in its dual-channel mode. (With this setup, I wasn't measuring just the speaker's response but that of my whole system, including the effects of my preamp's loudness compensation, which I had left on. If I had connected the "CAL" input to the output of the power amplifier or the speaker's input terminals, the effects of the loudness compensation—and any other deviations in my lab system's electronics—would have been calibrated out and would not have affected the measurements.) While data is being acquired in this dual-channel mode, the bottom window on your computer screen normally shows the signal being fed to the "CAL" input, and the top window shows

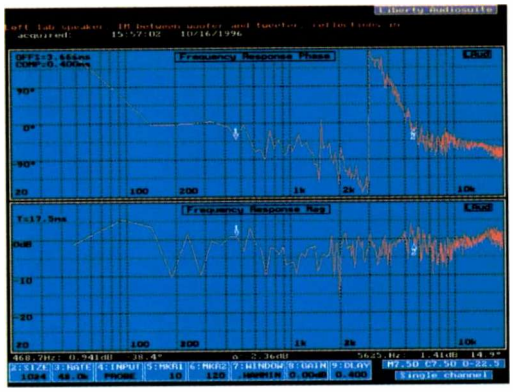


Fig. 4—Phase response (top) and frequency response (bottom), derived from full-length MLS impulse at top of Fig. 1.

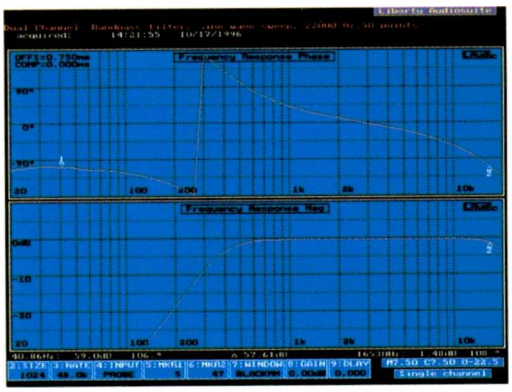


Fig. 5—Phase response (top) and frequency response (bottom) of lab filter (with bandwidth of 400 Hz to 20 kHz), for stepped sine-wave signal.

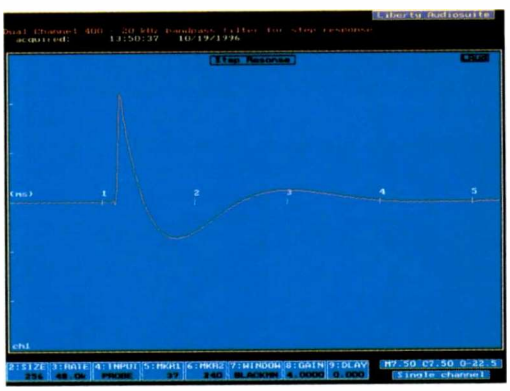


Fig. 6—Step response of lab filter, derived from impulse response test (not shown).

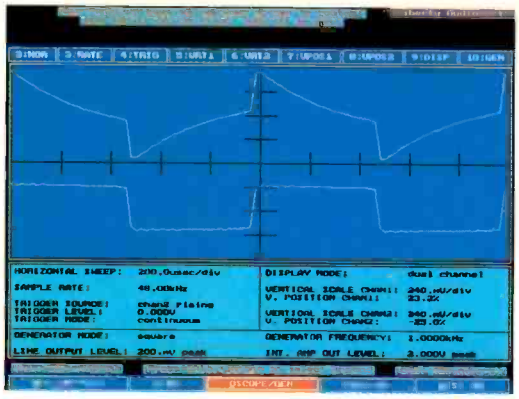


Fig. 7—Oscilloscope-mode display of lab filter's response (top) to 1-kHz square-wave input (bottom).

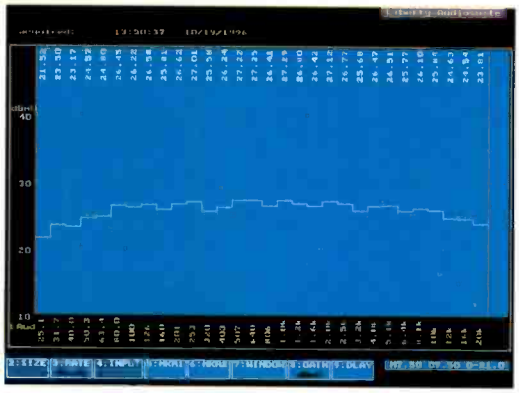


Fig. 8—RTA-mode display of output from the Audiosuite's pink-noise generator.

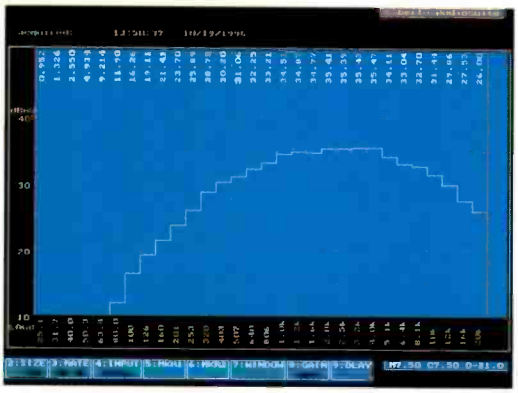


Fig. 9—Third-octave RTA of A-weighting filter response.

the response of the device you're testing. Once the data is acquired, you can switch to single-channel mode and view the selected portion of the impulse response, as seen in all the figures presented here.

For Fig. 5, I switched to the Audiosuite's sine-wave mode to measure the low-frequency response of a noise-measuring filter I use in my lab. This filter's bandwidth is 400 Hz to 20 kHz, with 18-dB/octave slopes. In the top window, you can see almost 270° of phase lead when the amplitude response (bottom window) is well into its attenuation slope, just as you'd expect from such a filter.

For Fig. 6, I returned to impulse mode and used the Audiosuite's processing capabilities to derive the filter's step response, the mathematical integral of impulse response. The step response in Fig. 6, which covers some 5 milliseconds, shows what the level transition of a 100-Hz (or lower) square wave would look like after passing through this filter. What you see is predominantly the low-frequency rolloff's transient response.

The Audiosuite's oscilloscope mode is handy for looking at audio waveforms, within the limitation of its 21-kHz bandwidth. The bottom trace of the dual-trace display in Fig. 7 is a 1-kHz square wave from the Audiosuite generator; the top trace is the same signal after passing through my noise filter. Although the trace resolution is not the greatest, the 'scope mode is still a useful tool, especially if you don't have a real 'scope on hand.

Next, I turned to the Audiosuite's spectrum analyzer in its RTA mode. Before using the instrument for any other tests, I measured its overall flatness by displaying a third-octave analysis of its own pink-noise source (Fig. 8). Some rolloff is noticeable at both ends of the audio range, and this lack of flatness may preclude the RTA's use for precise work. I then set the lab noise filter for A-weighting and measured its response; the RTA in Fig. 9 is a reasonable representation of it.

In its distortion-analyzer mode, the Audiosuite can display two curves at one time, either total harmonic distortion and a particular harmonic or two selected harmonics. By overlaying several runs, you can see how a number of harmonics vary with frequency in the device that you're testing. For Fig. 10, I set my noise filter to a bandpass of 20 Hz to 20 kHz and measured its second and third harmonics.

One floppy holds the entire Audiosuite program.

THE IMPEDANCE CURVES WERE VIRTUALLY THE SAME AS THOSE I'D MADE ON COSTLY LAB EQUIPMENT.

I then tried the Audiosuite's novel Distortion Visualizer, which magnifies the distortion of the device under test, making it easier to see how that distortion affects sine waves. For Fig. 11, I used the Visualizer to boost the 1-kHz distortion from my noise filter by a factor of 1,000.

Figure 12 shows the impedance phase (top curve) and magnitude (bottom curve) of the NHT-built dummy speaker load I now use for testing power amps, measured in the Audiosuite's sine-wave mode. (These results are virtually identical to those I've obtained with the Audio Precision System One, a far more expensive laboratory measurement system.) The readouts just below the display window are of impedance magnitude and phase angle at the two cursor locations. What excites my engineering soul about the Audiosuite's display is that you can move the cursor to any point on the

curve and read the impedance magnitude and phase—*and* the equivalent resistance and inductance or capacitance in both series- and parallel-equivalent forms.

Audiosuite 2.0 is quite a versatile measuring system, and tests of my lab filter and dummy load, whose performance characteristics I know well, demonstrated that it is reasonably accurate. On the downside, I distinctly disliked that in many operating modes the display screen would be blanked and redrawn a number of times in rapid succession. I missed having enough bandwidth to check tweeter and circuit response above 20 kHz; other measuring systems, and by no means just expensive ones, don't have this limitation. And the Audiosuite's microphone inverts polarity, so that a positive pressure input produces a negative-going output. While I admit that such lofty reference mikes as the B&K 4133 share this problem, I was still

An extensive manual is included.

annoyed that I had to temporarily reverse speaker connections to get impulse and step-response measurements to read the right way.

But, hey, you can't have everything, especially at the Audiosuite's price. Overall, the program and its associated hardware worked well. I am quite enthusiastic about Audiosuite 2.0 and would sincerely recommend it, to home experimenters and professionals alike, as a way to get a lot of measurement capability for the money. A

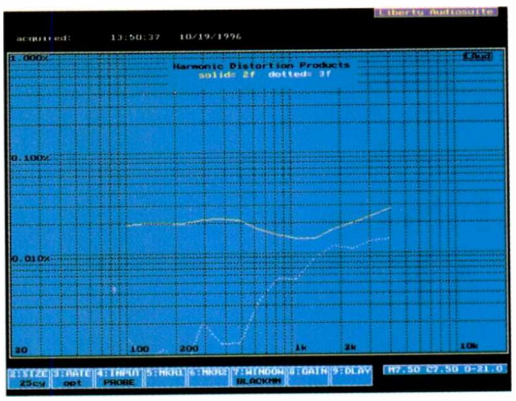


Fig. 10—Second- and third-harmonic distortion vs. frequency of filter (with bandwidth of 20 Hz to 20 kHz).

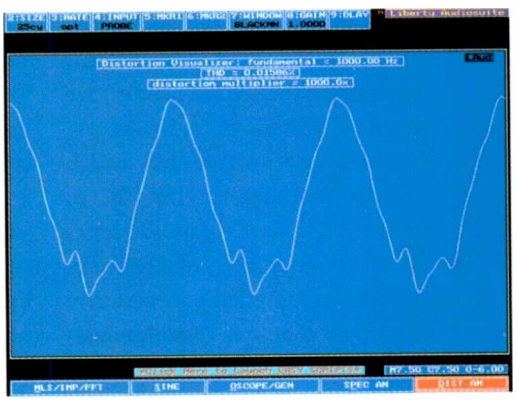


Fig. 11—THD of 0.016% on 1-kHz sine wave, magnified 1,000 times by the Audiosuite's Distortion Visualizer.

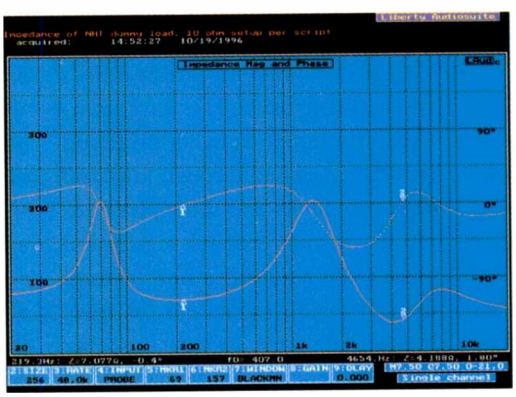


Fig. 12—Impedance phase (top) and magnitude (bottom) of dummy speaker load.

MARANTZ, *continued from page 56*

The CD-17 maintains a very quiet, deep, "black" background for music to develop from. On Lyle Lovett's "North Dakota" (*Joshua Judges Ruth*, MCA MCAD-10475), the sparse opening bars of hand percussion sounded transparent and only naturally crisp, with the decaying tail of the recording's top-quality studio reverb delivered full-length and smoothly intact. The Marantz also preserved spatial characteristics extremely well: The first moments of Janis Ian's *Breaking Silence* (Morgan Creek 2959-20023) distributes voice, hand percussion, and guitars over a fairly broad

S/N RATIO AND DYNAMIC RANGE WERE OUTSTANDING, AND DISTORTION WAS EXTREMELY LOW.

stage; the CD-17 delivered full-breadth sound with excellent stability and a very believable illusion of space and depth.

Music with wide dynamic range brought out the best in the player. A Denon recording of Mahler's Ninth Symphony (Eliahu Inbal and the Frankfurt Radio Symphony, Denon CO-1566/67) is an oldie-but-goodie that I've found a good test. This decade-old recording doesn't match the best of today's discs sonically, but it still sounds excellent on an accurate player; on less-exact hardware it can come across a bit harsh or artificial. The massive opus sounded fine via the CD-17, notably the Rondo's extensive triple forte and dense counterpoint, which maintained good definition, timbre, and natural smoothness. I also observed excellent bottom-octave sound and impact from the Marantz player during all my listening. Deep-bass character sometimes seemed a touch richer than from my everyday player.

The Marantz CD-17 is a very fine and highly musical basic Compact Disc player. Obviously, you could buy a better one, at least on paper, for two or three times the money. But I also believe that it's equally possible (and statistically more probable) that you could spend the larger sum and end up with no audible gain. Which puts the CD-17 right where it ought to be. A

AURICLE

BASCOM H. KING

GENESIS V SPEAKER

When I first heard the Genesis Vs, a year or two ago, I was enormously impressed with their sonic realism. Although they cost $14,500 per pair, including a servo bass amp, the Vs fall right in the middle of the Genesis Technologies loudspeaker line, all of whose woofers use accelerometer feedback. The Vs are of a more manageable size and weight than the models above them in the line and do not use the long ribbon midrange drivers found in the more expensive and larger Genesis models.

The Genesis V, which has four woofers, a mid/bass coupler, a dome midrange, and two tweeters, is a dipole radiator over most of its frequency range. To accomplish this, one tweeter, with its polarity inverted, is mounted on the cabinet's rear, while the 3-inch midrange and 6-inch coupler vent to the rear. Two woofers also fire to the rear but (unlike the second tweeter) are in phase with the front drivers.

The four 8-inch woofers, which handle frequencies from 16 to about 90 Hz, have composite cones made from two layers of aluminum with a damping layer in between; their total cone area roughly equals that of two 12-inch woofers. The enclosure is divided into identical sections for each of the woofers, and all four woofers are driven in parallel by a servo amplifier, which is rated at 400 watts per channel.

Company Address: 164 Railroad Ave., Minturn, Colo. 81645; 970/827-9515.
For literature, circle No. 94

The servo system uses feedback from an accelerometer mounted on the top front woofer's voice-coil former. The amp compares the signal from its front end (which has passed through low- and high-pass filters and some phase rotation) to the feedback signal and adjusts the amplifier's output until the front end's signal and the feedback signal match. Because the other three woofers are closely matched to the woofer that has the accelerometer, they all produce the same acoustic waveform in response to the processed input signal.

Besides the four woofers, the cabinet's rectangular base section holds the aluminum-cone, 6-inch mid/bass coupler, which handles frequencies from about 90 to 500 Hz. Just above the mid/bass coupler, at the bottom of the enclosure's truncated-pyramid top section, is a 3-inch midrange with a titanium/silicon-carbide dome; it covers the frequencies from 500 Hz to 3.6 kHz. Located above this driver is the front tweeter, which has a circular ribbon diaphragm and handles frequencies from 3.6 kHz all the way up to 40 kHz.

Genesis says that the V's drivers are operated well within their piston range; any breakup modes outside a driver's operating range are strongly attenuated by the crossover's filters. The drivers are all custom-made for Genesis—no off-the-shelf or modified stock drivers here!

Connections and controls are grouped at the bottom rear of each speaker system. The controls include a three-position midrange level switch and a variable tweeter level control. The Genesis V is necessarily biamped, since frequencies below 90 Hz come from the servo amp via a Neutrik high-current connector that also carries feedback to the amp. But binding-post terminals are provided for bi-wiring the rest of the system, with a toggle switch selecting single- or bi-wired operation; the latter switch position splits the mid/bass coupler from the midrange and tweeters.

The two pairs of dual binding posts, which accommodate large spade lugs or heavy-gauge wire, are the finest I've seen. What's truly elegant about them is that the collars you tighten don't bear directly on the wires—instead, they press against a clamping bar that does not rotate. This lets you make exceptionally tight connections with no fear that wire strands will squirm off the post as you tighten.

The servo bass amplifier's front panel carries a digital display but no controls. It's operated only by a remote (which also can be used with other Genesis servo bass systems and the company's Digital Lens jitter-reduction device); the amp's display

shows what function has been selected and what value you've selected for it. Up/down buttons on the remote are used to alter bass level, low-pass crossover frequency, and phase; single buttons control power on/off and the frequency of the high-pass (low-cut) filter. This frequency increases for each push of the button until it reaches its maximum; with the next push, the filter drops to its minimum frequency.

The amplifier's IEC line-cord socket, line fuse, heat sinks, and input and output connectors are on its rear panel. High-quality RCA and XLR connectors are provided for unbalanced and balanced inputs. Power and feedback connections to the woofers are made via the same type of Neutrik connectors used on the speaker cabinet.

On to the sonic experience of the Genesis Vs. You don't just plunk down speakers of this caliber, hook them up, and get audio nirvana. First, you have to break the speakers in, position them, and try them with different amplifiers and various interconnect and speaker cables. This is an iterative process that finally gets you the best sound these speakers can deliver in your room and with your ancillary equipment.

THE GENESIS Vs' IMAGING, TRANSIENTS, FREQUENCY RESPONSE, AND BASS QUALITY ARE ALL OUTSTANDING.

I first positioned the Genesis speakers where my regular speakers usually sit. Next, I started assessing the Genesis V's sound with the various amplifiers I had on hand, which gave me a chance to break the speakers in at the same time. The amps included a Crown Macro Reference, Quicksilver M135s, a Spectron 1KW, and a pair of Sonic Frontiers Power 3s. I quickly found that these speakers are fussy, or revealing, about the amplifiers they're used with and that the Spectron and Sonic Frontiers amps sounded best with the Vs. And I initially had some trouble finding the best settings for the Genesis system's servo bass amplifier, getting too much mid-bass and not enough low bass.

By the time I'd done all this, I was getting familiar with the speakers, and they were beginning to get broken in; it was time to start experimenting with their placement. I moved the Vs out into the room more and got better spatial characteristics and more correct tonality. Moving them closer together improved the spatiality, imaging, and timbre even more. By this point, I'd found which amps sounded best with the Genesis Vs and where the speakers would sound best in my room. But I still heard some high-frequency edginess, so I decided to see what effect changing the cables might have.

The listening setup I had been using to this point included a Sonic Frontiers SFT-1 CD transport feeding a Genesis Digital Lens jitter reducer. I used the Lens to feed Sonic Frontiers SFD-2 MKII and Classé Audio DAC-1 D/A converters. I used AES/EBU balanced connections in and out of the Lens, through cables I'd made up from Gepco International's Digi-Aud wire. I also used Digi-Aud wire for the balanced connections between the D/A converter and my tube line driver preamp. For these interconnects, I was using 2-foot pieces of the Digi-Aud wire. The preamp's balanced outputs were connected to the Genesis V's servo bass amplifier input via an undistinguished pair of 2-meter cables; the preamp's unbalanced outputs drove the power amplifier that fed the Genesis V's upper drivers, via 9-foot interconnects from Music and Sound (MAS) that I have been using for some time. When I listened to sources other than CD, I used a Spectron or Pass Laboratories Aleph-P preamp in place of the line driver. The power amp was connected to the Genesis Vs through a 6-foot pair of Cardas Hexlink that I've used for quite a while.

At about this point, I started to think about changing digital interconnects in hopes of ameliorating the high-frequency edginess I was hearing. I first tried some digital interconnects from Audient Technologies. When I originally used these cables, while listening with B&W 801s, I had not particularly liked them; they made the system sound edgier and less real. But this may have been because I had not yet broken these cables in. When I tried one between the output of the Digital Lens and the D/A converter while listening with the Genesis speakers, the presentation became very noticeably more musical. Yet some irritation still remained. Arnie Nudell of Genesis suggested I try Illuminati DX-50 AES/EBU cables from Kimber Kable; when I put in a pair, things really started to fall into place. Now the sound was amazingly good. Depth, dimension, and space were better than I had ever heard, and the level of musical believability was at an all-time high. With these cables, all of the power amps sounded more musically acceptable to me, though they still sorted out in the same order as before. (Interestingly, when I put some Russian Svetlana 6550C output tubes into the Quicksilvers, they began to sound more like the Sonic Frontiers Power 3s, which use those tubes.) I got a further improvement by substituting new interconnects and cables from MIT and Transparent Audio. Putting an Audio Research LS22 balanced line preamp into the system made it better yet (it's the best preamp I have heard in my system to date).

So what do the Genesis Vs sound like after all this tweaking? In a word, wow! Imaging is very specific, soundstaging is wide and deep, frequency response is very smooth, instruments sound like they are supposed to, transient detail is amazing, dynamics are startling, and bass quality, quantity, rhythm, and pace are outstanding. The space and air around instruments are superb. Most important, with appropriate recordings it sounds as if you have a window into the space where the performers are. You are there or they are here, however you prefer to look at it.

This has been an exciting adventure into state-of-the-art audio for me. I finally achieved sound so musically satisfying and realistic that I'm going to have a hard time accepting anything less. Communication with the music can get to such a satisfying—sometimes overwhelming—level with this kind of reproduction! If I hadn't appreciated the importance of good cables in achieving overall realism, I wouldn't have gotten to the level that I did with the Genesis Vs. But the speakers themselves deserve most of the credit. For one thing, they act like a magnifying glass that throws these cable differences into sharper relief. The Genesis Vs are truly state of the art. Try to hear a pair at a dealer who knows how to demonstrate their full potential. A

AURICLE

COREY GREENBERG

NAD 512 CD PLAYER AND 314 INTEGRATED AMP

Amazing Yet True Hi-Fi Tale™ No. 69: On a recent visit to a well-known high-end loudspeaker manufacturer to hear its latest flagship models, the sound in the company's main listening room just wasn't happening. They'd measured and remeasured the bejesus out of the new speakers, but this was the first time they'd actually fired them up in that room, and it was clear something was seriously wrong.

Given the company's pedigree, I knew these speakers had to sound better, so I checked out the rest of the rig. An Arcam CD player: cool. Bryston muscle amps: cool. Audio Research LS2B tube preamplifier: Suddenly my spider sense tingled, and squiggly red heat lines shot from my head like snakes from a barrel. The ARC is well liked by many audiophiles, but I hadn't had good luck with this particular preamp. To my ears, it dulls the top end and adds an opaque, congested quality to the midrange. And that's exactly how this system sounded, to the manufacturer's clear dismay.

I saw another preamp sitting in the corner, so I asked the techs if we could try it instead. We swapped the preamps, fired the new one up, and within a few minutes of warm-up the system sounded much cleaner and more musical. The speakers sounded like legitimate high-end monitors, and everyone was smiling.

So what *was* this mystery preamp, you ask? Okay, so I lied. It wasn't really a preamp; it was the preamp section of a five-year-old budget NAD integrated amp. (Sorry, ARC. Can you send me your $30k monoblocks anyway?)

I relate this Amazing Yet True Hi-Fi Tale™ because I've been living for the past few months with NAD's latest giant killers, the $399 Model 314 integrated amp and the $349 Model 512 single-disc CD player. Man, is this hi-fi after my own heart! Simple, cheap, unassuming little dark gray boxes that hide more musical-sounding circuitry inside than anything else I can think of for anywhere near the same green. When I auditioned their predecessors, the $380 NAD 304 integrated amp and the $300 NAD 502 CD player three years ago, I thought they couldn't be beat for the money. But these new NADs are even better, and for just 70 clams more than the old combo! Let's all raise a glass to the poor bastard in the marketing department at NAD who got canned for getting the prices wrong when he sent the brochures out to the printer. And let's hope he lands on his feet real, real soon, preferably at my local

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It's not often I describe hi-fi gear as being "fun," but the NADs *are* fun. They're fun to listen to and fun for me to recommend to anyone who's ever picked up a hi-fi mag, done a Danny Thomas spit take at the prices of this stuff, and figured he'd just have to do without real high-end audio this go-round. Because for 750 measley clams, all you have to do is add a good pair of speakers and you've got high-end sound. Not "entry-level high end," not "Class-C (provisional, pending DA's Formal Reappraisal, to be published sometime this year) high end." *Real* high-end sound. Better sound than any of the retro tube geeks are getting, I can assure you. And better sound than anyone with Shun Mooks in his listening room and/or a monocle is getting, I can promise you that. These NADs are the real deal, and anyone who laughs them off as not-quite-high-end will be missing out on two of the greatest steals in all of hi-fi.

IT'S NOT OFTEN I DESCRIBE HI-FI GEAR AS FUN TO LISTEN TO, BUT THE NADs ARE FUN.

The 314 integrated amp is the updated version of NAD's 304, its best-selling budget box of several years ago. The new NAD enjoys subtle circuit improvements and better parts, but we're still talking the same basic concept: a cute li'l 35-watt-per-channel integrated with a killer preamp section, a lively and clean amp with enough short-term beef to sound much more commanding on actual music signals than the spec implies, and no attention whatsoever paid to making the volume control feel heavy and reassuring, the front panel thick and gleaming, or the RCA connectors good and golden (even though the phono and CD inputs are gold—not those big, jutting jewelry jacks that warm my cockles, but gold nonetheless). Every red cent of the 314's $399 price but one goes into making it sound great on the inside. Then NAD takes that last penny and bites on it like Underdog. The company doesn't even spend that penny on a shiny chassis finish or a cool, severe logo; it gnaws on it and then puts it back into its pocket. Because that penny must be the only profit NAD ever sees from this box.

When you put them together, the NAD 314 and 512 make the ultimate affordable audiophile system. Normally you have to junk whatever rig you started with when it's time to get real in hi-fi, but this NAD combo is fully upgradable in every possible dimension. Say you want to start in stereo but eventually move up to multichannel surround sound. Unlike most budget integrated amps, the NAD 314 has separate preamp outputs and power amp inputs, so you can hook up something like the $700 Marantz DP870 Dolby Digital surround processor and turn the 314 into an AC-3-ready home theater control center. And, of course, you can use the pre-out/amp-in jacks to connect the NAD's excellent preamp section to a more powerful amplifier when you move on up to that de-luxe apartment in the sky-yi-yii.

Even so, I have to say that the 314's 35-watt amplifier section sounds impossibly loud for its rated spec. When I first got it, the 314 did duty in my bedroom system, driving a pair of big, inefficient AR 303 acoustic-suspension speakers. And even though this system has but one job, to blast The Stooges' *Funhouse* so I can get moving in the morning, the NAD 314 never broke a sweat or sounded strained in any way. These have got to be the meatiest 35 watts I've ever heard, and I didn't even have to switch on the NAD's "soft-clipping" circuit, which smooths clipped musical peaks but murks the sound up noticeably. The 314, like NAD amps before it, sounds better with this switch turned off.

The 512 CD player offers its own upward spiral as well. If the upgrade bug ever bites you down the road (or anywhere else on your person, for that matter), the 512's digital output will turn it into a high-quality CD transport. I hitched the 512 up to a Meridian 563 D/A converter, and in no way did the sound suggest that the $1,395 processor was hamstrung by the $349 NAD.

But don't automatically assume that any of the cheap, entry-level D/A converters are going to improve on the sound you get from the 512's own audio outputs. Unlike any other $350 CD player I know of, the 512 not only has premium Signetics 5532 op-amps in its analog audio section but also a DC-coupled output circuit, which means no low-grade coupling caps in series with the signal path. All of this adds up to a clearly better-sounding CD player than anything else I've heard for the money. If you want CD sound that's significantly better, you're going to have to pony up the dough for at least something like Theta Digital's excellent $675 Chroma D/A converter. (I cannot tell you how many calls and letters I've received from owners of the NAD 502 who bought cheap outboard D/A converters and sheepishly admitted that the sound got worse. And the 512 sounds even better than the 502 did.)

Believe me, this is no "tide me over till I get the Benson & Hedges account" CD player. Neither is the 314 a cheap 'n' cheerful substitute for "real" electronics. These are true audiophile components that sound cleaner and smoother than mass-market CD players and receivers and better even than many expensive audiophile separates. Right now, the NADs run in my home office, driving a $350 pair of NHT SuperOnes flanking my PC monitor. If I'm getting hit right in the puss all day long with music, it better sound great or it's going to irritate the hell out of me. With the NAD/NHT rig, I'm listening to high-end sound all day long and loving every minute of it.

Taken on its own, the 314 integrated amp sounds very neutral and accurate. It doesn't warm over the top end, like many of the British integrateds do, and it doesn't hype the treble into a keening wail, like some of the Japanese budget amps do. The NAD's bass, in particular, is really nice. The low end is the one area where budget amps tend to sound small and lean, but the 314's bass is tight, well defined, and all there. No doubt its EDP (Extended Dynamic Power) circuit, which switches over to a higher power-supply voltage rail for brief signal peaks, enables the 314 to sound like a much bigger amp than a 35-watt rating would normally suggest. (And the rating may be, in classic NAD fashion, very conservative.)

The real star of the show is the 314's preamp section. NAD has always been known for using simple, great-sounding discrete circuitry in its preamps, even in its budget integrateds (which is why you can pull the kind of trick I did at the loudspeaker

demo). They're just damn-good, no-funny-stuff, very neutral preamps. And the 314 continues this tradition. Its discrete-circuit line stage is as good as or better than gear costing many times the 314's price, and it makes a difference you can easily hear. Believe it or not, the NAD's line stage sounds better than the one in the $4,000 Citation 7.0 surround preamp I normally use in my system. Image focus is more precisely defined, and the top end is slightly cleaner. The Citation's an excellent-sounding preamp and does magical things with surround sound that no other preamp I've used can match, but I wish its line-level stage sounded as clean as the NAD's.

Even the 314's phono stage, at best a cheap op-amp-based throwaway circuit in most budget gear, is a fully discrete design that has high-quality film caps, low-noise metal-film resistors, and an isolated power supply. When I plugged my Rega Planar 3 turntable and Sumiko SHO cartridge into the NAD's phono stage, the playback was smooth, clear, open, and totally musical. The NAD's internal phono section sounded a lot better with my Rega/Sumiko setup than Audio Alchemy's $259 VAC-in-the-Box external phono stage did. Fed to one of the 314's line-level inputs, the AA sounded hard and tizzy, compared to the NAD, and a lot leaner in the bass. In fact, the NAD's phono section came quite close to the quality of sound I get from McCormack Audio's excellent $495 Micro Phono Drive, the external phono stage I use in my reference system. The NAD's highs weren't quite as pristinely clean as the McCormack's, and the low end was stronger and more tightly defined via the more expensive phono section, but the NAD's got a phono stage I could definitely live with. It sounded clearly better than the VITB and is easily worth the entire price of the 314.

THE NAD'S LINE STAGE IS AS GOOD AS OR BETTER THAN GEAR COSTING MANY TIMES THE 314'S PRICE.

I should tell you about something I tried that really made a significant improvement to the sound of the NAD combo. Now, I'm not big on tweaks anymore; I used to be up for trying just about any tweak that came down the pike, no matter how kooky it seemed, but so few of these geegaws made any kind of real sonic difference that I pretty much stay out of that mess now. (The whole $50 magic drink-coaster scam that's so in vogue right now with the hardcore geek elite kind of sealed that meal for good, as far as I'm concerned.) But after a few equally tweak-free friends raved about the sonic improvements they were getting from Townshend Audio's Seismic Sinks, I figured what the hell—the company's down in Texas, so that's a good sign right there: I haven't eaten Mexican food worth a tinker's damn since I moved to L.A. two years ago, so I welcome anything postmarked "TX" with open arms.

The Seismic Sinks are isolation bases you sit your gear on, with an inflatable inner tube sandwiched between two steel plates. They come with a little bicycle pump, and the idea is to fill the Sinks with just enough air to float your gear on a compliant cush-

ion, but not too much air or else the compliance of the suspension won't be high enough to isolate your equipment from physical vibration.

Townshend sent me its He-Man jobs, big $350 1-Std. Sinks with little red LEDs on the front that blink if you need to give the Sink a puff or two, and that's what I started out with under all my usual gear. But even though I heard some nice improvements in low-end weight and definition, the real shocker was when I tried, almost on a lark, Townshend's budget $150 CD Sink (no LEDs, so you have to eyeball the right inflation) under the two stacked NADs (the amp on top of the CD player).

Man! This made the biggest difference of all. Even though I also got good results with a $50 set of four Navcom rubber pucks under the NADs, the CD Sink was unquestionably the better-sounding geegaw to stick under them. If the 314 and 512 sounded impressive before, now they sounded all out of proportion to their combined 750 clams. As with my reference gear, the most noticeable difference was in the bass: Sitting on the budget Sink, the NADs gained a stronger and meatier low end, with greater power and clarity. Other things, like image focus, got subtly better, but the most obvious boost was a bigger, better, more coherent low end that came embarrassingly close to the sound of my Theta/Citation/Aragon electronics. As a reformed tweakaholic, I'm almost depressed at how much the budget Sink improved the sound of the NADs, but if you can stretch your scratch from $750 to $900, I totally recommend the CD Sink for squeezing the most performance out of these budget NADs.

There has never been a better time to be an audiophile on a real-world budget. When I first caught the hi-fi bug, you needed to spend many thousands of dollars to get the kind of smooth, clean, naturally musical sound that the $399 NAD 314 integrated amp and the $349 NAD 512 CD player deliver. Add a good pair of $350 speakers like the NHT SuperOnes or the Paradigm Mini-Mk3s, stack the NADs on a $150 CD Sink, and I'm telling you, you're going to flip out over what you'll hear. If you're just starting to get serious about hi-fi, or if you're coming in from the cold after years of getting *too* serious about it, this is the stuff you need to own. A

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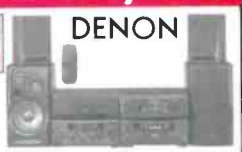

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AURICLE

LEN SCHNEIDER

COINCIDENT DIGITAL MASTER SPEAKER

Photo: Michael Groen

Old MacDonald's audio farm has produced some strange harvests lately; witness the recent bumper crop of single-ended triode amplifiers. Unfortunately, this retromutation has caused a small-scale musical famine, as most speakers just murmur politely when tickled with the low-power output delivered by many of these watt-not designs. But, given their popularity among some avant-garde practitioners of the audio art, it was inevitable that designers would soon offer speakers with the high efficiency and benign impedance curves demanded by these little glowing gremlins.

A case in point is Coincident Speaker Technology's Digital Master, a smallish two-way, stand-mounted loudspeaker with some interesting qualities. Available in a variety of veneers in addition to its standard black-lacquer finish, the Digital Master measures 18 inches tall x 11 inches wide x 16 inches deep. Lest you think "box," be advised that this enclosure has no parallel surfaces and looks, uh, different. It has an 11- x 16-inch footprint and narrows to 8 x 11 inches at the summit. But you can't even rest a wine glass on it because the top surface slopes down to meet a backwards-canted, fully finished front baffle that's beveled to help minimize diffraction. Coincident calls the design AWE (Asymmetrical Wall Enclosure) and claims that it, along with the absence of internal bracing and damping material, eliminates internal standing waves and sonically destructive reflections.

This version of the AWE enclosure also eliminates any grille covering, revealing the drivers in all their unprotected splendor. Although this helps improve high-frequency dispersion, Coincident recognizes that some people may not like the look and thus provides foam covers that attach with Velcro.

The Digital Master's drivers, though relatively conventional, are carefully matched. For the ferrofluid-damped silk-dome tweeter, Coincident claims a 30-kHz upper limit. Bass/midrange reproduction is left to an 8-inch polypropylene woofer driven by a 2-inch voice coil situated in the gap of a large, 5½-pound magnet structure. The basket is a magnesium casting, and the surround has been optimized for use in the vented enclosure.

The speaker's crossover is a first-order (6-dB/octave) Butterworth alignment at 2 kHz and consists of just two components, a polypropylene cap in series with the tweeter and an inductor on the woofer leg.

A single set of gold-plated binding posts, thankfully unrecessed, makes amplifier connections easy. The crossover design doesn't support bi-wiring, so there are no additional terminals or jumpers to juggle. The only other rear-panel element is the reflex port.

Finish, if the mahogany samples I auditioned are any indication, is good and should withstand casual cleanings. Although I had to remove residue from adhesive tape securing protective Styrofoam rings around

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the tweeters (a somewhat crude packing technique for speakers selling for $1,995 per pair!), the enclosures were not affected by the recommended solvent.

Coincident suggests a 50-hour break-in period for the Digital Masters before attempting serious listening. I complied, placing the speakers face-to-face and driving them out of phase with a continuously repeating complex sweep tone from a "system burn-in" track.

As I began to play music, I experimented with room placement and did not find any unexpected anomalies. The Digital Masters were quite happy in the same spots where I've placed many small dynamic speakers over the last few months. They ended up about 3½ to 4 feet from the back wall and 5 feet apart, with the midpoint between the two offset toward the right of the room. One hint: Don't place the Digital Master (or any other stand-mounted speaker, for that matter) so that the distance from a side wall to the woofer's center point is the same as that from the floor to the woofer. If you do, you'll probably reinforce room standing waves to the detriment of lower-midrange clarity. Toe-in, at least in my room, didn't much change tonal balance or imaging, so I aimed the speakers straight ahead. I suspect that the tweeter's relatively even dispersion and the beveled baffle's shape contributed here.

I'm not convinced that single-ended triode amps offer the sonic salvation claimed by their advocates, so I disregarded Coincident's repeated references to the synergy resulting from using such an amp with its speakers. Instead, I used two solid-state amps: a pair of Rotel RMB-100 MOS-FET monoblocks and a slightly older Adcom GFA-555II bipolar behemoth. Neither the Rotels nor the Adcom caused any hemorrhaging (internal or external) of the Digital Masters, despite my rather cavalier approach to volume control.

The Digital Master's high sensitivity (rated at 91 dB) proved a real benefit. Even at high volume, I had no sense of the system strain that often clouds less well-matched combinations. Because the Adcom's brute power, a requirement with many gourmand-appetite speakers, was totally unnecessary, I quickly went to the less-etched-sounding Rotel amps for the balance of my listening sessions.

If there's any one track that reveals dynamic compromises, it's the (in)famous "Tricycle" from the Flim & The BB's album of the same name. About a year or so ago, dmp's Tom Jung remastered the original 1982 recording and released a limited-edition disc (dmp Gold-9000) that is significantly better in many ways than the original. The Digital Master speakers rendered the initial drum and synthesizer shots with impressive delineation and body. High frequencies, particularly the nicely syncopated stick work on hi-hat cymbals, were also well presented. Further on, the speakers did justice to Flim Johnson's Alembic bass as he ran through some upper-fret gymnastics (listen particularly to the segment beginning at 1:27). On the downside, I did miss the bottom octave. Track 1 has significant content below 60 Hz that the Digital Master did not render clearly. To its credit, however, the speaker did not appear to shroud this lack with an artificial mid-bass peak. (Cellos, for example, were reproduced with natural timbre.) For those who say that small speakers can't be expected to descend to the musical basement, I can only point to a few (Platinum's Solo, for one) that will go significantly lower than the Digital Master, but they demand far more powerful amplifiers. In the world of speakers, there's no free lunch!

EVEN WITH THE DIGITAL MASTER AT HIGH VOLUME, THERE WAS NO SENSE OF SYSTEM STRAIN.

Further listening, this time to Stravinsky's *The Rite of Spring* (Reference Recordings RR-70CD), brought other elements into clearer focus. The Digital Masters convincingly conveyed the brassy, urgent stridency of "The Sacrifice." While maintaining orchestral coherency, these Coincident speakers unraveled the complex interplay between violins and brass very well. If there was a question, it centered around the Digital Masters' ability to recover from each of the successive tympani strikes beginning at 7:14. To my ears, low-frequency bloom was a bit restricted.

An old favorite, The Eagles' "Hotel California" (from *Hell Freezes Over*, Geffen GEFD-24725), revealed a minor midrange anomaly: The audience recognition (primarily handclapping), which begins at 1:20, sounded slightly more hollow than with some other speakers. Although that was a difficult test, I was somewhat surprised to note how quickly this became apparent.

Imaging was acceptable if not spectacular. Lateral spread was very good. The Digital Master anchored things so well that side-to-side movement produced only moderate shifts in the aural canvas. Depth was slightly less impressive, as the speaker tended to foreshorten the rear soundstage. This was not a major failing, however, as "Witchi-Tai-To" (on Oregon's *Beyond Words*, Chesky JD 130) placed Paul McCandless' penny whistle and soprano sax slightly outboard and far enough behind the right speaker so that they did not "crowd" other instruments. And within its lower frequency limits, the Digital Master projected Glen Moore's upright bass in a dynamically convincing and coherent manner on the same track.

I found the Digital Master a dynamically pleasing loudspeaker. Its ability to present small level differences accurately, without destroying musical integrity, makes it a member of an exclusive club. Its overall character is essentially neutral through the critical midrange, although it did appear to have a somewhat reticent quality about the frequencies immediately above—fret noise on acoustic guitar, for example, was a bit subdued. High frequencies were very extended and exhibited only a trace of stridency when hit with high-level transients, such as brass fanfares.

Although you might want some augmentation for extended low-frequency reproduction, matching this speaker to an ordinary subwoofer may be difficult, as it is clean and reasonably articulate to about 60 Hz. But the Digital Master is relatively easy to position in a room, and its driver complement and shape combine for imaging that will let you focus on individual threads in a complex aural tapestry. That ability, along with a penchant for making the most of whatever amplifier power is available, places the Coincident Digital Master in a rather elite category. You owe yourself a careful listen. A

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—James Schillinger
Audio Video City
Santa Maria, CA

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—John Flanner
Flanner's Audio & Video
Brookfield, WI

Flanner's Audio&Video

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—Tom Bartee
Wright's Sound Gallery
Shreveport, LA

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—Gord Tranter, Pete Edwards
Brack Electronics
Toronto, Canada

BRACK electronics

CLASSICAL RECORDINGS

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Mozart: String Quartets, Vol. III (K. 499, K. 159, and K. 575)
The American String Quartet
MUSIC MASTERS 67160
CD; 58:29
Sound: A–, Performance: A

Dvorák: Piano Quintet in A, Op. 81; Schumann: Piano Quintet in E Flat, Op. 44
Alban Berg Quartett; Rudolf Buchbinder and Philippe Entremont, piano (on Dvorák and Schumann, respectively)
EMI 5 55593, CD; DDD; 69:06
Sound: A+/A–, Performance: A

Haydn: String Quartet, Op. 76, No. 5; Corigliano: String Quartet
The Cleveland Quartet
TELARC 80415, CD; 53:42
Sound: A–, Performance: A

These three recordings are excellent musically and sonically, but what different varieties of excellence! The only thing they have in common is that all were made in halls noted for their sonic effulgence. But they are so close-miked that, if you aren't paying attention, you may think you're hearing exceptional studio recordings.

The American String Quartet, playing a "matched" set of Stradivarii loaned by the Smithsonian Institution, turns in wonderfully poised, clean performances of one early Mozart quartet plus two fine mature examples. The Purchase, N.Y., hall yields luscious results, as other recordings prove. Perhaps this CD's sonic reticence is consonant with the tight focus the quartet has on the music, but I would have preferred a touch more velvet.

The Alban Berg Quartett is at the other extreme, playing with a tremulous emotionalism that is almost overwrought at some moments in the Dvorák. The passion is disarming, however, as is the sound in this piece, which was recorded in the Vienna Konzerthaus in 1993. Yet when the Schumann begins, we are in a distinctly different sonic world: Carnegie Hall in 1985. The relatively thin, spatially undifferentiated miking puts the players at a distance without a strong surrounding ambience; the Vienna pickup seems to place the performers in your listening room. The audiences in both live recordings are mercifully silent until the final, well-deserved applause.

The Cleveland Quartet, in what is billed as "The Farewell Recording" now that the group has disbanded, was nothing if not a virtuoso ensemble. This quartet's phenomenal articulation almost convinces me that the breakneck prestissimo at which it takes the Haydn finale actually makes sense. And John Corigliano's String Quartet, written with the Cleveland in mind, demands just such virtuosity. I've heard enthusiastic reports about the Worcester (Mass.) Mechanics Hall, but little of its acoustics show through Telarc's miking.

Robert Long

HINDEMITH

Ludis Tonalis and Suite "1922"
John McCabe, piano
HYPERION CDA66824
CD; DDD; 69:23
Sound: A, Performance: A

"Ludis Tonalis" (which translates as the game of tones or the play of tone) is to our times what Bach's "Art of the Fugue" was to his—a bit more playful perhaps but a similarly exuberant exploration of musical means. The Suite is an early work that is fun in a different way. John McCabe's immaculate playing comes complete with the necessary wit, and Hyperion's equally immaculate sonics have just the right sense of intimate space. If you're not afraid of intellectual fun and games, go for it.

Robert Long

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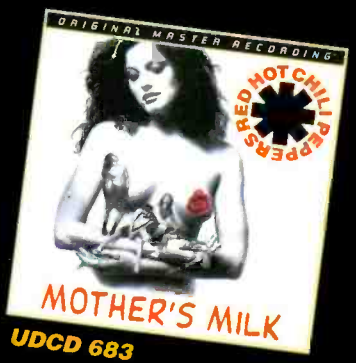

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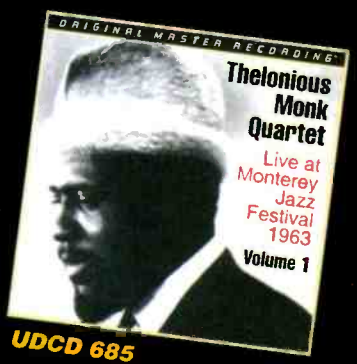

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Placido Domingo, tenor; Veronica Villarroel, soprano; Juan Pons, baritone; Orquesta Sinfonica de Madrid, Antoni Ros Marbà
AUVIDIS VALOIS V 4759
Two CDs; DDD; 1:21:12
Sound: A, Performance: A

Franz Lehár's operettas have attracted superstars like Elisabeth Schwarzkopf and Fritz Wunderlich, while Federico Moreno Torroba's zarzuelas have had to settle for lesser lights. Until now. The full-blooded performances and Torroba's delightful music are captured in appropriately stage-like sonics and accompanied by a quadrilingual libretto, which includes synopses of omitted dialog. *Olé!* *Robert Long*

Michael Murray: Bach at Zwolle (works for organ)

Michael Murray, organ
TELARC CD-80385, CD; 72:51
Sound: A, Performance: A+

Michael Murray, one of the world's foremost organists, is particularly known for his interpretations of Bach. This CD not only exhibits the genius of both composer and performer but also provides an interesting contrast between two different organs from Holland containing pipes that predate Bach himself.

The major works—Preludes and Fugues (BWV 532, BWV 548, and BWV 534), the Toccata and Fugue (BWV 540), and the Fantasy (BWV 735)—were performed on the great Schnitger organ at St. Michael's Church in Zwolle, the Netherlands. The sound is massive, energetic, and commanding, especially in the Prelude and Fugue in F Minor, "The Great." Murray is not afraid to play Bach with powerful emotion, and he opens this work with a drama that is almost operatic.

The three chorale settings are less bombastic and reveal more of Bach's spiritual side. The last piece, "Before Thy Throne I Now Appear," was dictated by the composer on his deathbed. The creation of this ethereal work was described by Albert Schweitzer: "In the manuscript we see all the pauses that the sick man had to permit himself; the drying ink becomes more watery day by day; the notes written in the twilight, with the windows closely curtained, can hardly be deciphered."

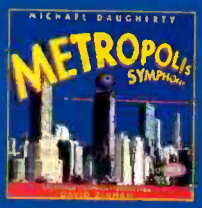
This disc is excellent for experiencing the many facets of Bach's favorite instrument. Murray performs with the ease and authority that the composer himself might have displayed in the organist's role. When an acquaintance once remarked on Bach's wonderful skill as an organist, his characteristic humility and wit came through in the simple reply, "There is nothing very wonderful about it; you have only to hit the right notes at the right moment, and the instrument does the rest." *Patrick Kavanaugh*

Michael Daugherty

Metropolis Symphony and Bizarro

Baltimore Symphony Orchestra, David Zinman
ARGO 452 103, CD; 51:56
Sound: A, Performance: A

In Michael Daugherty's large family in Cedar Rapids, Iowa, nearly everybody is a professional musician, and his background encompasses jazz, rock, and electronic music as well as serious composition studies. American pop culture provides the titles and inspiration for most of his music: His previous works have dealt with such icons as Elvis, J. Edgar Hoover, and "I Love Lucy."



The 1988 celebration of the 50th anniversary of Superman's first appearance in comics was the stimulus for the Metropolis Symphony. Although not programmatic, its five movements present various aspects of Daugherty's emotional response to the Superman character. "Lex," the first movement, has a fiendishly difficult violin part representing Superman's diabolical foe, Lex Luthor. The second movement, "Krypton," mixes fire bells and more standard percussion as it grows toward a deafening climax. (Krypton, that's Superman's exploded planet. And Daugherty claims the work is not programmatic.) The final movement is "Red Cape Tango." Via use of the familiar "Dies Irae" theme, it honors Superman's fight to the death with an adversary.

Filling out the album is "Bizarro," another Superman-inspired composition, sparked by dastardly Lex Luthor's creation of a faux Superman in an alternative world. The brash and zany work drops the string section and uses three rock drummers.

David Zinman and his players never lose the musical fun in these complex scores while giving them the professional accuracy required. With all the percussion and unexpected instrumentation, this is also a great demo CD. *John Sunier*

Handel: 12 Concerti Grossi, Op. 6

Orpheus Chamber Orchestra
DEUTSCHE GRAMMOPHON 447 733
Three CDs; 2:43:54
Sound: A, Performance: A+

George Frideric Handel wrote few concertos until he deliberately set out to counter the acclaim of the concerti grossi of his rival, Francesco Geminiani. With Opus 6 of 1739, Handel established himself as a master at this Italian genre, which placed a small group of two violins, a cello, and a continuo against a larger body of strings with separate continuo. He even copied Italian title practice by calling his pieces 12 Grand Concertos.

This year is the 25th anniversary of Orpheus, one of the finest chamber orchestras performing today. The 26-member, self-governing ensemble was founded by musicians aspiring to perform the chamber orchestra repertory without a conductor. The results are evident in most of its 40+ recordings. The vital and energetic style and sound give the impression that each Orpheus member is really listening to the others and intent on achieving the best ensemble sound rather than avoiding a conductor's ire. It only takes comparisons between the Orpheus Chamber Orchestra and other ensembles to recognize that many other groups sound like they are playing in their sleep.

Most of these 12 concertos open with a slow movement and have four to six short movements. Contrapuntal movements are balanced with sprightly or stately dance-based ones. References to other works—such as by Vivaldi and Corelli, Handel operas, and organ concertos—can be heard. The Opus 6 is surely one of the Handel's major instrumental statements, and this set offers a not-to-be-missed recording of it. *John Sunier*

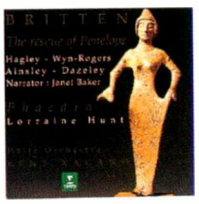
Britten: The Rescue of Penelope; Phaedra

Lorraine Hunt, soprano (on Phaedra); Janet Baker, narrator (on Penelope); assisting artists; Hallé Orchestra, Kent Nagano
ERATO 0630-12713, CD; DDD; 51:09
Sound: A, Performance: A

This is a remarkable album. Two concert dramas, so to speak, both on ancient Greek themes but realized through the distinctive musical vocabulary of Benjamin Britten and both with connections to Janet Baker. Here

s e narrator in a concert version of a 1943 radio dramatization of Ulysses' return to Ithaca; the cantata *Phaedra* was written for her in 1975, when Britten was an invalid following heart surgery. The CD thus has coherence, despite the time span. It also fills an important niche in the Britten discography, particularly since it includes the first recording of *The Rescue of Penelope.*

Penelope is the more immediately attractive of the two. It is full of wonderful sonic images and devices, as befits a radio broadcast that the listener presumably had only one shot at (although, in fact, it was revived by the BBC at least twice). *Phaedra* is much more complex, both musically and psychologically, even though it is much shorter: a distillate, indeed. Neither is a piece for casual listening, but both are absorbing—thanks in no small part to the text of Edward Sackville-West (*Penelope*) and Robert Lowell's verse translation of Racine's *Phèdre* (in the cantata). Both are supplied with German and French translations.



It's hard to see how the performances or the recording might be bettered. Kent Nagano is a compelling interpreter of this music. Baker's narration strikes just the right tone, and her "backup" singers are well chosen. In *Phaedra*, the cantata written for Baker, Lorraine Hunt is brilliant. The soundstage is convincingly used, though Erato makes no mention of the venue. *Robert Long*

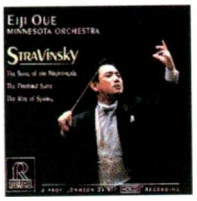
Stravinsky: The Rite of Spring, The Firebird Suite, and The Song of the Nightingale

Minnesota Orchestra, Eiji Oue
REFERENCE RECORDINGS RR-70CD
CD; 73:57
Sound: A, Performance: A

The great works Igor Stravinsky composed for Serge Diaghilev's ballets are now so universally admired that we tend to forget the scandalous sensations they provoked at their premieres. The audience's rioting at the first performance of *The Rite of Spring* is legendary: In the middle of the maelstrom, Saint-Saëns huffed out of the theater in disgust, Capu screamed that the music was a huge fraud, and Ravel shouted "Genius!" Roland-Manuel boldly defended the music and got his collar torn from his shirt, while Debussy pleaded futilely with everyone to quiet down so that he could hear.

One of these works' greatest innovations is the composer's elevation of the orchestra's percussion instruments to an equal footing with the string and wind instruments. Not only is the percussion section enlarged in number and featured throughout (particularly in *The Rite*), but the music's savage rhythms overshadow much of its melodic and harmonic content.

This rhythmic emphasis is strongly highlighted by Eiji Oue and the Minnesota Orchestra. Indeed, in some movements of *The Firebird Suite*, you almost believe you are standing among the busy percussionists. The bass response is so forceful in places (such as the final pages of *The Rite*) that you begin to feel like your head is inside the bass drum! Doubtless, this was both Oue's and Stravinsky's intention. The conductor's tempos are generally faster than usual, but this allows him to exhibit well-placed ritards in dramatic moments (such as in the final chords of *The Firebird*).



The sound quality of this HDCD recording is very convincing. The opening bass lines of *The Firebird* are the perfect test of the low end of any audio system.

The Minnesota Orchestra has produced a world-class recording. From *The Song of the Nightingale*'s lyricism to the precision of the difficult chords in *The Rite*'s final movement, the musicians play with tight ensemble and uniform clarity of line. They have risen to Stravinsky's challenge: "It is precisely because I consider all of the instrumentalists to be equally important that I write difficult music for each one of them." *Patrick Kavanaugh*

Bellini and Wagner: Opera Scenes

Jane Eaglen, soprano; The New Company and Orchestra of the Age of Englightenment, Mark Elder (in Bellini); Orchestra of the Royal Opera House, Covent Garden, Mark Elder (in Wagner)
SONY CLASSICAL SK 62032
CD; DDD; 78:38
Sound: A, Performance: A to B

Bellini and Wagner?! In the notes, music critic Richard Dyer labors long to convince us that the coupling is a natural—but in vain. Soprano Jane Eaglen would have to do both composers' works superbly to justify the mix of scenes from Vincenzo Bellini's *Il Pirata*, *Bianca e Fernando*, and *Norma* ("Casta diva"—what else?) with the predictable bits from Richard Wagner's *Tristan und Isolde*, *Die Walküre*, and *Götterdämmerung*. She certainly is good, but not sufficiently individual and compelling to make the concept stick. Mark Elder's conducting is fairly routine; the Covent Garden orchestra does a more polished job of realizing his intentions than do the forces for the Bellini. *Robert Long*

ROCK~POP RECORDINGS

Photograph: © 1996, Jill Greenberg

Animal Rights

Moby

ELEKTRA 4-61937, 77:49

Sound: A–, Performance: A

From boisterous, terrifying power to placid, New Age etherealisms, the yin and yang of Moby's music can grip, assault, and impassion. Whether ranting like a delirious punk rocker or writing a love song to his mother, he fills his songs with a surfeit of intense and compelling emotions. Moby's sad songs can choke you up with their almost immediate appeal to the heart, while his mad songs will have you pumping your fist in the air. (Emotional subtleties are at a minimum here.)

Everything Is Wrong, Moby's full-length debut and one of the best albums of 1995, succeeded because of the same raw alchemy of heavy industrial bluster daubed with serenity. But just when you thought Moby would trump Trent Reznor with a seething electronic polemic of his own, *Animal Rights* pulls a quick U-turn and heads toward a more organic, rather than electronic, direction. It's an ironic about-face. Just when you thought, and rightfully so, that electronic music of all stripes would be the wave to carry pop music into the 21st century, Moby abandons his own electronic ship, choosing instead an instrument believed to be rapidly dying out: the guitar.

Moby floods at least half of *Animal Rights* with his furious punk-inspired guitar. On "Someone To Love" he hammers out Buzzcocks-style power chords; "You" suggests the late Jeffrey Lee Pierce and The Gun Club; and "Heavy Flow" and "Face It" sound like vintage Butthole Surfers. He even covers one of the most enduring post-punk guitar anthems, Mission of Burma's "That's When I Reach for My Revolver," the album's first single. Shot through with (anomalous) guitar solos and simple percussion tracks, Moby's hard rock lunges at you with ferocity, anger, and adrenaline.

Moby can also kill you with kindness. For every cranky electro-punk anthem, there's a sweeping, classically inspired instrumental. The cello on "Now I Let It Go" reaches to the heavens with sadness and melancholy, "Living" moves in lovely ripples along a touching central theme, and "Alone" is an entrancing ambient work that reveals elegant keyboard textures as it evolves. It's a

Slim Dunlap

Times Like This

MEDIUM COOL/ RESTLESS 89277, 36:43

Sound: B, Performance: A–

Former Replacements axeman Slim Dunlap has a penchant for decidedly Stones-like albums (circa *Exile on Main Street*) that are more at home in a greasy-spoon diner or the tape deck of an old, rusty pickup truck than some hipster club scene. This, of course, means Dunlap does not get the kind of attention that his more famous peers and former bandmates do, but his behind-the-scenes struggle has served to heighten his sharp-witted cynicism, in turn sparking his second album, *Times Like This*, with a grizzled vigor.

Returning with his band and guest shots from Paul Westerberg and other Minneapolis luminaries, the album pairs Dunlap's soured view with a guit-rhythm that rivals Keith Richards' (along with a vocal range to match), and there is as much bluster as on his 1994 debut, *The Old New Me*. Here, he echoes Tom Waits in the rumbling beat of "Jungle Out There," laments dashed dreams of stardom in the melancholic "Nowheres Near," and pulls out something "Lola"-esque and roadhouse-like in "Chrome Lipstick." The closer, the sentimental, longing, Westerberg-inspired title track, fuels the question why Dunlap labors without deserved recognition in the shadow of his more famous former bandmate.

Vickie Gilmer

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masterwork of lush electronica and the album's centerpiece.

That Moby believes these two sonic worlds can coexist in a listener's psyche is a leap of faith. To most people, the darkness and light might sound strange, disjointed, inconsistent, and uncomfortable. But to an open mind ready for an assault of the unpredictable, the darkness and light on *Animal Rights* can come together like oil and vinegar rather than oil and water. Or, in a more universal sense, they come together the way peace and anger, love and hate, and night and day do in our everyday lives. *Bob Gulla*

Harmacy

Sebadoh
SUB POP SPCD 370, 50:22
Sound: B, Performance: A

It's pretty fascinating how the traits that mark kids as losers and geeks in high school are often the ones considered artistically admirable 10 or 15 years down the line. But if sensitivity and vulnerability made people desirable in real life, the members of Sebadoh would be three of the most eagerly sought-after young men around. Of course it doesn't, and they're not—and if they were, they wouldn't have such passionate and heartfelt sentiments.

Even more than on its previous albums, on *Harmacy* Sebadoh wears its broken, bleeding heart on its tattered sleeve. Throughout, Lou Barlow and Jason Lowenstein sing about dysfunctional relationships and unrequited love in voices that express absolute misery to angry frustration. In Sebadoh's tortured world, a relationship brings out the worst in a person. A sexual partner is someone you desperately search for; once your search is over, what you've found no longer seems so desirable, and it's time to go looking for someone else.

But Sebadoh's songs aren't overly dreary or morose. The band conveys its poignant messages in catchy doses of compact, low-fidelity indie rock. And while Barlow's songs are still poppier and better crafted than Lowenstein's, the two are at least thinking along the same lines artistically, making *Harmacy* more complete and cohesive than the band's earlier, more musically scattered offerings.

You'll likely favor Barlow's songs, such as "Ocean," which contrasts a spangly guitar rhythm with weary vocals, and the driving "Beauty of the Ride," which is sonically reminiscent of Barlow's earlier years with Dinosaur Jr. But Lowenstein's "Nothing Like You" is an impressive teary ballad, and his harder-rocking track, "Mind Reader," grooves like Mudhoney crossed with The Jon Spencer Blues Explosion.

All those awkward and humiliating years for Sebadoh have now paid off with the release of *Harmacy*. Geek rock has rarely sounded this good. *Jon Wiederhorn*

The Kinks

To the Bone

GUARDIAN 2438-37303
Two CDs; 1:41:31
Sound: B, Performance: B

Ray Davies is one of Britain's premier songwriters, and his work with The Kinks—particularly during the '60s and '70s—ranks as rock's most literate. Today, however, the band's following can best be described as cultish, although Davies has breathed new life into both his and The Kinks' career by performing solo acoustic shows. Shown in part on VH-1 recently, Davies' show comprises Kinks songs, anecdotal musings, and readings from his autobiography, *X-Ray*.

Which brings us to this latest Kinks album, *To the Bone*. The smart career move for Davies would've been a recording of his solo show. Instead, he's opted for a strange two-disc set in which the current Kinks lineup performs "greatest hits" that span the group's entire career. The well-chosen songs and the first-rate musicianship were recorded in front of appreciative audiences, either in the studio or at recent shows. But these contemporary updates of classic songs hardly stack up to the originals. And with a sound akin to stadium rock, the production (particularly on the concert tracks) is imbued with a big-is-better sensibility. The studio tracks (recorded with a smaller audience) at least have intimacy going for them, but *To the Bone* is nevertheless weighed down by two new songs that are below par for a songwriter as brilliant as Davies.

Although *To the Bone* definitely has its moments, Kinks fans are still eagerly waiting for a Ray Davies solo album, albeit with bated breath that is in danger of expiring. *Jon & Sally Tiven*

Melting in the Dark

Steve Wynn
ZERO HOUR ZHD 1160, 44:42
Sound: B, Performance: B+

The only distinctive trait Steve Wynn has displayed through his prolific career has been the moving subtlety of his voice. On *Melting in the Dark*, the moody, emotive pipes of the former Dream Syndicate frontman have finally found a musical canvas capable of carrying his conviction. After a couple of mixed solo records (*Kerosene Man* and *Dazzling Display*), Wynn has recruited longtime friends from Come as his backing band. For the first time in years, his ability to rock with feeling is undeniable. From the moment the opening cut, "Why," explodes from the speakers, it's obvious that Wynn's pop sensibilities have found an energetic partnership that is successful in rekindling the energy of his compositions.

The Wynn/Come hybrid reaches its zenith on "Silence Is Your Only Friend," where Wynn's inflection is clobbered by strong, guitar-driven arrangements. Another future classic is the swaying "The Way You Punish Me," which could have been a B-side from Concrete Blonde's *Bloodletting* sessions.

Steve Wynn's latest offering is undeniably a giant leap from his previous two releases, even though a few clunkers prevent *Melting in the Dark* from being his career album. For the faithful, the rumor that the sessions lasted only four days provides hope that a full week of recording next time around will yield all the energy and subtlety that make this artist so endearing. *Lauren Somerstein*

Pre-Millenium Tension

Tricky
ISLAND 314-524 302, 45:35
Sound: C+, Performance: C–

No one is ever going to accuse Tricky of being humble. His peers in the genre-blurring English movement dubbed "trip-hop" (Howie B., Portishead, Massive Attack, et al.) are quick to laud the influence of American rap on their music. But on his second album of new material, Tricky scoffs at the entire world of hip-hop while presenting a bleak, angry, and nihilistic world view that makes the violent outlook of gangsta rap seem like kid stuff. What's more, he thinks he's the shit for doing it.

"They used to call me Tricky Kid/I lived the life they wished they did/I lived the life they saw afar/Now they call me superstar," Tricky raps in a mucous-clogged monotone on "Tricky Kid." But the backing tracks throughout *Pre-Millenium Tension* are droning, claustrophobic, repetitious, and grating—certainly not the stuff of superstars. Where Dr. Dre turns to ganja for inspiration to produce lush cocoons of sound and other trip-hoppers embrace psychedelics in transporting listeners to inviting imaginary worlds, Tricky just says yes, gets paranoid and edgy, and drags you along on his own bad trip. And he never even gets around to saying exactly what is bumming him out.

Maxinquaye, Tricky's 1995 debut, had similar problems with static grooves and not much happening musically, but critics were seduced by the sexual tension in the interplay between Tricky's rasping and his helper Martine's sensual crooning. *Pre-Millenium Tension* doesn't even have that going for it: Martine is present on about half the tracks, but she does little to brighten up Tricky's dour mood. These 11 same-sounding sonic pastiches will make you want to keep your distance from Tricky, leaving him to feel foul and evil all on his own. *Jim DeRogatis*

Soundtracks for the Blind

Swans
ATAVISTIC ALP59CD/YG01
Two CDs; 2:21:51
Sound: A–, Performance: B+

Often compared with Sonic Youth, Swans has consistently displayed greater stylistic diversity than its downtown N.Y.C. art-noise colleagues without deviating from frontman Michael Gira's singularly bleak vision. This, the band's last release (supposedly Swans is calling it quits), is no exception. It's an ambitious collage that folds found sounds, tape loops, and studio recordings into a dense aural mélange.

Soundtracks for the Blind eschews conventional verse/chorus/bridge structures, favoring experiments with timbre and juxtaposition instead. The 1-2-3 transition from the disorienting samples of "Her Mouth Is Filled with Honey" into the churning rock repetitions of "Blood Section," followed by the twisted howl of "Hypogirl" (sung by longtime collaborator Jarboe), could prompt a case of whiplash. Testimonies from unspecified individuals, as in the unnerving "Minus Something," offset majestic instrumental interludes of cello, bells, guitar, and keyboards. Often the most captivating elements border on subliminal, such as the fax tones buried in "Red Velvet Corridor" or the organ accents of "I Love You This Much."

The cumulative sensation of *Soundtracks'* disparate elements is akin to eavesdropping on dozens of psychotherapy sessions, hearing seemingly disassociated sets of ideas underpinned with a constant surge of raw feeling. Swans has been criticized for a decade and a half for being a difficult band for listeners to understand, but you don't have to know the details of the emotional impetus behind Gira's music to appreciate its raw power. *Kurt B. Reighley*

Diary of a Mod Housewife

Amy Rigby
KOCH KOC-CD 7922, 40:15
Sound: B, Performance: B+

"A woman being dragged kicking and screaming into adulthood" is one way that Amy Rigby describes the "mod housewife," a new variation of the human species and one "trapped somewhere between bohemia and suburbia." On her cathartic debut, the former Spinane addresses these and other issues, but her songs seem to derive from personal experience as a divorced, single, rock 'n' roll mom.

With a crying catch in her voice, Rigby sings with urgency, and her songs don't hide their influences. "Down Side of Love" is like a long-lost Buddy Holly song, while "The Good Girls" (a skewer job on consumerism) feels like Jay & The Americans. In an angry romp depicting a messy 3 a.m. confrontation, "20 Questions" crosses Dylan's "Outlaw Blues" with "These Boots Are Made for Walking," and "Knapsack," the album's solo acoustic song, is about an unrequited crush on the kid who checks incoming bags in a bookstore.

Throughout, button-cute Rigby is a charming singer who has some endearing, often memorable quirks. Producers Elliot Easton and Gene Holder (both with serious pop expertise from their tenures as members of The Cars and The dB's, respectively) complement Rigby's songs and sensitivities. *Diary of a Mod Housewife* isn't out to change the world, but it surely helps make it a much more tuneful place to live. *Michael Tearson*

Dust

Screaming Trees
EPIC EK 64178, 44:21
Sound: A–, Performance: A–

It's gotta be frustrating to be a band that cut its eyeteeth in the burgeoning late '80s Seattle scene, only to see its peers—Soundgarden, Nirvana, Pearl Jam—skyrocket to stardom. It's unlikely that being left in the dust influenced the title of Screaming Trees' latest effort, but the band ably expresses the dejection and rage of being ignored and forgotten, striking back with the best record of its career.

Some of Screaming Trees' earlier material tended to tread water, with a musical uncertainty that downplayed its strengths. *Dust*, by contrast, is filled with diverse song structures and tight musicianship. Benmont Tench embellishes many of the tracks with evocative keyboard textures, and drummer Barrett Martin provides extra dimension by adding congas, tablas, cello, and even harmonium to the yearning, churning melodies. But it's Mark Lanegan's heart-rending baritone that provides real emotional impact here.

Of course, the most passionate vocals in the world mean nothing if every song sounds the same. Screaming Trees have finally realized this and have sprinkled *Dust* with an assortment of high-octane stompers, psychedelic rockers, country-tinged folk tunes, and Bic-raising ballads. "Halo of Ashes" swims and undulates to psychedelic sitar, quivering strings, and tribal drums; "All I Know" opens

MR. JOHN

Unchained

AMERICAN 9 43097, 43:40
Sound: B, Performance: A

This is one of those to-a-"t" matches that, as they say, is made in heaven: 64-year-old Sun Records iconoclast Johnny Cash moseying into a California studio with Dixie-fried outfit Tom Petty and The Heartbreakers as his backup band. Logically, the Rick Rubin-produced *Unchained* sessions turned out loose and rollicking. Not exactly a milestone in the classy Cash canon, it's still a solid new entry that relies on camaraderie as much as dusty country classics like "The One Rose," "Kneeling Drunkard's Plea," "I Never Picked Cotton," and the tongue-twisting travelog "I've Been Everywhere." Only one moment smacks of Svengali-ism, the awkward, almost forced cover of Soundgarden's grim "Rusty Cage."

On his previous album, *American Recordings*, a comeback of sorts, Cash toyed with his tough-guy image a bit,

NY CASH

singing a lot of dark, acoustic dirges that befit his Man in Black profile. This time, he's more honest and more rooted in the Gospel music and sentiment that deeply colored his impoverished Arkansas childhood. Cash puts his rustling, weathered baritone to work on Josh Haden's open plea to Jesus, "Spiritual," and Jude Johnstone's metaphor-laden title track.

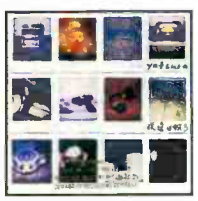
Tom Petty deftly keeps his own ego in check, even when Cash is crooning his trademark "Southern Accents." Petty and his band seem grateful just to be in the same room with this legend, and their playing consequently shines. The label is treating its star with similar awe: "CASH," reads the CD cover, in big commanding letters, as if nothing else need be said. But Cash's key to a successful renaissance is his steadfast determination to avoid deification, to keep his music everyman-understandable and down to earth. *Tom Lanham*

with a hook straight out of "I Am the Walrus" before evolving into a head-bobbing anthem; and "Sworn and Broken" rattles along with buzzing guitars and mellifluous strings that soothe like aloe on a severe sunburn.

Pearl Jam's *No Code* and Soundgarden's *Down on the Upside* may have been summer sizzlers, but *Dust* is the Seattle sleeper hit of the year. *Jon Wiederhorn*

We Are Yatsura
Yatsura
CHE/PRIMARY RECORDINGS, 61957, 42:42
Sound: B, Performance: B+

Although Yatsura is a Scottish band with a Japanese moniker, its compelling noise pop far transcends national boundaries. Almost doubling as a twisted soundtrack to these modern times, *We Are Yatsura* combines anthemic choruses with clearly audible angst, while pop smarts collide with infectious, guitar-rock riffing. In fact, the album's inspired guitar playing shifts on the fly between catchy and chaotic; creating chaos from order (and vice versa) is second nature to Yatsura. From the raw frenzy of the opening track, "Siamese," to the comparatively soothing tones of "Pachinko," the quartet displays relentless energy and diversity throughout this album.



Not afraid of flaunting influences (which seem to include Big Star and Sonic Youth), Yatsura still maintains a distinctive sound, one that—with guitars that collide, crash, and combine—is never safe or predictable. And simple but quirky lyrics provide a sharp contrast to Yatsura's sonic sophistication. Each successive listen to *We Are Yatsura* reveals more layers and nuances to the band's captivating aural power, built from an equal combination of dissonant and melodic sound. It's this power that makes *We Are Yatsura* such an enticing debut. *Laura Schlosshart*

FAST TRACKS

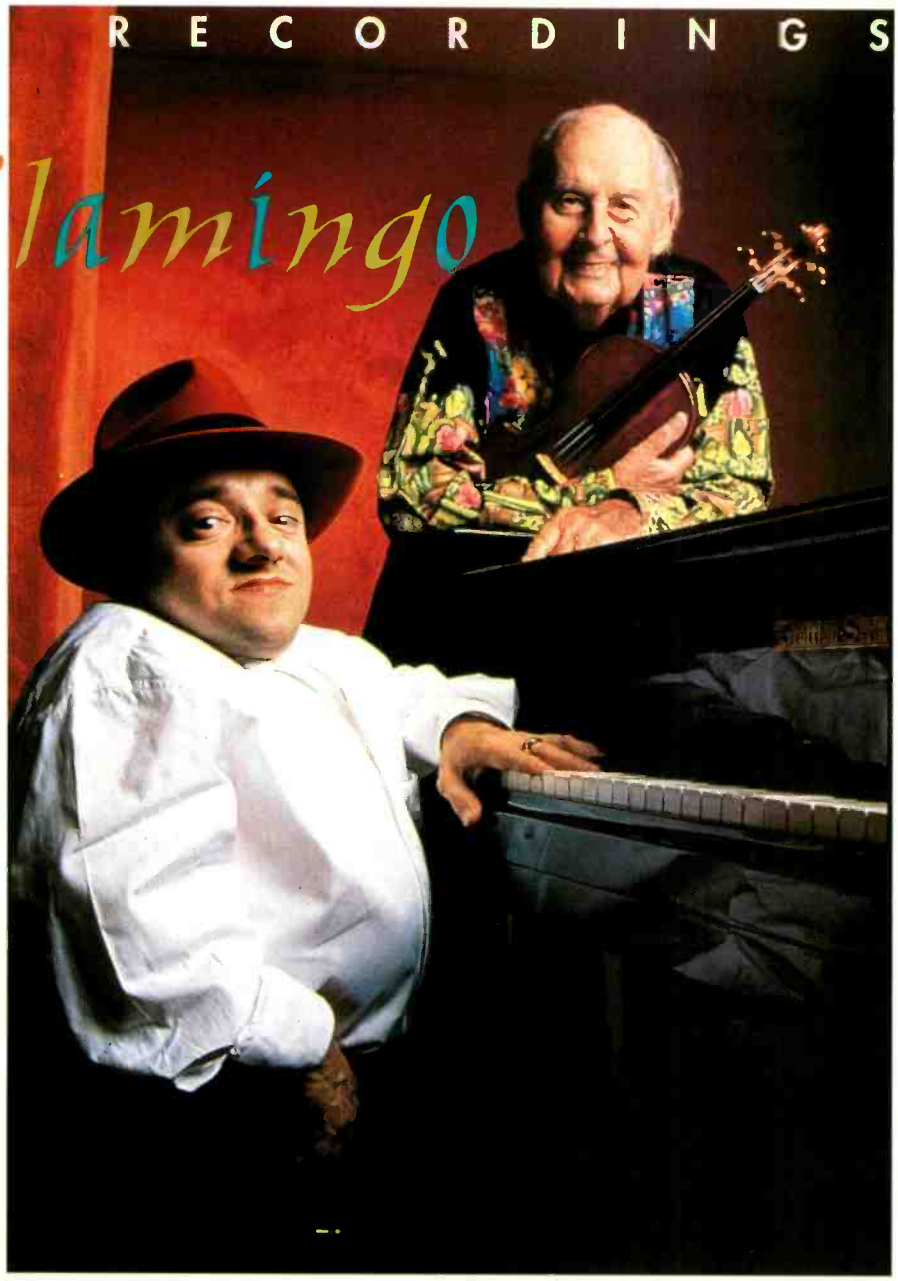
The Anthology, 1965-1967: *Small Faces* (DERAM/A&M 31453 3284, two CDs; 1:24:34). Before psychedelia set the stage for "Itchycoo Park," Small Faces were Mods to the hilt, relying on American R&B for inspiration. This set highlights the band's earliest DERAM material, hits like "Sha-La-La-La-Lee" and "What'cha Gonna Do About It," and presents Small Faces before the paisley influence reared its head. It's also interesting to hear Steve Marriott at this early, confidence-building point of his career. **M.B.**

Blue Guru: *Jon Tiven's Ego Trip* (Fountainbleu 7007021004, 50:20). You'll recognize Jon Tiven's name from these pages, but he's also an accomplished songwriter and producer who's songs have been recorded by B.B. King, Alex Chilton, and too many others to mention; he has also written with legends like Arthur Alexander, Don Covay, and Sir Mack Rice. *Blue Guru* showcases Tiven's talent via R&B material that features guest shots from Memphis and Muscle Shoals stalwarts. Of particular note is "Let's Think About It," written with Alexander and featuring his lead vocals. Not to be missed. (Available from Fountainbleu Entertainment, 91-38 114th St., Richmond Hill, N.Y. 11418.) **M.B.**

Blues Singer, 1929-1931: *Gene Autry* (Columbia/Legacy CK 64987, 63:14). Before he became a singing cowboy, Autry was a top disciple of Jimmie Rodgers' country blues and blue yodels. This set includes 23 early songs, many of them Autry's own and others covering Rodgers. This is fabulous stuff, and the fine notes illuminate the music. **M.T.**

JAZZ~BLUES

RECORDINGS



Flamingo

Stéphane Grappelli and Michel Petrucciani

DREYFUS JAZZ FDM 36580, 55:11

Sound: A–, Performance: A–

At 88 years of age, jazz violinist Stéphane Grappelli keeps going and going and going, seemingly as limber and lyrical as ever. He became a huge star when he teamed up with guitarist Django Reinhardt in the Quintette du Hot Club de France in 1934, and their on-again/off-again collaboration lasted through the late '40s. Since then, Grappelli's vast output has been as a leader, with stops along the way for projects with the likes of Duke Ellington, Earl Hines, and McCoy Tyner. These pairings have yielded some of his best work, so it should surprise no one that this new coupling, with pianist and fellow countryman Michel Petrucciani, is such a splendid success.

Flamingo was initiated by Petrucciani: "My aim was to modernize Stéphane's music and prove that he was still young at heart. . . ." Petrucciani later admitted he didn't have to change a thing. From the first instant Grappelli and Petrucciani played together, they knew it was right. And this "French union" just had to be recorded in Paris, but of course! The two are ably assisted by the great Roy Haynes, a drummer whose light touch leaves plenty of room for the flights of fancy that ignite *Flamingo*. Rounding out the quartet is George Mraz, whose nimble bass fills out the bottom of this amalgam.

Flamingo is yet another collection of jazz standards, but these men treat them as freshly mined gems. They truly make it seem as if they're playing these tunes for the first time. Grappelli's zesty fiddling bounces off Petrucciani's understated comping on "I Got Rhythm." Then the quartet jumps off, and everybody solos, but it's Haynes who drives this baby home. Petrucciani's continuing de-

SONNY ROLLINS

Silver City: A Celebration of 25 Years on Milestone

MILESTONE 2MCD 2501

Two CDs; 2:19:17

Sound: B+, Performance: A

Saxophone Colossus is but one of Sonny Rollins' nicknames, garnered early on as he wrestled dramatically with every song form he manipulated. His physical stance alone is enough to inspire bodybuilding. And for the past 25 years at Milestone Records, Rollins hasn't let up. His playing remains forceful, his tone as commanding as ever. The performance quality of his studio recordings has taken direct hits from critics infatuated with his live concerts. But Rollins is a man of strong convictions. Every recording will someday be seen as a sacred stone, none to be left unturned.

And what better way to get an overview of Rollins' Milestone days than with a compilation by the man himself? This two-disc set is an excellent mixture of born-again pop tunes, hard-core original barn-burners, and, of course, his famous variants of calypso. So spontaneous as to be overwhelming, Sonny Rollins is, literally, one of the last true improvisors. *James Rozzi*

sire to pare down to the essence is evident on his intro to "Misty," and when the band joins in, they're seduced by his gentle spell. The exquisite interplay on "These Foolish Things" and "Sweet Georgia Brown" will have you savoring each scrumptious note.

This is a beautiful, clean-sounding CD. Even more important, you really feel the connection between the musicians. One problem: Petrucciani's piano stretches from speaker to speaker, and his left and right hands can seem a little disjointed.

Nevertheless, *Flamingo* has that go-for-it, expressive feel that exemplifies what jazz is all about. You realize that these two virtuosos are not just playing with each other, but for each other. *Steve Guttenberg*

Big Band

Joe Henderson
VERVE 314 533 451, 60:11
Sound: A, Performance: A+

Tenor saxophonist Joe Henderson is part of jazz royalty, right up there with living legends Sonny Rollins, Benny Carter, and Ornette Coleman. His early Blue Note sessions of the '60s (as a leader and as a sideman with such notables as Horace Silver, Kenny Dorham, and Andrew Hill) are timeless gems that have found a new audience some 30 years later through Blue Note's ambitious reissue program. Henderson's recorded output on Milestone through the '70s further represents his willingness to straddle the inside/outside aesthetic, and it serves as a role model for several of the most adventurous young jazz players today. A reactivated Blue Note coaxed Henderson back into its roster during the '80s, and now Verve has been championing the tenor great throughout the '90s.

With such a profound artist as Henderson—whose luxurious and personal tone, totally distinctive phrasing, and improvisational daring are unparalleled—the question each year for executive producer Richard Seidel becomes one of context. Thus far, Henderson has had great success with a series of composer songbooks (1992's *The Music of Billy Strayhorn*, 1993's *Musings for Miles*, and 1995's *The Music of Antonio Carlos Jobim*), earning three Grammy Awards and winning jazz magazine polls while racking up impressive sales. The latest Verve offering places Henderson in a big band setting. And at last we get to hear some of his own classic compositions, fleshed out for 18 pieces.

With arranging assists from Bob Belden, Slide Hampton, and Michael Philip Mossman, Henderson blows new life into '60s compositions "Isotope" and "Inner Urge" and his oft-covered Latin-flavored ballad "Recordame." Henderson's own ingenious arrangement of Strayhorn's lovely "Chelsea Bridge" is a highlight of this spectacular album. Guest soloists include trumpeters Nicholas Payton and Freddie Hubbard, bassist Christian McBride, and pianist Chick Corea (who toured with Henderson in a quartet back in 1981, as captured on the excellent *Live in Montreux* on Stretch Records). But the star of this show is Joe Henderson, whose gorgeous tone, expressive approach, and irrepressible sense of swing resound with great authority in this dynamic orchestral setting. *Bill Milkowski*

Radiant Warmth

Mari Boine
ANTILLES 314 533 520, 64:12
Sound: B+, Performance: B+

With a more inviting climate than ever, the musics of the world have begun to migrate Stateside in ever greater numbers, and the welcoming listener benefits. On *Radiant Warmth*, Mari Boine introduces us to her people in the northernmost reaches of Scandinavia, the Sami, and to their music, yoik. In the past, the Sami people were too often associated solely with reindeer herding; today, they are an important ethnic group, intent on merging their ancient traditions with a more contemporary way of life. Boine's music, both reverent and eerily modern, is an important part of that merger.

By blending elements of trance ("Feather the World"), jazz ("Katrin Who Smiles"), and rock ("No More") with Sami language vocals and instrumentation, Boine's yoik sculpts a sound that exalts and transcends tradition. Since her international breakthrough, 1989's *Gula Gula*, Boine has brought this fascinating mélange into world view.

That this woman from the Arctic North calls her recording *Radiant Warmth* is a testament to her passion for her art and her loyalty to her roots. Graced with flutes, ocarina, electric guitars, violins, and melodica—and outlined by Boine's soaring vocal chants—the record is warm and accessible. Quite different, you might say, from the contours of her homeland. *Bob Gulla*

Salsa Fresca! Dance Hits of the '90s

Various Artists
RHINO R2 72195, 72:56
Sound: B+, Performance: A–

Havana Club: The Fever of Salsa Dance!

Various Artists
MILAN LATINO 35768, 69:39
Sound: B+, Performance: A–

Each of these salsa compilations is animated enough to earn its title's exclamation mark. A major difference between them is that whereas *Havana Club* contains Cuban tracks dated from 1993 to 1996, mostly credited to bands, *Salsa Fresca's* tracks, from 1987 to 1993, are from all over (Cuba, Puerto Rico, Colombia, and New York) and mostly credited to singers.

The Rhino set's sound is generally smoother and more romantic. There's plenty of piano push and swinging horn punctuation on *Salsa Fresca*, plus (especially in Johnny Ray's and Alex Leon's tracks) hefty barrio-gang choruses countering delicate-yet-manly lead-lothario vocals.

It's hard to tell whether the reason is primarily geographical, chronological, or its ensembles' instrumental configurations, but *Havana Club* tends toward speedier polyrhythms and more catchily complex vocal interplay. Veteran virtuoso combos may wander occasionally toward Latin jazz, stirring in mountains of tropical spices. Los Van Van mathematically builds fiesta-chattered syncopation, and Irakere jams out a smoking take on "Feliz Cumpleanos." Paulo y Su Elite raps through electronic rain and telephone sound effects, and Jose Luis Cortes' pair of contributions has him engaging in call-and-response conversations reminiscent of Bo Diddley and August Darnell. In general, the spoken tracks engage more fully than the sung ones. While rap guys dipping into salsa often come off rigid, salsa guys performing hip-hop make the hybrid perspire. *Chuck Eddy*

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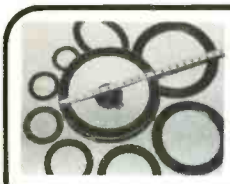

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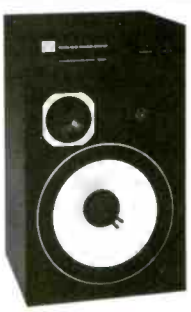

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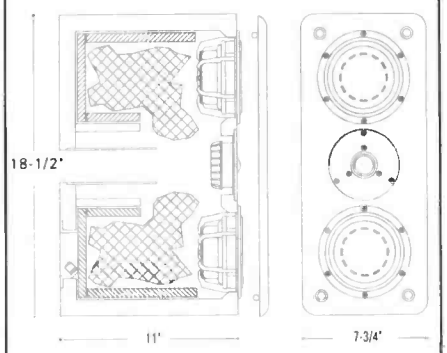

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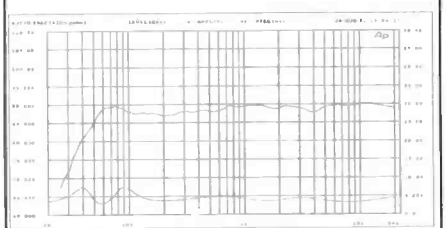

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Peter Mitchell, *Stereophile* Vol. 17 No. 4, April 1994

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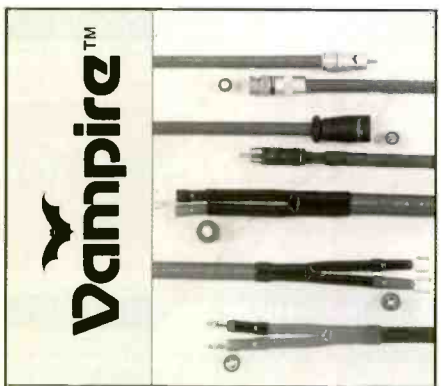

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DYNACLEAR TWEETER LENS ANTI-DIFFRACTION RINGS

Diffraction, which can make speakers sound less clear and distinct, usually occurs where the tweeter's output meets the edges of the speaker baffle. Dynaclear's Tweeter Lenses are designed to prevent this by absorbing high frequencies before they can travel out from the tweeter to the baffle edges. The rings, which cost $11.95 per pair, are ⅛ inch thick and 4⅜ inches in diameter, with a 1⅞-inch center hole. They are made of sound-absorbing felt and have adhesive backing.

Tested on speakers that have ¾- and 1-inch dome tweeters, the rings did clarify the sound. However, they also changed each speaker's high-frequency response, which is to be expected when part of the total output is absorbed. If engineers incorporate absorbing rings like Dynaclear's Tweeter Lenses into an original design, they can compensate for these changes. But when you use these rings with an existing speaker, you may or may not like the result. I suggest you try them out by leaving the paper over the rings' adhesive backing and temporarily attach them around your tweeters with a glue stick. If you prefer the sound with the Tweeter Lenses, you can then attach them permanently with their adhesive. (**Dynaclear**: P.O. Box 215, Oradell, N.J. 07649; 718/921-1537.) Edward M. Long

GRADE: B

For literature, circle No. 120

Monster Cable RF Splitters

After I went suburban a few years ago—and TV sets, VCRs, and accompanying cable drops proliferated through the house—I eventually started to suffer from noisy pictures and recordings. Some of the problems were intermittent and at least partly caused by the deteriorating quality of the cable TV service itself, but I knew that accumulated signal losses through long runs of coax and multiple splitters were the main culprits.

I was about to invest in an RF amplifier or two when I remembered some measurements shown to me by Noel Lee of Monster Cable. He had graphs of signal attenuation versus carrier frequency for a number of ordinary RF splitters and some low-loss models developed by his engineers. The differences were astoundingly large. Hard to believe it was possible to make such a big improvement in something so fundamentally low-tech.

With that in mind, I bought a few of the company's one-in/two-out models and made some strategic substitutions, with gratifying results. Improvements in picture quality were immediate and obvious. Over the last month, I've replaced every splitter in or outside my house, thereby restoring the original luster to my TV reception. Of course, better splitters can't do anything about the cable service's occasional bad hair days, but I wasn't expecting miracles. I used Monster Cable's 2-GHz splitters designed for satellite feeds, because they were readily available, but I expect the less expensive, 900-MHz, Standard models would work just as well in my application (or for TV or FM antenna feeds). The splitters come with mounting screws, connector caps, and screw-on 75-ohm terminators for unused outputs. Prices: 2-GHz models, $14.95, $19.95, and $24.95 each for two-way, three-way, and four-way splitters, respectively; 900-MHz Standard models, $9.95, $10.95, and $11.95, respectively, and $19.95 for an eight-way. (**Monster Cable**: 274 Wattis Way, South San Francisco, Cal. 94080; 415/871-6000.) Michael Riggs

GRADE: A

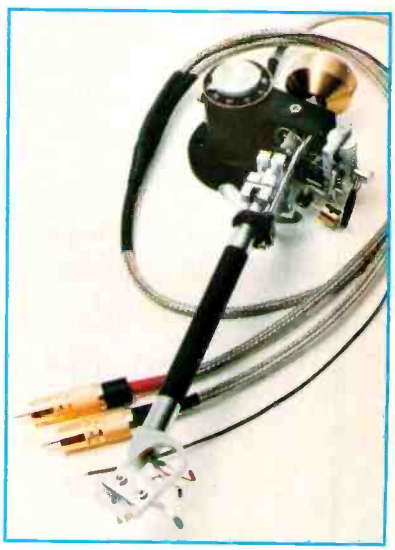
For literature, circle No. 122

WHEATON TRIPLANAR ULTIMATE TONEARM

One of several great state-of-the-art tonearms made in the United States, the Wheaton Triplanar Ultimate is hand-built in small numbers, making it virtually a collector's item. A medium-mass pivoting arm, the Ultimate is well suited to top moving-coil cartridges. Its construction, wiring, and damping are outstanding. It is one of the few arms whose vertical tracking angle (VTA) can be adjusted while a record is playing. Further, the VTA adjustment is calibrated, so you can easily reset it for different records.

The Triplanar arm has been refined over the years, through four major generations. The current iteration is intended to be the final one, hence the name "Ultimate." The major change from the prior version is the use of Discovery cable in the tonearm, and it really does make a difference. The Triplanar arm has always done an excellent job of extracting detail from the grooves, but the Ultimate produces even better bass and dynamics. The arm is available in aluminum or black finish and wired with RCA-jack, RCA-plug, or balanced outputs. Price is $2,495 to $2,815, depending on the options. (**Wheaton Triplanar**: 8 Saddlebrook Court, Silver Spring, Md. 20906; 301/949-8392.) Anthony H. Cordesman

GRADE: A



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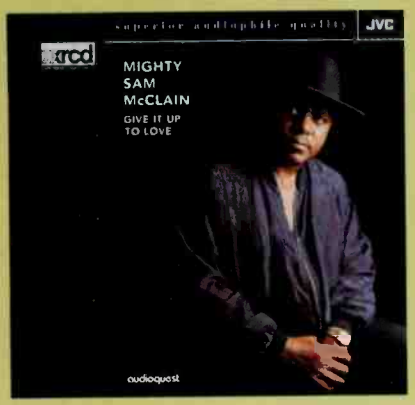

Mighty Sam McClain
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The Old Songs

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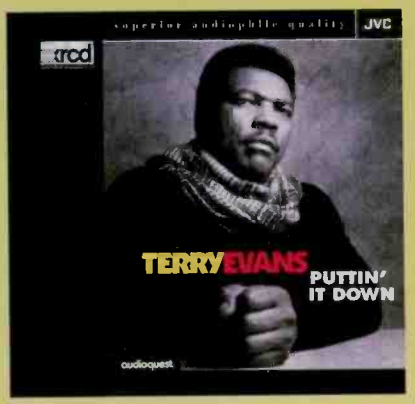

Terry Evans
Puttin' It Down

JVCXR-0014-2

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- Stereophile

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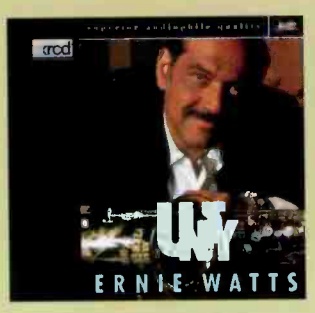

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Unity
JVCXR-0003-2

Tiger Okoshi
Two Sides To Every Story
JVCXR-0004-2

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Dayna E.
The Hi-Fi Buyer
The Audio Adventure
February 1996

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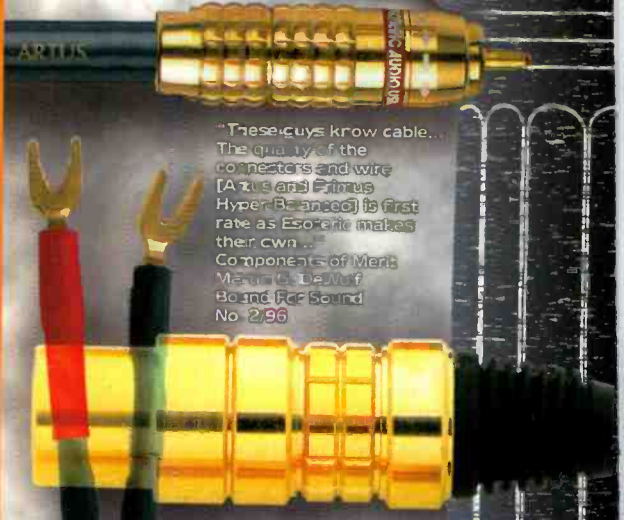
Recommended Components
Wes Phillips
Stereophile, Vol. 19, No. 4, April 1996



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

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