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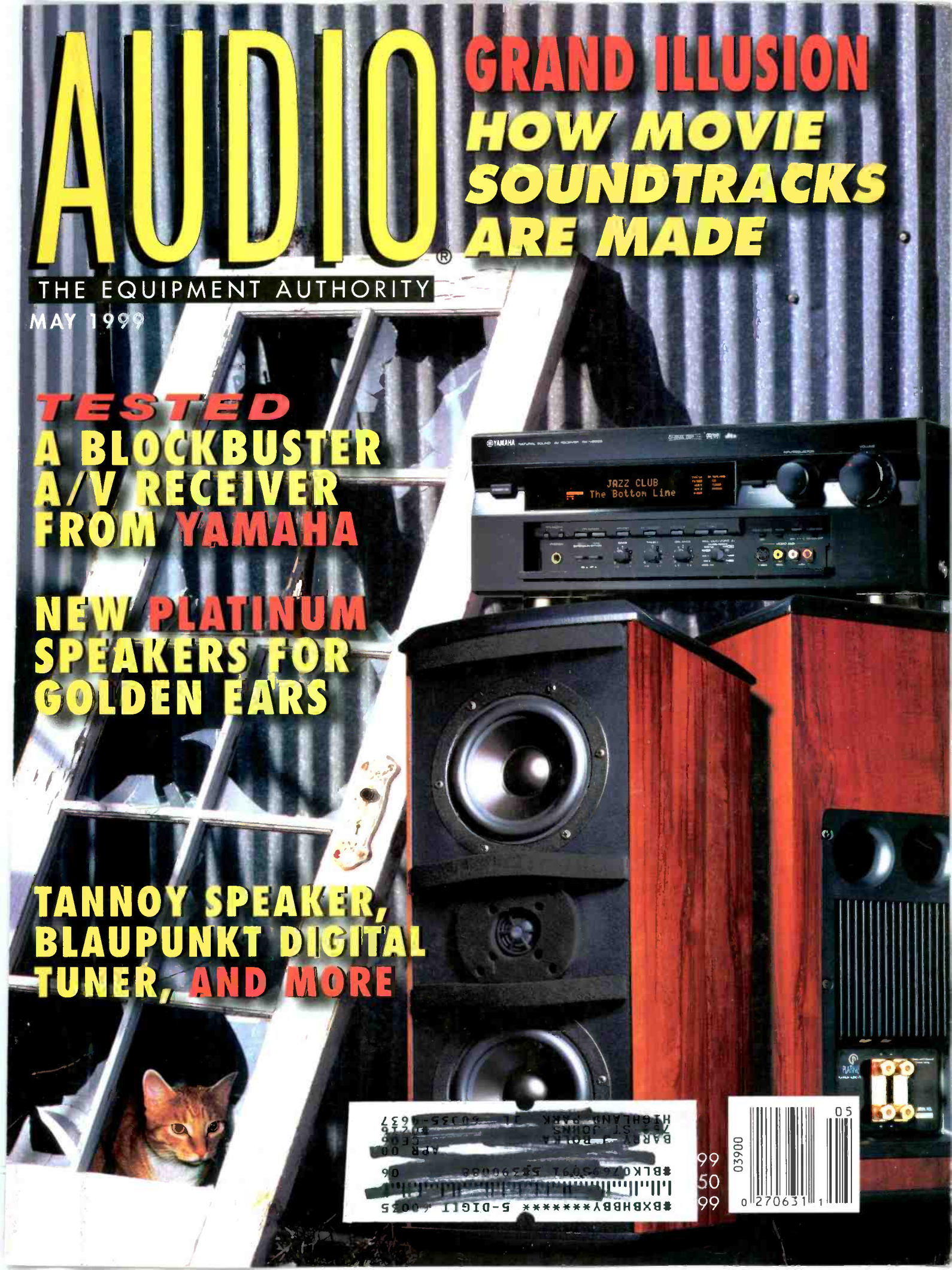

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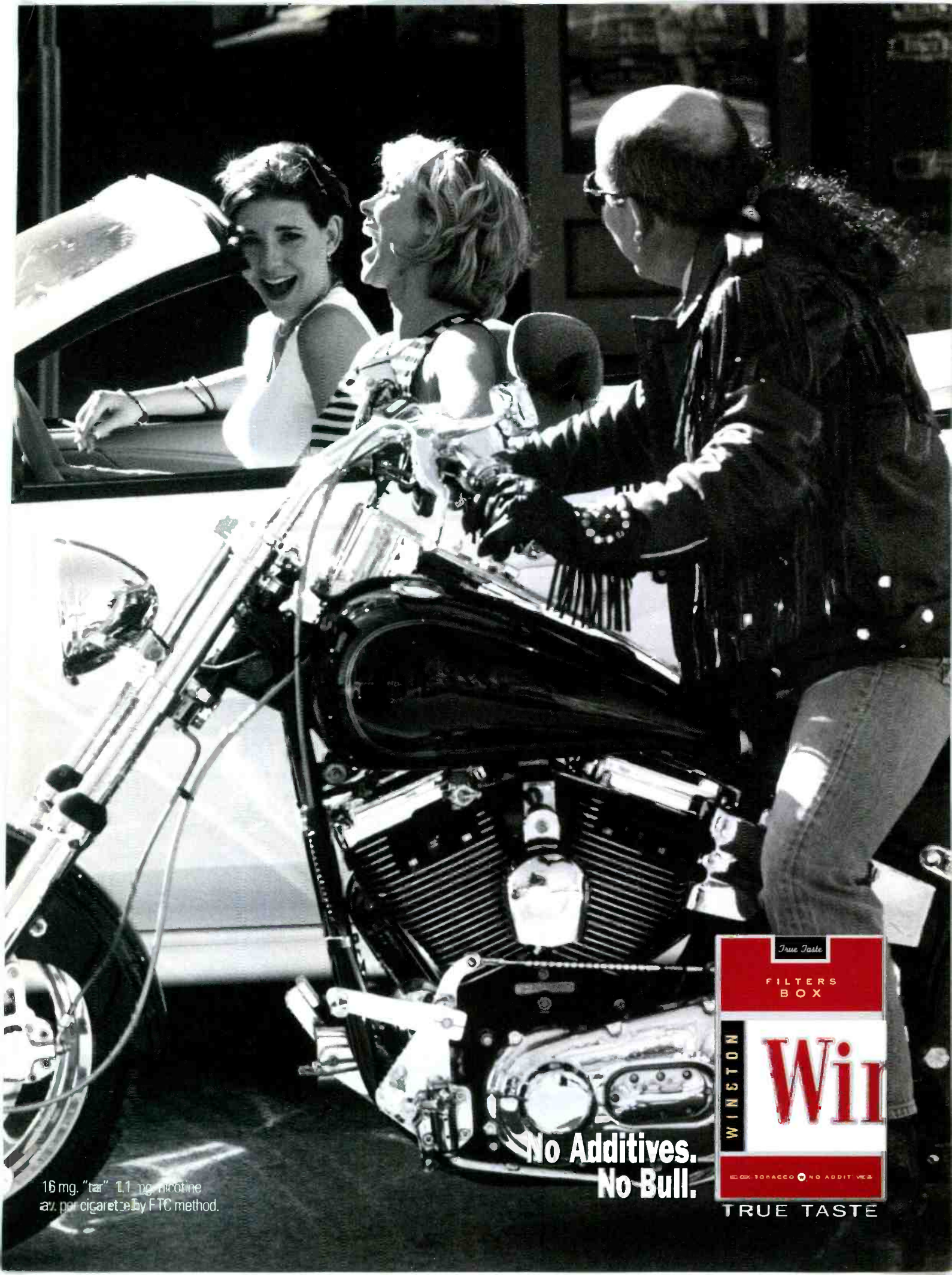
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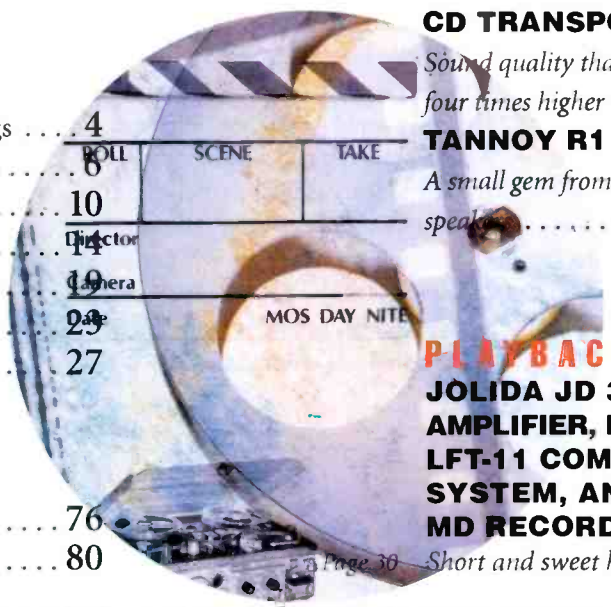

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PLAYBACK

RECORDINGS

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FAST FORE-WORD

DVD-Audio recently passed two important milestones on the road to launch later this year. First was approval of the final "1.0" specification for the system by the full DVD Forum. There are no surprises in the spec. Primary audio coding will be 16- to 24-bit linear PCM with sampling rates of 44.1 to 192 kHz, with or without lossless compression (at the option of the producer). The compression system is Meridian Lossless Packing, or MLP. Programs are limited to two-channel at the 192-kHz sampling rate but can be up to six channels at any of the lower ones. Multichannel programs can be made compatible with two-channel playback either by inclusion of a separate two-channel version on the disc or by programmed fold-down from the multichannel mix, according to parameters set by the producer. So far, so good.

What the primary specification does not contain are details of the copy-protection system. That is left to be worked out separately. And for the most part, it has been. In early March, IBM, Intel, Matsushita, and Toshiba, together with five major record labels (BMG, EMI, Sony Music, Universal Music, and Warner Music), agreed on what they described as a framework for DVD-Audio copy protection. It includes and goes well beyond the provisions of the existing Serial Copy Management System (SCMS).

So far beyond, in fact, that I don't have room here to describe it in detail. But in brief: The core is an optional encryption system that DVD-Audio players must support and that future recording systems must recognize and respond to in order to make dubs from encrypted DVD-Audio discs. The system also gives producers control over the number of dubs that can be made and their quality, ranging from identical to the original to two-channel at the original bit rate to CD quality or less. Recording to existing digital media, such as CD-R and MD, is allowed, but the resulting copies must comply with SCMS and, naturally, will be two-channel, CD-quality or less.

I expect most audiophiles will consider the encryption scheme a silly inconvenience but not much worse than that. The "watermarking" option is likely to be more controversial, however. Watermarking, when applied, is identifying information that is actually embedded in the audio signal, so that it is carried through even to unencrypted copies or broadcasts. Devices complying with the DVD-Audio license will recognize these watermarks and refuse to play or record unauthorized digital copies. It thus represents a second layer of security for the record companies. The question is, since the watermarks will become part of the audio signal, can they be applied in a way that never causes any audible degradation?

The answer is, nobody knows for sure (seems unlikely, although probably it could be made aurally undetectable on all but a small percentage of musical material). At this writing, tests are underway to help determine a system that is both effective and either inaudible or, at worst, innocuous. And, of course, the watermarking, like the encryption, will be optional. Given the record industry's usual priorities, however, I doubt we'll see many DVD-Audio releases that don't use both, and I expect virtually all will at least be encrypted. One of my most cynical friends goes so far as to opine that the appeal of DVD-Audio to record labels has nothing at all to do with quality and everything to do with locking up their property much more thoroughly than they could on CD. We'll find out.

An interesting side note in all this, by the way, is Sony Music's participation. Its decision to support DVD-Audio would seem to indicate that Sony will not attempt to sell Super Audio CD over DVD-Audio, as everyone has been expecting, but beside it. We'll find out about that, too.

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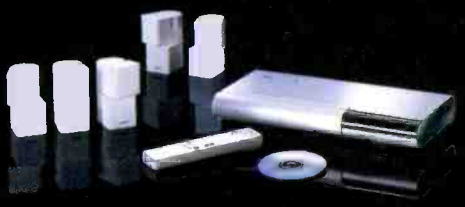

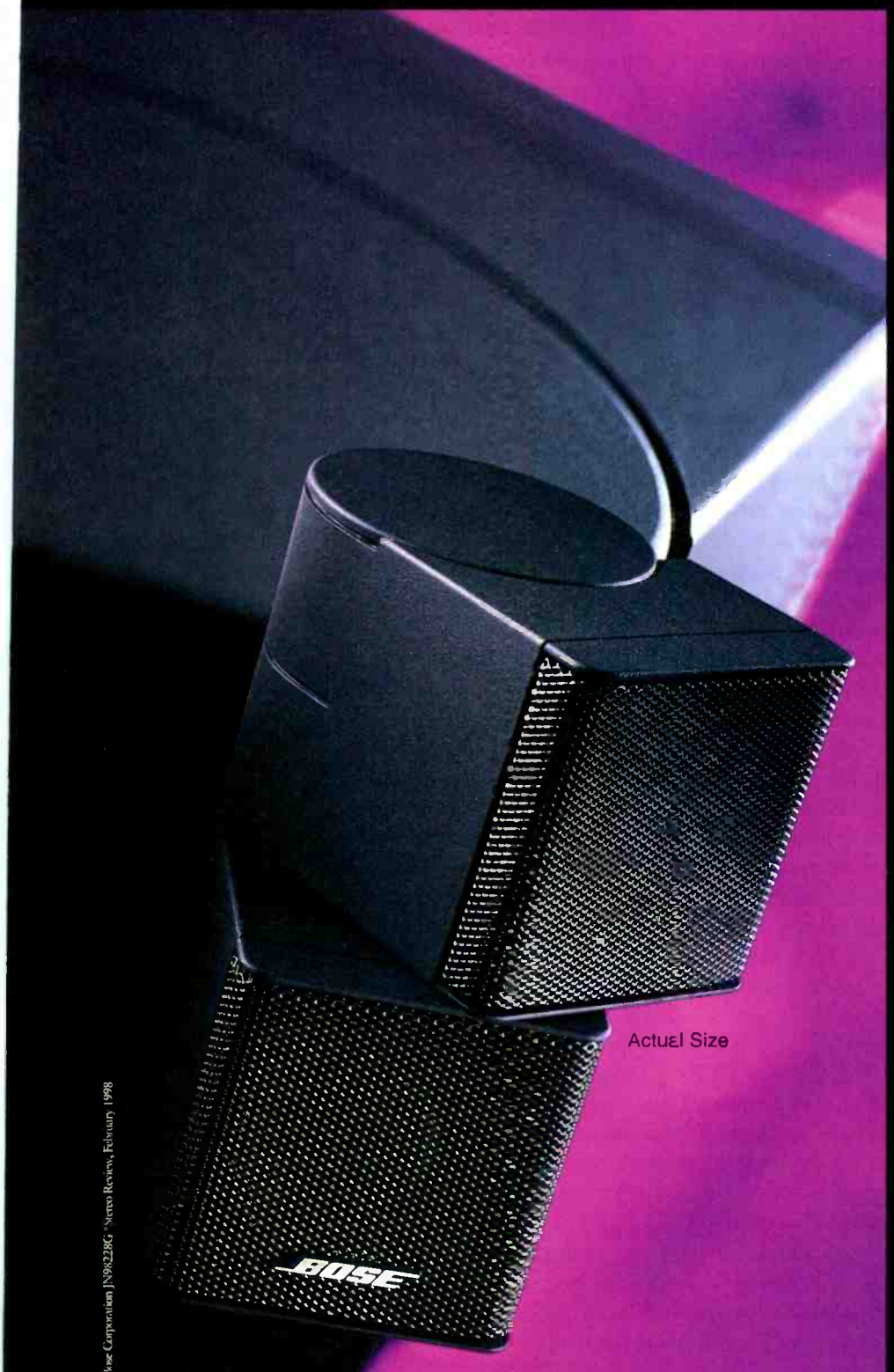

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LETTERS

DVD-Audio Coding

In his December 1998 "Fast Fore-Word," Michael Riggs discusses DTS and DVD-Audio. He notes correctly that many producers will use this medium for 96-kHz/24-bit audio in five or six channels and that Meridian Lossless Packing (MLP) was adopted for this mode.

Riggs reported that DTS urged the DVD Forum's Working Group (WG-4) to adopt the DTS system as a mandatory standard for DVD-Audio so that both a six-channel and a dedicated two-channel (stereo) version of an album could coexist on a single-layer DVD, avoiding an automated mixdown. True. He goes on to say that having this six-channel-plus-stereo combination is "the main point of adopting a lossless compression system like MLP" (not true), that MLP "makes [this] possible," and that you "can figure [this] out in five minutes on the back of an envelope."

Let us start with a fresh envelope.

The goal posed by the International Standards Committee (ISC) and the WG-4 was to facilitate audio at 96 kHz/24 bits, in six channels (96/24/6), for 74 minutes, on a single-layer disc.

The single-layer disc holds 37.6 gigabits. To simplify, we will ignore overhead. Seventy-four minutes of playing time necessitates an average data rate of no more than 8.47 megabits/second. This is the disc-capacity constraint, which is relieved if an album is shorter than 74 minutes or if a second layer is used (at additional manufacturing cost and not the original goal).

The crucial constraint is peak data rate. DVD-Audio is limited to 9.6 megabits/second by pit size and rotation rate; this figure is not negotiable.

Linear pulse-code modulation (PCM) in 96/24/6 has a constant data rate of 13.8 megabits/second. Add a 96/24 stereo track, and you have 18.4 megabits/second. So just to fit the six-channel music, you need to compress the data by 13.8 divided by 8.47, which equals 1.63 times. For six channels plus stereo, the data compression must be even more—18.4 divided by 8.47, or 2.17 times.

Lossless compression works by exploiting signal redundancy only. The amount of redundancy in music varies, so a lossless system has a constantly varying compression ratio. For example, a single sine wave, silence, and some "simple" musical material contain significant redundancy and are easily compressible. On the other hand, pure noise—or signals that resemble it (such as raucous cymbal crashes)—will afford little or no compressibility. A lossless system depends on there being enough passages that are compressible enough to offset the passages affording little or no compression. The desired overall compression is then achieved on average. This averaging task is made more difficult on DVD-Audio because the peak data-rate limit (9.6 megabits/second) is scarcely higher than the average limit (8.47 megabits/second). During the WG-4's testing of various lossless coders, all of them were brought close to these limits by relatively simple recordings.

Will lossless 1.6:1 be possible on most albums? The question must be answered individually for each album, based on the nature of the music. One hopes that if the answer is no, the music will not be altered to accommodate the system. Or perhaps recordings will be monitored through the encoder as matrix recordings are now, to ensure that they will meet the lossless compression target. Will lossless 2.2:1, affording the dedicated stereo track, be possible for most albums? Not likely. In our estimation, it will be difficult to contain music within the peak bit-rate limit, and lossless 1.5:1 is the most that can be hoped for on typical material.

Therefore, for ISC/WG-4 guidelines, as DTS has said, while MLP *may* provide six channels (and no stereo) for *much* material, DTS *will* provide six channels *plus* stereo for *all* material. Is there a mistake somewhere on our envelope?

Riggs characterized DTS as providing too little compression for DVD-Video and too much for DVD-Audio. DTS, in fact, occupies a broadly useful middle ground between a system like MLP, which provides indeterminate compression that is too little for most uses, and AC-3, which is very compact but at the sacrifice of transparency. (See Soulodre et al., *Journal of the Audio Engineering Society*, Vol. 46, No. 3, and Riggs's own assertion that AC-3 is "extremely close," i.e., not transparent, to CD-standard PCM, much less 96/24.) DTS DVD-videos are now on the market and show that DTS audio and high-quality video can coexist nicely. Should movie-watchers be limited to less than audio transparency because you consider AC-3 good enough?

DTS also suggests that our system would provide backward compatibility between DVD-Audio and DVD-Video. Riggs calls this "brazenly preposterous," but, in fact, DTS is the only system that can provide 5.1 channels of transparent audio on both media. We regret that we are not mandatory standards, since this limits the audience to whom we can offer this compatibility.

Stephen Smyth,
Vice President, Engineering and Development
Lorr Kramer,
Director, Special Technical Projects
Digital Theater Systems
Agoura Hills, Cal.

Meridian Audio's J. Robert Stuart Replies: Thank you for giving me the opportunity to clarify the points on Meridian Lossless Packing (MLP) raised in the letter from DTS. I regret having to point out that there is an error on DTS's "envelope." DTS seems to have misunderstood how DVD-Audio operates.

There are two main options to provide a multichannel mix (like 5.1 or six-channel) and a two-channel mix of the same basic material on DVD-Audio.

The first uses mixdown in the player so that a track can be mastered and distributed as multitrack and carry with it the instructions that enable the player to create a two-channel mix if called for by the listener. The mixdown instructions use a very small amount of data. This method is part of the SMART content technology provided by Warner Music.

When the multitrack is linear PCM (LPCM), the mixdown coefficients are fixed for each track or song.

One of the many reasons MLP was favored by WG-4 was its powerful lossless

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matrixing and lossless processing technology. This allowed us to add a great deal of flexibility to the mixdown feature and at the same time remove complexity from the player. In particular, when MLP is used to carry a multichannel mix, the mixdown coefficients that produce the two-channel version can be changed as frequently as 1,000 times a second. The MLP method actually allows the mixdown to be made in the studio—to be monitored and signed off by the album producer—and then both the original multitrack and the two-channel mixdown are delivered losslessly by MLP. The cost in data rate to provide the mixed-down version as well as the multichannel version is around 0.15 megabit/second—i.e., very low.

This option of mixdown at the studio or in the player will be very helpful for many projects where the result is good enough, where the cost of mastering twice is prohibitive, or where the intent is that the multichannel be the primary mix and the stereo is provided purely for compatibility.

There is a second option, however, as there may be artistic, legacy, or practical reasons why a producer may not wish to use player or even studio mixdown to derive the two-channel track. Maybe the multichannel and two-channel versions are different in some arbitrary way—such as reverberation, EQ, or duration; in such cases, the disc must carry both mixes.

However, they are not (as DTS suggests) carried in the same stream but are placed on different areas of the disc. Therefore, the data rates of the two versions do not add together and the argument about peak data rate is irrelevant.

DTS does rightly point out that peak data rate is an important consideration in the DVD lossless application, and we are quite convinced that MLP's very superior performance in keeping peak rates below 9.6 megabits/second was also a strong factor in its selection. Contrary to the implication, MLP was not driven to its limits by ordinary material, although all the other systems tested did, in fact, fail on standard material.

MLP was developed and refined with the DVD-Audio application in mind and has been extensively tested on difficult-to-compress material. So far it has coped with all real content.

MLP does rely on exploiting signal redundancy; it examines correlations between the channels, within each channel's audio waveform, and in the resulting coded signal. It also uses buffering methods to control peak data rate. Because the compression that results depends on the material, there is no hard and fast rule about how much compression one obtains. For example, if the sound is highly tonal, if the sound is smooth, or if the mike rolls off at high frequencies, more compression will result than if these factors are not in play. We find, in practice, that taken over an hour of music—which by its nature is not truly random—MLP saves in excess of 8 bits per sample at 44.1 kHz, more than 12 bits per sample at 96 kHz, and even more at 192 kHz.

Consequently, with MLP the target maximum input data rate (six channels of 96-kHz/24-bit audio) can be sufficiently reduced that we can expect a DVD-Audio disc to play for 86 minutes. A two-channel version can play for four hours. But perhaps the most important practical prediction is to be able to put 74 minutes each of two separate 96-kHz/24-bit mixes, one with 5.1 and the other with two channels.

These examples tend to be extreme. It is more likely that the producer will elect to use mixdown for some tracks and separate mixes for others—all of which can free up disc space for still pictures, liner notes, and maybe the main song as a DVD-Video using Dolby Digital.

So you see, MLP does not provide too little compression, as DTS suggests. It also does deliver transparency, because there is *no* loss of information. All the original data are delivered intact. It is mischievous to imply that somehow any lossy coding system can be claimed to be transparent. This has not been proven to my knowledge, which is the very reason that—on DVD-Audio, where the ultimate quality was paramount—all lossy coding schemes were rejected.

ERRATUM

In the March "PlayBack" review of the Wyetech Topaz 211A amplifier, the company phone number listed was incorrect. The correct number, c/o North-Country Audio, is 315/287-2852. We regret the error.

Finally, I refer to the last paragraph of the letter. It has been suggested before that MLP is the reason that current DVD-Video players cannot play DVD-Audio discs. This is not the reason. DVD-Audio has a different navigation system, operates on quite different audio combinations, and has a different feature set. And for just this reason there is not the hinted backward compatibility between optional DTS on both carriers. DVD-Audio requires multichannel at high sampling rates, and DVD-Video players cannot cope with this, DTS or no DTS. I think it is also fair to point out that the version of DTS that could offer some compatibility delivers six channels of 48-kHz/20-bit resolution. If presented with this signal, MLP would provide more playing time, too—something in the region of three hours on a DVD-Audio disc.

China Syndrome

Ken Kessler wrote in February's "Mondo Audio" that "free, unrestricted trade is a good thing." He is upset that the sale of American-made high-end audio equipment is not permitted in China. Other than the raw materials needed to manufacture items for export, China bars major imports.

Maybe Kessler should instead be upset that the communications, home appliance, and consumer electronics industries have been devastated in the United States. All the major name brands are now manufactured overseas, mainly in Asia. Free, or nearly free, labor—especially in China—has eliminated thousands of jobs in this country. If China's trade practices bother him, he should take a look at the import requirements in Taiwan and, to some extent, Japan. All of the Asian-block nations protect their own markets either with tariffs or with extremely complex marketing regulations that make our products much more expensive.

I do not want the United States to become isolationist in its trade practices, but until the playing field is truly level and unrestricted, we should protect our markets over here by restricting the import of products manufactured in countries that don't allow us to do the same. This is only a dream, of course, since too many companies are "multinational" now and would not be able to bring any product at all into this country if such a restriction were imposed. Perhaps Kessler should just face up to the fact that some, or maybe all, of the high-end companies he is concerned about will have to go under. China has won the trade war without firing a shot.

Laurence R. Perkins
Nashua, N.H.

Oversite

I enjoyed the timely "Audio Site-Seeing on the Web" (March), but how could Gordon Brockhouse omit Ebay.com's audio auction Web site? My audiophile friends and I have been addicted to this site for months. It's a great way to buy and sell audio gear.

Name withheld
via e-mail

Editor's Reply: It was impossible to list even all of the audio-oriented Web sites. However, reader response prompted us to root out a couple more: www.hififarm.com (Hi-Fi Farm, new and used audio gear) and www.audaud.com (Audiophile Audition, an e-zine). Thanks to those who pointed out the omissions.—*S.V.C.*

JOSEPH GIOVANELLI

Amplifier Placement

Q *Does positioning an amplifier close to the speaker(s) improve a system's sound quality? If so, how do you get a stereo amp near both speakers simultaneously (because having the amp closer to one speaker puts it farther from the other)? Could I use separate mono amps to drive each speaker, and would this setup produce stereo sound when required by the music?*—Evelyne Girard, Ottawa, Ont., Canada

A If you use suitably thick cable (e.g., 12-gauge), you can place your amplifier(s) some distance from your speakers with no deleterious effects on sound quality. Using thick wire for runs of 20 to 40 feet will reduce cable resistance to a tiny fraction of an ohm, thereby enabling unimpeded transmission of power (voltage and current) from the amplifier to the speakers. And I see no reason why cable lengths for both speakers need be the same, as some suggest.

You shouldn't be concerned about hearing stereo if you use two mono power amplifiers. After all, what is a stereo power amp but two mono amps that share a common power supply and chassis? Of course, by using a separate mono amp for each channel, you will achieve maximum channel separation and reap the benefit of having entirely independent power supplies. But you can achieve perfectly fine sound using a good stereo amp.

Shielding and Computer Sound Cards

Q *Is it safe to pump the output of a Sony PlayStation or a computer sound card into a conventional audio system? I notice more buzz than normal at high volume levels. Are sound cards shielded properly? And how does a computer audio system differ from a conventional one?*—Rich Sheridan, via e-mail

A Shielding is not a factor when feeding a sound card's output into your audio system. You may think the buzz is caused by poor shielding, but usually it is not. Computers are rather dirty (i.e., noisy) devices. Some of that noise appears on the bus that connects your sound card to the computer. The noise finds its way into the electronics of the card, and there is little that can be done about it.

It's also possible that the noise is the result of ground loops produced by the grounding of your AC lines with those ubiquitous three-pronged plugs. Leave the computer ground intact, but try lifting one or more of the other grounds to see if that reduces the buzz. Incidentally, the buzz won't damage your audio system.

The audio systems sold with most computers are not intended to perform at true hi-fi levels. They are supplied mainly for convenience, so you can hear the audio output from programs that produce sounds. Games and other software rely on audio output to supply cues and various enhancements.

Does Doubling Power Double Loudness?

Q *I always considered myself fairly knowledgeable about audio reproduction. But recently I read an old book (*Basic Audio, *by Norman H. Crowhurst, copyright 1959) that made me doubt this. In a chapter on human hearing, the author gave an example to explain our logarithmic sensitivity to sound. He explained that if we had one screaming baby and another one joined in, the screaming would sound louder but not twice as loud. In order for the screaming to sound twice as loud, 10 screaming babies would be needed! Now suppose I had a 1-watt amplifier driving a speaker. According to the above logic, I would need nine more identical speakers and amps for the music to sound twice as loud. I gather I could replace the 1-watt amplifier with a 10-watt unit;*

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

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from what I can determine, this equals an increase in power of 10 dB. I have always been under the impression that a power increase of 3 dB doubles the perceived loudness. This 3 dB amounts to twice the amp power. Am I right, or is Crowhurst?—Stephen Bolser, Fort Worth, Tex.

A The author, Crowhurst, is right; you're (somewhat) mistaken. A decibel compares the relative power between two sounds or between two electrical signals. But the relationship between amplifier power (in watts) and how loudness is perceived by the human ear is not linear, i.e., it is not one-to-one but logarithmic. Acoustical experiments conducted with large groups of people have revealed that a 1-dB change in loudness at midband is about the smallest audible step that average listeners can detect; a 3-dB increase in loudness is termed "slightly louder." But here's the surprise: A 3-dB increase in loudness requires twice as much amplifier power! Thus, although it seems logical enough that a 100-watt amplifier should sound twice as loud as a 50-watt amp, it will, in fact, sound only *slightly* louder. This illustrates the logarithmic relationship between sound power in decibels and amplifier power in watts.

The experimental tests also determined that for a sound to seem twice as loud, it must increase by about 10 dB. But—and this is the kicker—it will require *10 times* as much amplifier power. A 6-dB increase in loudness—termed "clearly louder" by average listeners—will need four times as much power (in watts). In real-world terms, if you were using a speaker of low sensitivity that pushed a 25-watt amplifier to its limit on peak sound levels and you wanted to buy an amp that could produce levels that were twice as loud, you'd need to get a 250-watt amp (assuming that the speaker could handle such a level without damage).

Timers on Cassette Decks

Q *Is there a timer-equipped cassette deck that can record radio stations on schedule or a timer for a cassette recorder that works like the timer on a VCR?*—Herman Chen, via e-mail

A So far as I know, there are no cassette decks with internal timers that operate like a VCR's. Over the years, however, there have been cassette decks that work with an *external* timer; such decks usually have a mode switch with a "timer" position. When the switch is set and an external timer sends power to the deck, it begins recording. A tuner can be operated from the same timer as the one used to drive the tape deck. Radio Shack offers a variety of external timers, from simple mechanical models priced at less than $10 to digital models that go for about $25.

If you own a Hi-Fi VCR, the most convenient alternative is to use it as a preprogrammed audio recorder. Program the VCR to turn on at the date and time of the radio show you want to record, and connect your tuner's outputs to the VCR line inputs. (Be sure, though, to set the VCR's input selector to "Line.") Of course, you'll need to leave your radio on and tuned to the station you wish to record.

The Sangean ATS818CS world-band AM/FM radio ($224.95) has a built-in cassette recorder that can be programmed to turn on and record at a preset time within a 24-hour period. Recording is limited to one side (45 minutes) of a 90-minute cassette

and stops automatically at the end of the tape. The Sangean is available from the C. Crane Company (800/522-8863), as is the Reel Talk ($149.95), a quarter-speed cassette recorder with an internal AM/FM tuner. The Reel Talk records three hours continuously on a C-90 cassette and can be set to turn on and off within a 24-hour period. According to the company, the audio is intelligible but has some audible distortion.

Does Cable Size Matter?

Q *My dealer told me not to mix wire gauges, types, or lengths across the front three channels of my home theater setup. Another salesman told me it's unnecessary to use cable thicker than the 16-gauge I've got because my Dolby Pro Logic receiver is rated at just 85 watts per channel. He said that only receivers rated at 100 watts or more need heavier wire and that you can damage speakers by using too heavy a gauge. Other salesmen have said I can use thicker wire, regardless of my receiver's power, and that doing so might improve overall performance. Who's right?*—Scott Kiver, Cleveland, Ohio

A There's no reason why you can't use different wire sizes for the various speakers in your system's front channels. And I see no need to have runs of equal lengths when room arrangements don't dictate that. The length of the cable should dictate the gauge, with the goal being to keep resistance to no more than 0.1 to 0.3 ohm.

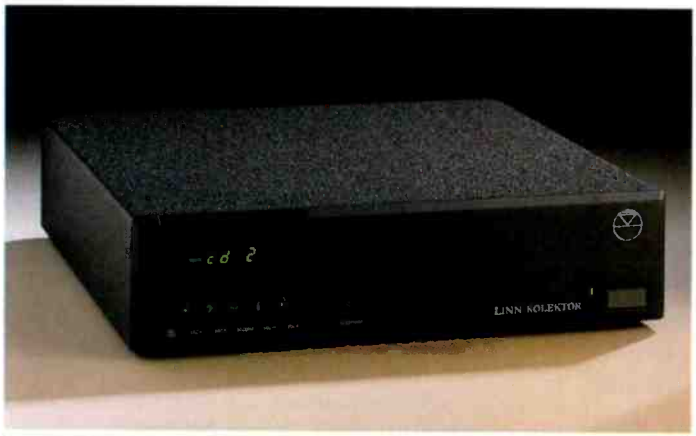
You cannot damage equipment by using a wire gauge that is heavier than necessary. The only consequence will be lowered resistance, which is desirable. It is when you use a wire size that is *thinner* than necessary that you run into problems, though you still won't damage your speakers or amp. The most likely effects will be reduced bass output and a squandering of amp power because of increased cable resistance.

To reiterate, the major factor in choosing speaker cable is the length of the run. With stranded wire, 16-gauge is the lightest I would use; this should work fine for most runs of about 30 feet. When solid wire is used, the gauge can be light because resistance is usually lower. I have seen systems that work well with 40-foot runs of 18-gauge solid wire. From the standpoint of electronics, this makes no sense to me, but I have heard the results and cannot argue with success. **A**

What's New

Snell SPEAKER

Dual 10-inch woofers driven by an internal 300-watt amp comprise the bass section of the XA 90ps, a seven-driver tower that is said to deliver superior clarity by controlling vertical directivity. The system also uses two 6½-inch lower midranges, two 2½-inch upper midranges, and a 1-inch aluminum-dome tweeter. Rear-panel switches adjust crossover characteristics and subwoofer parametric EQ (±10 dB) to enable optimal room-matching; you can also control bass and treble levels with a wireless remote. Price: $7,000 per pair. *(Snell Acoustics, 978/373-6114)*



Linn Preamplifier

With 10 inputs, including a low-noise phono stage, the Kolektor is said to be more flexible than a conventional Linn preamp. All switching is solid-state, as is gain adjustment, which can be set in 1-dB steps over a 60-dB range. To avoid coloration and distortion, the bass and treble controls operate at the extremes of the audio band: ±10 dB at 40 Hz and 20 kHz. An internal headphone amp avoids compromising the main audio path. The Kolektor will accept an optional RS-232 communications card. Price: $990. *(Linn, 904/645-5242)*

Legacy Surround Processor

Besides decoding Dolby Digital, DTS, Dolby Pro Logic, and MPEG-2 bit streams, the NexStep switches three S- and three composite-video inputs, three sets of analog audio inputs, and six digital audio inputs. With the supplied microphone and the processor's AutoSetup mode, you can balance levels, adjust polarity, and improve the time coherence of all channels. Theater re-equalization (to subdue strident soundtrack mixes) can be applied to all channels. A programmable, backlit LCD remote is included. The NexStep also is RS-232 controllable. Price: $2,995. *(Legacy Audio, 800/283-4644)*

AERIAL ACOUSTICS LOUDSPEAKER

The Model 7B is a vented system using dual 7-inch woofers, a 5-inch midrange, and a 1-inch dome tweeter. The extensively braced enclosure is 43 inches tall and has two 2-inch-thick side walls to reduce coloration. The nominally 6-ohm system has a rated frequency response of 35 Hz to 22 kHz, ±2 dB; crossovers are at 400 Hz and 2.7 kHz. Price: $4,000 to $5,000 per pair, depending on choice of wood finish. *(Aerial Acoustics, 781/235-7715)*

What's New

ACOUSTIC RESEARCH SPEAKER

An internal, 500-watt Sunfire amp, designed by Bob Carver, drives the AR1's 15-inch side-firing woofer, which is said to yield bass down to 18 Hz. The three-way, magnetically shielded tower, about 43 inches tall, uses dual 5-inch magnesium/aluminum cone midranges and a 1-inch diamond-coated titanium dome tweeter. Frequency response is rated at 18 Hz to 23 kHz, ±2 dB, with sensitivity of 95 dB/1 watt/1 meter. Price: $2,500 per pair. *(Acoustic Research, c/o Recoton, 800/225-9847)*

BOSE RADIO/CD PLAYER

By devising a 27-inch tapered waveguide, Bose has combined a CD player and an AM/FM tuner in one cabinet without sacrificing bass performance, according to the company. Active equalization and integrated signal processing, plus the waveguide, are said to enable the Wave Radio/CD to fill most rooms with full-bodied bass and lifelike sound. Clock-radio functions, auxiliary inputs and outputs, and an infrared remote are among the Wave Radio/CD's other features. Price: $499. *(Bose, 800/919-2673)*

Case Logic Portable CD Holder

Designed to hold a portable CD player, headphones, and extra batteries in an outer mesh pocket, the DM-5 belt pack also has a zippered inner pocket that holds up to four CDs in their jewel cases. The adjustable waist belt is padded for comfort and has supplementary zippered side pockets for personal items. Price: $24.99. *(Case Logic, 800/447-4848)*

JBL Mono Car Subwoofer Amplifier

Because of its very efficient PowerValve switching-amp circuit, the BP-1200.1 is rated to deliver 600 watts into 4 ohms or 1,200 watts into 2- or 1-ohm loads. Yet the BP-1200.1 draws less current and creates less heat than a standard Class-AB amp, says JBL. An adjustable electronic crossover, with an 18-dB/octave slope and variable bass boost, is built in. S/N is rated at better than 90 dB. Price: $749. *(JBL, 800/336-4525)*

JVC DVD PLAYER

Equipped with component-video outputs and a 10-bit, 27-MHz video D/A converter, the XV-D701BK is said to yield very low video noise and crisp color reproduction. A Video Fine Processor enables you to adjust picture sharpness and reduce video noise. Horizontal resolution is specified at 500 lines and video S/N at 65 dB. The internal Dolby Digital (AC-3) decoder has 5.1-channel analog outputs; the coaxial and optical digital outputs also pass DTS signals. Price: $599.95. *(JVC, 973/315-5000)*

What's New

Altra Equipment Cabinet

Constructed of wood with a medium-oak lacquered finish, the Rio RA1100 cabinet's adjustable shelves are said to be wide enough (at more than 20 inches) to accommodate extra-wide components and deep enough to hold power amps and CD changers. The large storage drawer is intended for CD and tape collections, and a wire-management system keeps cables out of sight. Price: $199.99. *(Altra Furniture, 973/778-8844)*

Mirage Center & Surround Speakers

Part of Mirage's FRx forward-firing series, the magnetically shielded FRx-Center has two 4½-inch polypropylene woofers and a ¾-inch metal-dome tweeter. It is said to be timbrally matched to the FRx-Rear surround speaker, which is an Omnipolar design. Each FRx-Rear has two ¾-inch metal-dome tweeters and a 5½-inch polypropylene woofer. Frequency response of the FRx-Rear is pegged at 55 Hz to 22 kHz, ±3 dB, and the FRx-Center's is 58 Hz to 22 kHz, ±3 dB. Prices: FRx-Center, $250 each; FRx-Rear, $350 per pair. *(Mirage, 416/321-1800)*

MUSIC LABS AMPLIFIER

Equipped with balanced XLR and unbalanced RCA inputs, the ML815 MKII is rated at 150 watts per channel into 8 ohms (0.002% THD) and 300 watts per channel into 4 ohms. All circuits are direct-coupled, including the output stage. The ML815 MKII self-calibrates output bias and DC output offset; this calibration is said to ensure consistent sonic performance throughout the life of the amp and despite variations in line voltage. Price: $1,683. (Music Labs, 847/940-1949)

NHT POWERED SUBWOOFER

Rated at 250 watts output at 0.3% THD, the SubOne's internal amp uses Sunfire technology that is said to yield tight control of the 10-inch woofer. The low-pass filter is variable from 40 to 180 Hz, with an 18-dB/octave slope; the high-pass is selectable at 50, 75, or 110 Hz and has a 12-dB/octave slope. Besides its volume, phase, and bass-boost functions, the SubOne's external controller will adjust bass contour—flat for music or boosted for home theater. Overall frequency response is rated at 25 to 180 Hz, ±3 dB. Price: $800. *(NHT, 800/648-9993)*

ROCKUSTICS OUTDOOR SPEAKERS

Made from crushed stone and weatherproof resins, Rockustics' Stonewall speakers can be installed in new or existing walls, like the Weathered Stonewall pictured (center). The Stonewalls use 6 ½-inch Vifa woofers and 1-inch tweeters that are said to withstand heat, rain, wind, snow, and ultraviolet rays. These speakers are available in brick, river-rock, and split-face cinder block textures. Price: $1,000 per pair. *(Rockustics, 800/875-1765)*

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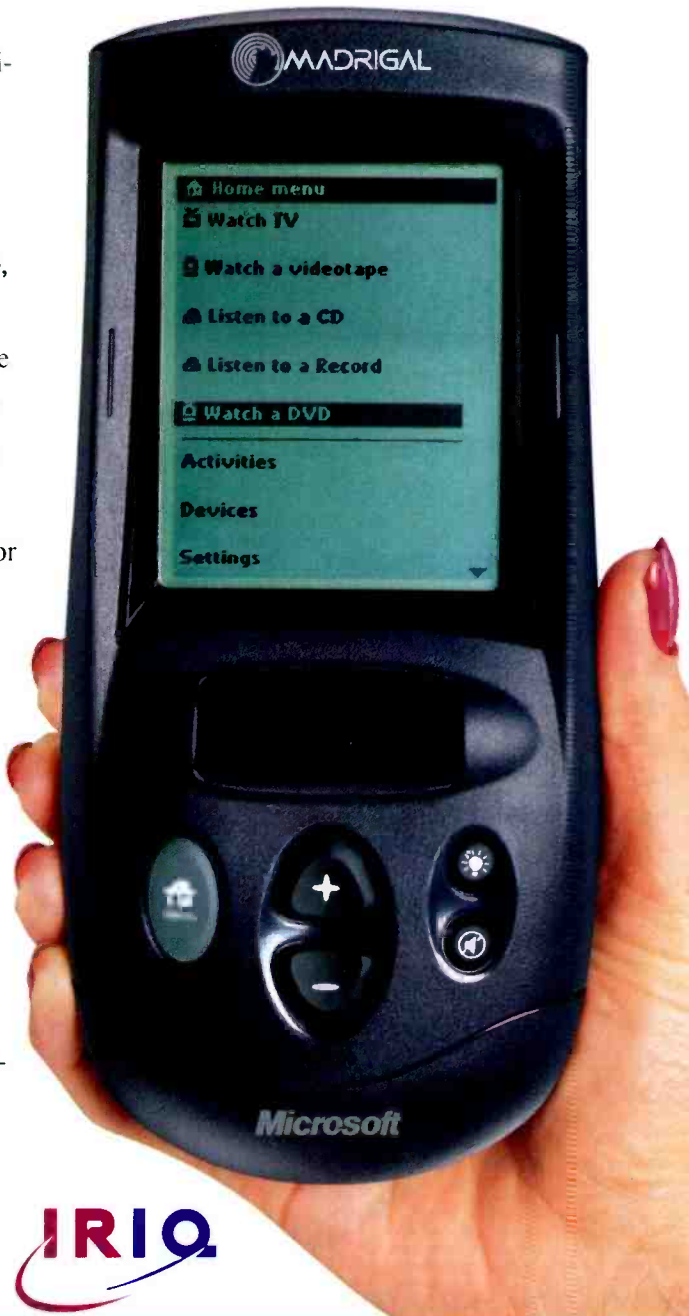

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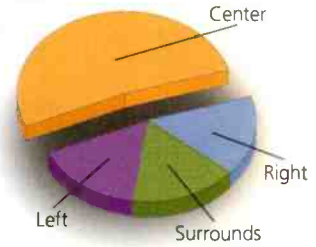
H A Harman International Company

"Do you need a center speaker with bass?"

Matt Polk, Speaker Specialist

"I cringe every time I hear a center speaker referred to as a 'dialogue' speaker. The center speaker plays *all* the sounds associated with the on-screen action; that includes explosions, slamming doors and yes, dialogue. It's not unusual for more than 50 percent of a movie's sound to come through the center speaker. The center speaker has a tough job. It needs to play as loud and clear as your main speakers without distortion. Your center speaker should be as good as your main speakers.



The center channel speaker typically reproduces over 50% of a movie soundtrack's sound. That means the center speaker must have full dynamic range and high power handling capabilities.

Which one to buy?

If you are looking to add a center speaker to main speakers you already own, ask the manufacturer which of their center models is the best match. If you are buying main and center speakers at the same time, stick with the same brand and quality level as your front speakers.

Evaluating center speakers

Listen to a movie with just the front three speakers connected. Close your eyes and listen. You shouldn't be aware that the center speaker is playing. It should integrate with the main speakers to create a seamless wall of well-balanced sound. Next, listen to the center speaker by itself. Walk around the room as you listen. The sound should be clean and clear. Dialogue should be clear, natural and articulate; male voices rich but not 'thick' or 'chesty.'

So, what about the bass?

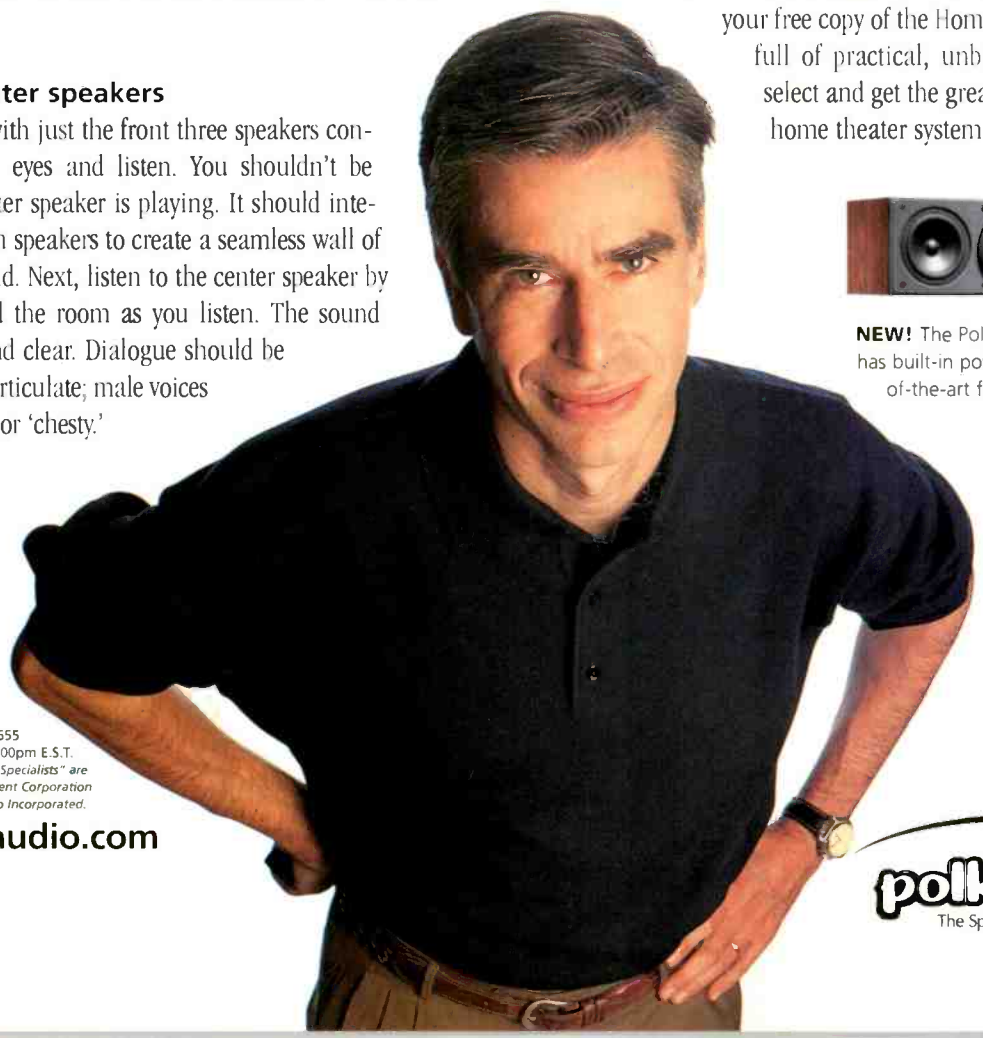
All surround receivers and processors have a 'bass management' function that allows you to mix the center channel bass information into the main or subwoofer channels. So you don't *need* a center speaker with good bass response. Of course you don't *need* a Mercedes either... but I bet you'd enjoy driving one.

The advantage of a center speaker with good bass response is that it relieves the main speakers or subwoofer of the job of reproducing center bass. That means you'll get better dynamic range and lower distortion. Also, I've found that the front stage imaging is more lifelike and seamless with a full-range center. If you're looking to assemble the ultimate performance home theater system, and you have the space, consider a truly full-range center speaker.

Free stuff

I could talk about this stuff all day, but there's not enough room on this page. Call (800) 377-7655 ext. 100 for your free copy of the Home Theater Handbook. It's full of practical, unbiased advice on how to select and get the greatest performance from a home theater system."

NEW! The Polk CS1000p center speaker has built-in powered subwoofers for state-of-the-art full-range performance.



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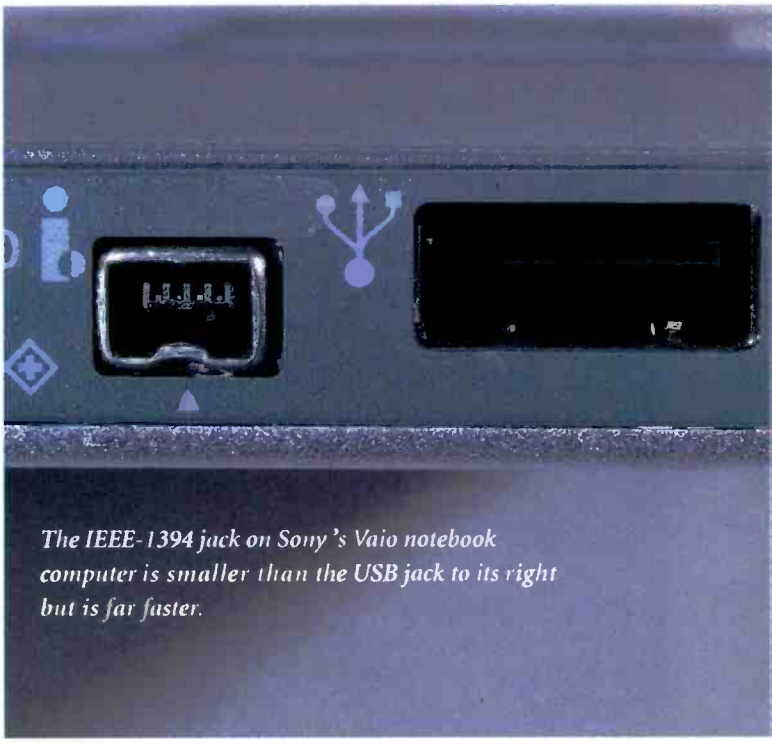
Spectrum

BY IVAN BERGER

SUDDENLY IT'S *1394*



The IEEE-1394 jack on Sony's Vaio notebook computer is smaller than the USB jack to its right but is far faster.

Photo: Len LaGrua

The IEEE-1394 bus, which Sony calls iLink and Apple calls FireWire, is a high-speed, wideband system for interconnecting digital devices (see my article, "Convergence Gets Convincing," in this issue and Mark Bridgwater's "Hot Wiring Your Hi-Fi" in the November 1998 issue). Because it's digital, it can carry audio, video, computer data, or device-control instructions with equal aplomb.

This bus has the potential to transform home entertainment systems. It might enable you to watch, on your bedroom TV, a DVD that's in your living room player. Or you might tell the music system in your den to "play some Beethoven" and have it come back with a list of all your Beethoven CDs, what Beethoven is currently available on FM or cable radio, and what Beethoven music you could download from the Internet. And it will likely lead to the development of devices that no one has yet thought of.

Last year, there was a mere trickle of consumer electronics gear with IEEE-1394 connectors: some digital camcorders and a few Compaq, Macintosh, and Sony computers. But a variety of bus-enabled products was on view at the Consumer Electronics Show in January, and a flood is building.

SoftAcoustik, of Quebec, exhibited a self-amplified three-way speaker that has IEEE-1394 and S/P DIF digital ports, priced at $5,500 per pair with integral 50-watt amplifiers or $6,500 per pair with 100-watt amps built in. An IEEE-1394 converter, with analog and S/P DIF inputs, will also be available; it's expected to cost about $500.

SoftAcoustik's SA 2.5 accepts IEEE-1394 and S/P DIF signals.

Digital Harmony presented an elaborate A/V system with IEEE-1394 links, using equipment from a variety of companies. Among those participating were Boston Acoustics, California Audio Labs, Crystal Semiconductor, Denon, Escient, IBM, Harman Kardon, Leviton, Loewe, Madrigal, Meridian, Microsoft, Monster Cable, NEC, PHAST, Philips, Pioneer, Replay Networks, Texas Instruments, Thomson Consumer Electronics, and Zenith.

Even more encouraging were important but less tangible developments behind the scenes. In February, six major companies—Apple, Compaq, Matsushita (Panasonic and Technics), Philips, Sony, and Toshiba—formed a patent pool and licensing program for IEEE-1394 developments. The pool will protect its members against patent-infringement suits from one another in this area and make it easy for other companies to license the technology.

Last December, a group of eight manufacturers announced Home Audio/Video Interoperability (HAVi) software to help equipment from many companies work more harmoniously together and share such devices as storage drives and printers. Philips will act as licensing agent for HAVi, which it developed in conjunction with

news & notes

● Copyright-protected music distribution is much in the news this year. In January, almost 50 companies involved with distributing music in the MP3 format ("Spectrum," November 1998) formed the Genuine Music Coalition to protect the copyrights of the music they disseminate. The GMC will use a version of Liquid Audio's digital "watermarking" technology. The watermark will embed copyright information and links to copyright owners' Web sites in each music file. In early February, IBM and five major record companies (Bertelsmann, EMI, Sony, Time Warner, and Universal) unveiled Project Madison, which will test a copy-protected music-distribution system via cable modem in San Diego this year.

● Downloading music and other files from the Internet is getting faster for more and more people. More and more cable TV companies now offer high-speed Web access over their lines. (The speed difference between regular dial-up access, even at the fastest rate, and cable is like the difference between your granddad's single-speed Schwinn and a Ferrari.) To counter this, a number of large regional phone companies announced plans within the first few weeks of this year to offer various versions of DSL (digital subscriber line) access via phone lines or to join remote hands with TV cable companies. Even rural areas may eventually get high-speed access, via radio.

● Computers with DVD-ROM drives are becoming so common that at least one company, BoardRunner (www.boardrunner.com), offers a motherboard with provisions for MPEG-2 video and Dolby Digital surround audio built in. The board, which accepts Pentium II or Pentium III processors, has virtual-surround analog outputs and an S/P DIF output to feed an external Dolby Digital decoder.

● While some scientists explore the possibilities of using DNA in building circuits ("Spectrum," September 1998), others are working at making microscopic machines from it. Nadrian C. Seeman and colleagues at New York University have built a DNA structure that bends when exposed to a particular chemical solution. The NYU device is more rigid and has a larger range of motion than previous chemical moving parts. Micromachines like this may someday be used to clear clogged blood vessels or fabricate ICs.

Grundig, Hitachi, Matsushita, Sharp, Sony, Thomson (RCA), and Toshiba. Meanwhile, Microsoft (which incorporated IEEE-1394 support in Windows 98) is pushing a similar but incompatible software system, HAPI (Home Application Programming Interface).

Though both HAVi and HAPI aim to interconnect home devices of many kinds, they take different approaches. Microsoft's HAPI is reportedly oriented towards control and coordination by a personal computer; HAVi is designed to let devices talk directly to each other without a separate computer. (However, HAVi can already be linked to Sun Microsystems' Jini interconnection language, a subset of Java, and there are plans to develop links for HAPI.) HAVi is reportedly designed primarily for such consumer electronic devices as DVD players, audio gear, and TVs; HAPI should work with refrigerators and other appliances as well. That may sound far-fetched, but in Europe, Electrolux has unveiled a prototype Screenfridge that can read the bar codes of food packages, display them on a screen, and use that information to compile shopping lists and send them to a grocery store via e-mail.

In addition to its participation in the patent pool and HAVi, Sony is working with Western Digital and Quantum, leading makers of computer storage devices, on "servers" to store audio and video data on hard drives. Such drives are being used for video recording by Replay Networks and TiVo and in the WebTV Plus set-top Internet box.

GALAXY TO EXPAND DIGITAL RECORDING UNIVERSE

Digital camcorders are common and digital TV is available, so there's consumer demand for digital VCRs—but few, if any, products available to meet it. The problem is not technology (as the existence of those camcorders and computer DVD-RAM recorders attests); it's copyright. If consumers could freely clone digitized movies, movie companies might stop offering them on DVD or allowing them to be broadcast digitally. Copy-protection standards must therefore be adopted before the recorders can be marketed; several copy-protection systems are currently competing for acceptance.

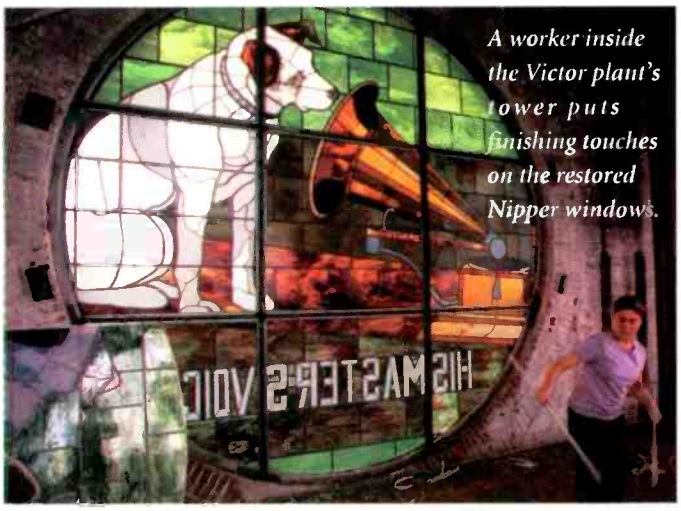
Early this year, two of these systems—one promoted by IBM and NEC, the other by Hitachi, Pioneer, and Sony—were merged into one, and the five companies formed the Galaxy Group to promote it. The proposed system reportedly will embed copy-protection code in every frame of a digital recording, to indicate the material's original source and to block digital recorders from copying it. Early reports claim that recorders using the system will detect the embedded code even in analog copies of digital originals but will almost never (maybe once in 64,000 tries) refuse to copy originals that do not contain the code.

Photograph: ©FPG International LLC

Doggone

Trademark laws and international trade have fenced in Nipper, the His Master's Voice fox terrier.

For generations, the image of the dog and the wind-up gramophone appeared on records from labels around the world: Victor (later RCA Victor) in North America, HMV (now renamed EMI but originally named for the painting's initials) in England, and Nippon Victor in Japan. Until the end of World War I, it was also used by Deutsche Grammophon and at one time was used by Pathé-Marconi in France. Today, Nipper earns his Alpo only from RCA.



A worker inside the Victor plant's tower puts finishing touches on the restored Nipper windows.

Photo: Avi Steinhardt, Camden Courier-Post

Except for Pathé-Marconi, the companies that used the Nipper logo were corporate relatives, linked via the disc gramophone's inventor, Emile Berliner. Even after these companies separated, they sold records mostly in their home countries, where they owned the trademark, and licensed them for production overseas by other labels. When a company did export directly, it had to remove the logo. That's why Nippon Victor products are sold here as JVC (short for Japan Victor Company). It's also why HMV's LPs were sold in the United States as Angel records, bearing the elegant and witty recording-angel logo that Nipper had originally supplanted.

But the size and profitability of the CD market increased world trade, and CDs' relatively low shipping costs (compared to LPs) have led more and more record companies to export directly. By dropping the Nipper logo from their discs, these companies can sell the same CDs at home and abroad.

Meanwhile, Nipper's fortunes have revived in Camden, New Jersey, where Berliner's early gramophones were produced by the company that became Victor. The Nipper windows that used to adorn the tower of the Victor plant were reconstructed last summer, after years of vandalism, under the direction of the Cooper's Ferry Development Association.

4...5...6...GO

Taking your car stereo with you when you parked was great security (unless you got mugged for it). But most people never bothered because of their head unit's weight and bulk. A detachable front panel is easier to carry off, but even that makes a bulge in your pocket, so many people don't bother with it, either. Philips Car Systems (now part of VDO) has a security system you might actually use: On its Model 624 RBOS (left) and Model 604, only a small portion of the panel—the part with the "4," "5," and "6" buttons—is detachable, and it slips into a protective case that fits on your key ring. If you forget it, the empty case should serve as a reminder.

news & notes

- Rare recordings from the British Broadcasting Company are now available under the new BBC Legends label. About 24 recordings per year will be released over a three-year period. Most of these performances have not been heard since their original broadcast dates, 1938 to 1979.

- In 1998, sales of MiniDisc (MD) portables in Japan surpassed those of portable CD players for the first time. The Electronics Industry Association of Japan (EIAJ) predicts that sales of MD portables will rise by roughly 50% this year, while sales of CD portables should merely remain steady.

- When you program your CD player to skip some tracks on a particular disc, your player may remember that programming next time you insert the disc—but no other player will. Xtrax Labs (www.xtraxlabs.com) hopes to change that. The Xtrax user-preference system consists of CD labels you can mark and unmark as your track choices change plus a label-reading sensor and software to be built into CD players. Cost, says the company, should be negligible.

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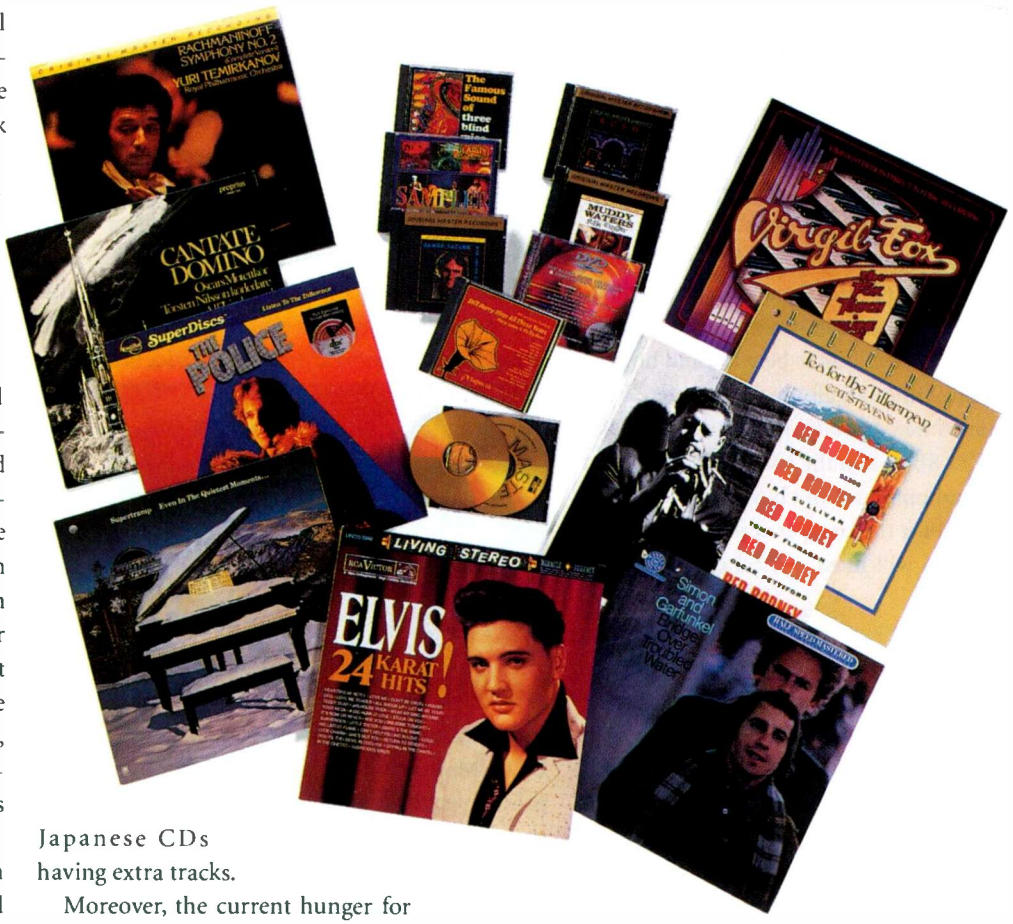
KEN KESSLER

IS THERE GOLD IN THEM THIAR DISCS?

Whither the audiophile disc? Does it matter anymore? Apparently so, even though it seems that the lust for superior pressings was far greater in the late '70s, when the LP ruled the world. Those of you old enough to remember the second wave of audiophile platters (we also mustn't forget Everest, in the '50s) will recall that those LPs were godsends: virgin-vinyl, 180-gram alternatives to the warped, noisy, poorly pressed dreck issued by the majors.

Before the appearance of such labels as Crystal Clear, Mobile Fidelity, Nautilus, et al., canny, quality-fixated American audiophiles sought out Japanese and British pressings, the former for their medical-grade packaging and flawless pressings, the latter—particularly the records of The Beatles, Led Zep, and The Rolling Stones—because of the likelihood that they were made from tapes one generation closer to the masters. *And* the British used superior inner and outer sleeves. But just so you'll know that the other man's grass is of a more verdant hue, there were (and still are, even in the CD era) British audiophiles who preferred U.S. pressings for releases by American artists.

Some reviewers and magazines on both sides of the pond have analyzed releases to the extent that some can expound on matrix numbers and inner-groove graffiti with the same intensity as a Talmudic scholar. And there are none more fixated than collectors of Beatles albums, who still swear that, say, the Sri Lankan mix of "Michelle" has extra instruments or that the Uruguayan *Sgt. Pepper* has different lyrics. But this particular diversion has little to do with sound quality, which is far more difficult to assess than something as obvious as Japanese CDs having extra tracks.

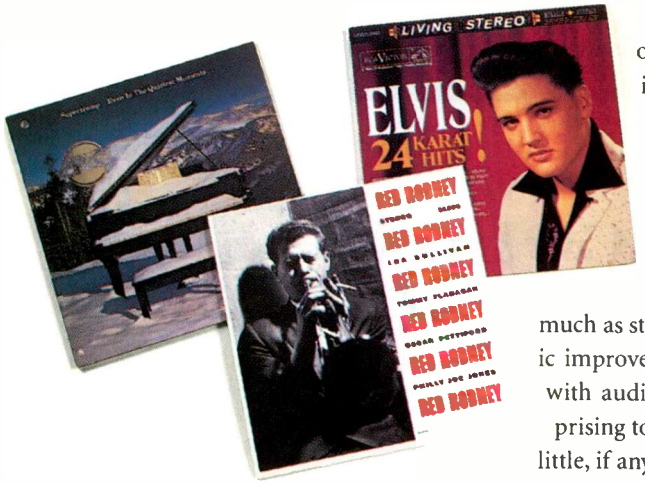


Photos: Len LaGrua

Moreover, the current hunger for Japanese CDs is not the same as the earlier passion for Japanese LPs, where sound quality *was* the issue. The CD-era fixation is more a case of quantity than it is of quality (though some might argue that Japanese CDs are pressed with more care than American or European discs). It was explained to me that Japanese record companies release CDs with extra tracks, typically material unavailable on albums released in the United States or elsewhere and almost always classified as "rarities," because of something as simple as perceived value. Even with Japan's economy in its current parlous state, Japanese CDs can cost more there than many imported CDs, especially mid-priced discs, so the record companies have to make the domestic pressings more attractive; otherwise, Japanese consumers might buy the less expensive imports. Which is why, for example, the Japanese edition of *7 Park Avenue*, the solo effort by Badfinger's Pete Ham, has five extra tracks.

THE LUST FOR SUPERIOR PRESSINGS WAS GREATER IN THE LATE '70s, WHEN THE LP RULED THE WORLD.

But sound quality? We've now reached the point where some releases—Miles Davis's *Kind of Blue*, Muddy Waters' *Folk Singer*, the entire



Kinks catalog, Bruce Springsteen's *Born To Run*, ad nauseam—have appeared in so many formats and editions that even anal-retentive types find it hard to keep them straight (extra tracks aside, that is). However much one propounds the theory that gold CDs offer audible benefits and however many times an album is remastered because of new technology (XRCD, XRCD2, HDCD, SBM, and the like), the majority of non-audiophiles won't buy them; they'll always opt for the cheaper version.

And so will most cynical or fed-up audiophiles.

Indeed, it's getting tougher to justify deluxe pressings—whether gold CDs or 96-kHz/24-bit versions—when nearly every major release, save in The Beatles and Garth Brooks catalogs, has ended up in the mid-priced bins. Imagine how painful it is for a premium label releasing a gold audiophile edition the same month that the identical title appears in the original label's mid-priced listing. It happens all the time, for the simple reason that the record label division that handles mid-pricing of the back catalog *never* communicates with the department in charge of licensing titles to independent audiophile labels.

That's why we found the European release of a 180-gram vinyl pressing of Mott the Hoople's *Mott* coinciding with Columbia's "Nice Price" CD edition at one-quarter the former's price. Or worse, two U.K. reissue labels releasing the same two-albums-on-one-CD of a pair of Impressions albums. (Apparently, Curtis Mayfield is a bit, uh, casual when it comes to selling exclusive rights.) An even nastier situation occurred when two U.K. labels released the same John Lee Hooker CD in the same month; it was originally a double LP, but one of the labels got only half of it. The list goes on, which makes reviewing CD reissues a constant challenge. But back to our more elitist tastes and the issue at hand.

Given that audiophile alternatives cost, typically, twice as much as standard releases and that the sonic improvements are evident only to those with audiophile inclinations, it's not surprising to learn that the general public has little, if any, knowledge of—or interest in—the premium versions. On the few occasions when a lifestyle magazine or a newspaper has picked up the story, it's often been in a gosh-wow or (more common) a who-do-they-think-they're-kidding tone, with the articles focusing mainly on price.

I search for audiophile discs relentlessly in mainstream stores around the world, but the distribution evidence suggests that only DCC, Mobile Fidelity, and Sony (with its gold Super Bit Mapping discs) have even a snowball's chance in hell of stealing some shelf space. Amusingly, the last time I saw a MoFi or DCC title in the U.S. in anything other than a hi-fi shop or one of the bigger Tower Records stores was in an airport—Atlanta, I think. And the only mainstream music outlets in foreign territories with any predilection for stocking gold CDs seem to be mega-stores like W.O.M. in Germany, Tower or Virgin in Hong Kong, or Yamagiwa in Tokyo. This leaves only one dependable avenue for the audiophile disc lover: mail order.

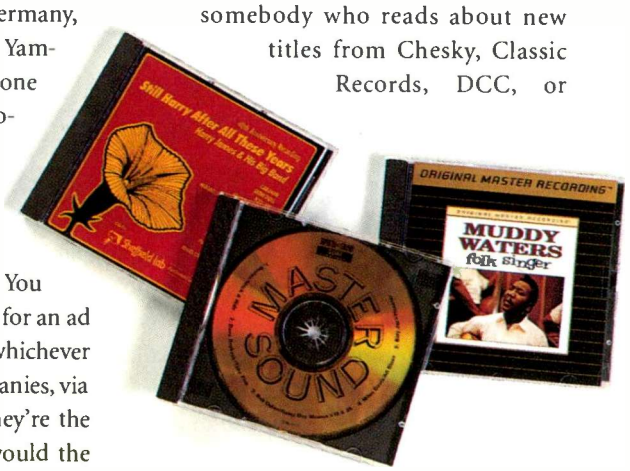
SOME REVIEWERS HAVE BUILT REPUTATIONS ANALYZING MATRIX NUMBERS AND INNER-GROOVE GRAFFITI.

Whatever is said about the Internet changing the way we shop, the bottom line is that it's really only a variant of mail order: You simply go online instead of looking for an ad in a magazine or newspaper. But whichever way you reach the mail-order companies, via PC or phone or postage stamp, they're the front line for specialists. Where would the CD gilding brigade be, for example, without Chad Kassem's Acoustic Sounds or each label's own mail-order facility? Fortunately for those who worry about the longevity of the genre, it would appear that the various mail-order firms do very nicely, thank you. It's no coincidence that the non-audiophile specialist reissue labels—Rhino, Sundazed, Norton, See For Miles, Ace, and so on—also depend on mail order and survive because of it; mainstream record stores are as uninterested in most back catalog as they are in audiophile CDs.

In Europe, the size of each country has led to near-monopolies, whereby one hard-working importer or distributor has assumed control of almost the entire territory. Admittedly, no single importer has the distribution rights to every label for its territory, but some come very close. Whether population or acreage determined it, In-Akustic in Germany and Vivante in the U.K. offer virtual one-stop shopping.

Germany and Italy, meanwhile, have always been good markets for premium LPs and CDs. Should you be averse to mail order, an annual visit to either country's hi-fi shows is usually enough to obtain everything at once. Between shows, the hi-fi magazines remind you of what's available and how to acquire it. The U.K., though, has had the spottiest history imaginable—and not just because the British are so damned cynical, suspicious, jaded, and tightfisted. From Quadramail in the late 1970s to Vivante in the late 1990s, there have been more audiophile-label distributors than, say, Monster Cable importers.

Vivante deserves thanks for imposing some sort of order and for ensuring that a steady flow of titles arrives in the U.K. You can imagine how frustrating it must be for somebody who reads about new titles from Chesky, Classic Records, DCC, or



MoFi to miss out on them entirely or subject himself to self-importation. (Not, I hasten to add, all that far removed from self-flagellation, despite streamlining of the mail-order process brought by credit cards, the Internet, and fax machines.)

Every time I speak with Vivante's Steven Carr and the subject of vinyl's survival or demise crops up, he disabuses me of my belief that it's only a handful of outspoken journalists who perpetuate the notion that the world is clamoring for LPs. He rattles off the sales figures for Classic Records' Jimi Hendrix box or how many of the Dylan live double album he's pre-sold. He cites a mailing list of 10,000 hard-core collectors and sales of typically 3,000 to 4,000 units a month (combined total), both of which point to the overwhelming ignorance or sloth of the outlets likely to benefit from stocking audiophile discs themselves: mainstream music stores and hi-fi shops.

Still, the future remains unclear. The alphabet soup of XRCD, DTS, SACD, HDCD, and SBM means that confusion reigns for all but the committed audiophile. If the specialists are to survive, they need a larger market, which means more mainstream consumers. And then there's the threat of audio-only DVD, which *could* be the Great Leveler that CD was supposed to be: a format that (allegedly) cannot be improved upon. With finalization of the DVD-Audio specification complete, all could be swept before it, but only if DVD-Audio emphatically blows away the myriad existing CD formats—including the very best of the gold CDs from MoFi and DCC.

HOW LONG WILL IT TAKE DCC, MoFi, AND THE REST TO ISSUE, SAY, GOLD DVDs?

But how long will it take DCC, MoFi, and the rest to issue, say, gold DVDs? How long before JVC comes up with XRDVD or Pacific Microsonics with HDDVD? Knowing the pace at which these guys work, it's probably happened already. But if Carr is right, they'll have no effect whatsoever on 180-gram vinyl or gold CDs. A

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COREY GREENBERG

SONIC FOUNDRY'S ACOUSTIC MIRROR

A couple of columns back, I threw a hissy fit and whatnot about the fact that nobody, save for a few smart outfits like Meridian, is doing anything even remotely intriguing or progressive in terms of DSP twiddling for high-end audio. Part of the reason was because I see so much cool DSP going on in the musical instrument market, where every six-month period brings radical advancement in what you can do to improve, modify, and just basically go buck wild with an audio signal on a home PC. While audiophiles like you and I spend thousands of dollars on new high-end audio products that aren't actually all that different in scope or function from what we bought five years ago, home studio hobbyists and musicians can go down to their local Guitar Center (which, by the way, *sucks*), plop down 500 clams or less, and take home bleeding-edge digital signal processing lurking inside super-cool effects units, digital mixers, and even the new breed of guitar amps that can clone the sounds of dozens of classic, unattainable amps (like a late-'60s Marshall stack or a Beatles-era Vox AC-30).

But what really put me over the edge and made me realize just how advanced the PC side of the digital audio equation has gotten in the past year was a miracle of nature called Acoustic Mirror. I'm telling you, this thing has fundamentally changed the way I record and process audio on my PC. A digital signal processing suite from software designer Sonic Foundry, it's hands down the coolest and most thought-provoking new product I've seen on the PC recording scene in a while. If it cost $500, I'd say it was indispensable to anyone who's into this stuff. But at just $250, I'm calling it a must-have. There isn't a single audio track I record onto my hard drive these days that hasn't been processed with Acoustic Mirror by the time I do a stereo (or, increasingly, a 5.1 surround) mixdown.

Acoustic Mirror isn't anything you can plug in, although it *is* a plug-in—a DirectX plug-in. DirectX, a Microsoft format for add-on software patches, has been adopted by most of the guys designing PC recording software these days—like Sonic Foundry for its Sound Forge and Syntrillium for its Cool Edit Pro (the program I mainly use for stereo and multitrack recording and just plain digital audio fiddle-about). If you've got DirectX-compatible software, you can load DirectX plug-ins, like Acoustic Mirror, onto your hard drive and access them as special effects while you record—kind of like fonts for your word processing software or plug-ins for your Web browser. Typically, DirectX plug-ins don't take up a whole lot of space on your drive (the entire Acoustic Mirror plug-in uses less than 5 megabytes), but each plug-in can do the work of a separate and expensive effects processor.

ACOUSTIC MIRROR HAS MADE ME REALIZE HOW ADVANCED DIGITAL AUDIO HAS GOTTEN ON PC.

Except, as I said, Acoustic Mirror is not expensive. Two hundred and fifty bucks? In my neighborhood that's a lunch and a back wax, not including tips for either. None of these cool plug-ins cost all that much, considering the amazing things they can do. And here's the why-the-hell-isn't-high-end-audio-doing-this part: *It's just the DSP.* That is all a DirectX plug-in is—digital code. It comes on a CD-ROM or a file that you download off the Net, and you just load it onto your hard drive. The expensive part—the power supply, the DSP chips, and all the related hardware that reads the code and runs through the routines a gazillion times a second—is already in your

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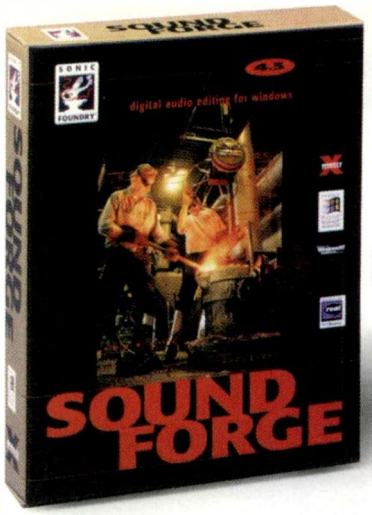


A box of sonic signatures

PC. In other words, the hardware part that makes outboard studio processors—Lexicon digital reverbs and Yamaha multi-effects and Manley limiters and dbx compressors—so expensive is something you already bought. The plug-in is just the instructions, so it *can be* cheap while still creaming a lot of the high-dollar outboard boxes at their own game. Are you figuring out yet why I'm so in love with this PC recording stuff?

These software designers may be pierced in places I've never even felt on my own body, but they've created an economical model that makes a ton more sense than having to buy a new $2,000 black box every year. This is where I see the high end going, if it ever pulls its head out and decides to compete with the outside world instead of just with itself. Take the Theta Digital Casablanca surround preamp I use as the anchor of my home theater rig. This wonderful chunk of steel costs well over six grand once you load it down with all the options, but in its heart of hearts, the Theta is really just a PC in hi-fi clothing. So why can't we download DirectX plug-ins off the Net that extend the Casablanca's capabilities? Theta's just announced a few upgrades, such as digital EQ and the like, but to get them you've got to shell out the long green for a replacement board. Imagine if you could go to Theta's Web site, flash the cyber plastic to the tune of a few hundred bucks, and then download the plug-ins to your Casablanca—where they'd just become another addressable feature.

Go further, and dream of a day when the high-end community (a term more figurative than literal, like "thousand points of light" and "fans of Tony Danza") agrees on a plug-in standard, whether Microsoft DirectX or something else, so all you'd have to do would be to buy a simple digital controller and then add whatever inexpensive, high-performance software plug-ins you wished. I would love to buy, say, a Theta Digital Casabasic and then add Dolby's $100 AC-3 plug-in for DVD-Video playback, Meridian's $100 MLP plug-in for DVD-Audio processing, and maybe even the free DTS plug-in that came in a box of Fruity Pebbles along with the plastic magnifying glass (which I actually will use).

But back to Acoustic Mirror. This is crazy stuff. It's not really a reverb, though it comes with the most wicked-cool-sounding digital reverbs I've heard yet. And it's not really a microphone modeler that makes your recording sound like you used vintage $10,000 Neumanns instead of $50 Shures, though it can do that, too. What

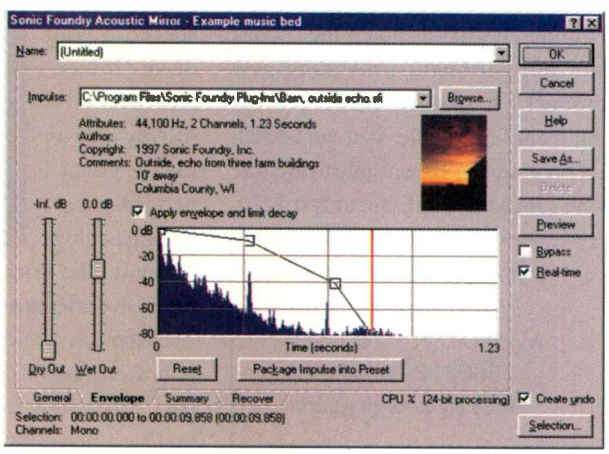
IMAGINE GOING TO THETA DIGITAL'S WEB SITE AND THEN DOWNLOADING CASABLANCA PLUG-INS.

Acoustic Mirror *is* is—are you ready for this?—an "impulse-convolution modeler." It chirps out a little impulse click into an acoustic environment (or through an audio signal path), studies every last squiggle that gets added to the waveform at the other end, and then models a full-range processing algorithm designed to replicate the room's sound. Acoustic Mirror can do this with any environment, no matter how big or small. It comes with presets of famous concert halls, such as the Meyerson in Dallas, but you can model the shoe box your Florsheims came in if you're interested in hearing what a full choir sounds like singing inside a cardboard box. And it can do the same thing for an electronic signal path, like a tube preamp, a cheesy spring reverb, or even a guitar amp. I used Acoustic Mirror to model my Fender Princeton, and now I've got an eerily real-sounding effect preset for its sound that I can use to color anything I record.

What makes Acoustic Mirror so special is that it's a modeler, *not* a simulator. Nearly all digital effects processors on the market, no matter how expensive, are simulations of the real thing. A Lexicon or Yamaha or Alesis engineer may have gone to ungodly trouble measuring the acoustic parameters of certain concert halls or a plate reverb, but in the end he's punching numbers on a workstation to create the effect. He takes a stock synthesized reverb preset and modifies it by bumping up the decay a few clicks here, adding a bit more pre-delay there, rolling off the highs for a deep hall ambience, or boosting them a bit for a brighter, harder small-room reverb effect. You can do a pretty impressive job simulating a real reverb if you're as wicked smart as the Lexicon and Yamaha engineers, but in the end it's always going to fall short of the real thing (if you listen closely). When I was younger, I used to glop on the digi-verb with my trusty Yamaha SPX-90 like there was no tomorrow; yeesh, I listen to those recordings now and cringe at the cold, hard, unnatural sound.

But this Acoustic Mirror is something else entirely. I find myself using it more, not less, because every one of its reality-modeled reverbs sounds great. With every other reverb processor, I have to page through every preset to find the one that sounds okay. With Acoustic Mirror, I have a tough time choosing from all the different reverbs because they all kick ass. Sonic Foundry

What echoes from a Wisconsin farm look like



The Sonic Foundry family of sound software.

ships the program with everything from famous concert halls to school gyms to plate reverbs to empty grain silos—like the one Scrooge McDuck used to keep all his money in and dance around on top of it all, cackling like a hen while nephew Donald and grand-nephews Huey, Dewey, and Louie busted their asses working the farm down below. So if you're looking to get some of that Scrooge McDuck sound on your next recording project, look no further.

But amazing sounding reverbs are only part of what Acoustic Mirror can do. As I said, it's a modeler, so it can clone acoustic environmental effects, such as reverb, as well as the sonic character of microphones. The CD-ROM has 14 presets to endow any recorded track with the sonic characteristics of a famous mike. Among them are the Neumann U-47, AKG C-12, and RCA DX-44, though Sonic Foundry wisely refrains from listing these presets as such—calling them Condenser Microphone #1, Ribbon Microphone #2, and so on. Any seasoned microphone aficionado, however, will instantly recognize which preset is which classic microphone.

Now, obviously you're not going to get a perfect clone of a classic microphone, because when Acoustic Mirror goes to work bending your track's waveform like soft taffy, it's got no idea what kind of mike you originally used to record it in the first place. All it can do is add the modeled mike's coloration to the sound of the mike you already used, but it's definitely a super-cool effect and does wonders in classing up the sound of a track recorded with a less-than-sterling dynamic mike. For example, although I've got some nice mikes to play with these days, I've still got an old beat-up Electro-Voice 635A dynamic from my days in radio. (I used to pound nails into drywall with it when the news reporter was not taking it out on assignment.) The 635A is a cheap, bullet-proof mike that sounded groinky and shrill even when new, but I like the way it sounds with a guitar amp so I keep it around. Almost as a joke, I used it to record some vocal tracks and then did the Acoustic Mirror mojo on them with the various presets for condenser, tube, and ribbon mikes. I was shocked at the results. If I didn't know better, I'd be easily fooled into thinking I was hearing a track miked with a $10,000 studio condenser. Seriously, the mike models do a much more convincing job than I thought they possibly could. And even when I use an excellent large-diaphragm condenser, such as the Audio-Technica AT4033, I sometimes like to "fool" the track into thinking it was recorded with an old RCA ribbon or a tube AKG, just to get a wider palette of sounds on a full mix while still using just one microphone to track everything.

WHAT MAKES ACOUSTIC MIRROR SO SPECIAL IS THAT IT'S A MODELER, *NOT* A SIMULATOR.

The coolest thing I've done so far with Acoustic Mirror is to model my Leslie rotating organ speaker. A Leslie is what gives Hammond organs *that* sound: You've got a dirty tube amp driving a speaker with a spinning rotor in front of it, and the resulting "police siren" effect gives it that thick, wobbly, churchy sound. Mine's an old Leslie Model 16 from the '60s that I've rebuilt with a Weber VST guitar speaker, and it's my favorite way for a guitar to sound. No matter how terrible a player you are, if it's going through a Leslie, you sound like a million bucks.

There's plenty of Leslie simulations on the market, but whether it's one setting out of 200 in a multi-effects processor like the Alesis Quadraverb or a single-purpose Leslie-clone stand-alone unit, none of them *really* sounds like a Leslie. Some sound cool and some sound comical, but none sounds as good as when you actually run your guitar or even your voice through a real Leslie (think John Lennon on "Tomorrow Never Knows" and "Blue Jay Way" or Jack Bruce on Cream's "As You Said") and then catch it with a good microphone.

So what I did was use Acoustic Mirror to model my Leslie, driven by an old Fender Princeton tube guitar amp miked with a stereo pair of Audio-Technica AT4050s. The Acoustic Mirror CD-ROM has test tones to create your own impulse files, so I just fed my CD player's output to the Princeton and miked the Leslie in stereo, with the 4050s on opposite sides of the cabinet. After recording the result on my PC with Cool Edit Pro, I launched Acoustic Mirror and, with maybe two or three keystrokes, used it to process the recovered impulse into a custom effect preset that makes any track I record sound like it was played through a real-life Leslie. In real-life stereo. All told, this took me 10 minutes. And I haven't even scratched the surface of what I'm going to do with Acoustic Mirror when I get real, *real* gone with it.

If you do PC-based recording, you have got to get Sonic Foundry's Acoustic Mirror. Even if you just use the supplied presets and never create your own custom impulse files, it's a ridiculous steal for just $250. But I can tell you that once you start exploring the world of DSP impulse-convolution modeling, you'll lose yourself in the endless possibilities this extraordinary software brings to any DirectX-compatible recording suite. And if you happen to model the sound of a pipe-smoking audiophile banging his head against a rec room wall because he's got to buy a new $2,000 box just to hear the new HDCD-encoded DTS DVD-Audio discs, e-mail me the impulse file and I'll trade you for Scrooge McDuck quacking through a Leslie inside a shoe box. A

THE MAGIC OF FILM SOUND

THINGS ARE SELDOM WHAT THEY SEEM

by IAN G. MASTERS

Sometimes reality is a poor substitute for artifice, as witness motion pictures, which may be the defining art form of the 20th century. Most people accept that what we see up on the big screen—or in our home theaters—is largely fake. Live action can be combined with animation or modified by various forms of trick photography and exotic processing to create an environment and series of actions that never existed. We know these are illusions, but we're charmed by them anyway.

Except in a vague sort of way, however, most of us don't realize that what we hear on a movie soundtrack is usually even more artificial than the visual images. Only the tiniest bit of what comes out of the speakers has anything to do with what was happening when the cameras were rolling. A movie soundtrack is built up sound by sound, layer by layer, long after the pictures have been finalized. It's all part of the post-production process.

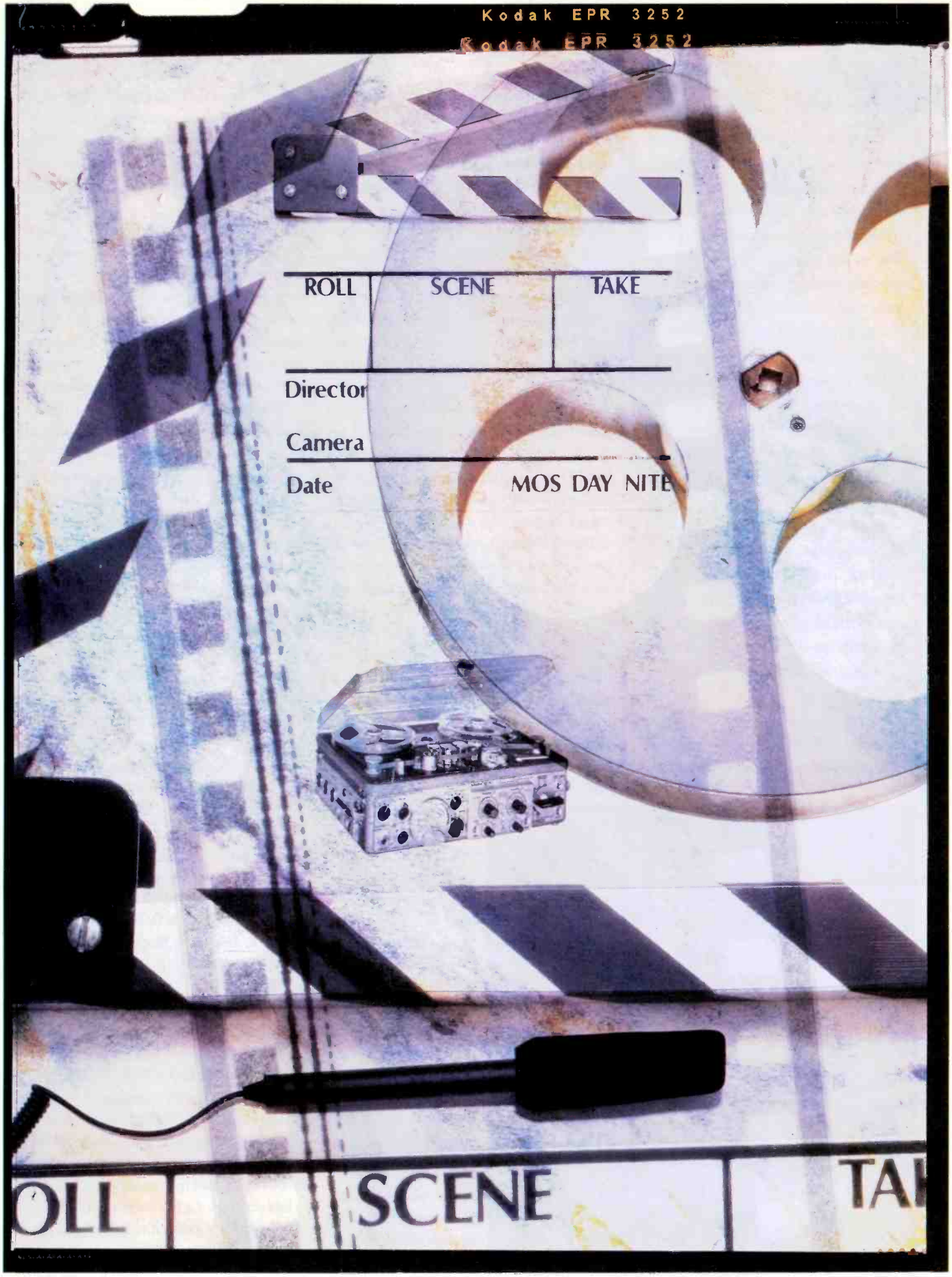
Even the simplest of movie scenes can require a lot of doctoring. It might seem that something as straightforward as a couple of actors walking along a sidewalk having a conversation might be easy enough to record, but that's not usually the case. For one thing, the natural sounds that accompany the action rarely record properly; they either sound unnatural or are too loud or too soft. And there's always the risk of a jet flying over an otherwise perfect take.

Part of the audio engineer's art in film, therefore, is to pick up as much of the live dialog as possible and eliminate as many of the other sounds as possible, knowing they will sound better when added in later.

ON THE SET

North American filmmakers like to use as much live dialog recording as they can. That makes matters simpler later and imparts a sense of spontaneity that other methods may lack. But even if the director knows that the sound recorded on the set will be unusable, because of extraneous noise or the difficulty of placing microphones properly without their being visible, it's still almost always recorded while the actors are acting. (In the film business, it's called production sound, in contrast to the sound added later on during post-production.) If nothing else, it can act as a guide when the dialog is rerecorded later.

For decades, the standard device for recording on-set dialog has been the Swiss-made Nagra open-reel tape recorder. Although

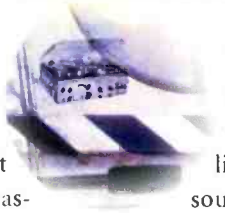


PHOTOGRAPH BY DAVID HAMSLEY

A DAME'S DIALOG

The producers of a recent television miniseries cast one of Britain's most distinguished actresses, and as expected, she turned in a flawless performance. Inevitably, some of the on-set dialog had to be replaced; however, despite some 60 years of filmmaking, the grande dame turned out to be hopeless in the automated dialog replacement (ADR) studio. The usual technique, in which the actor listens to the original sound through headphones and repeats the lines while watching the action unfold on screen, simply flustered her.

After a few experiments, the ADR engineers found something that worked: They ditched the picture altogether and spliced individual lines into loops of tape that the actress listened to several times. Then she whipped off the headphones and gave a perfect reading of the line. As long as she was not distracted by the original picture and sound, she could mimic herself exactly.

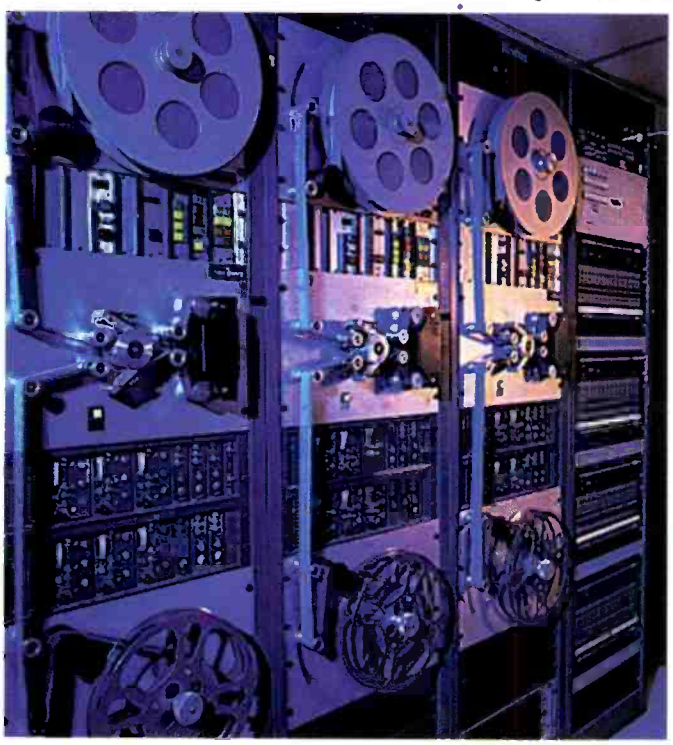


hardly larger than a lunchbox, this is one of the most highly regarded analog recorders in the world. It has occasionally been used for mastering music recordings in preference to much larger studio recorders.

For film use, the Nagra has one vital attribute: It records a control track alongside the audio so that the tape can be synchronized with the film during the editing process. Many of these machines are still in use, because audio technicians are fond of them and because they represent a sizable investment for the mostly freelance audio engineers who often do this sort of recording.

Nagra does have a digital machine that records four channels of 20-bit digital audio, but it's still relatively rare because of its cost. Another alternative is a film-specific DAT machine that can record a synchronizing track along with the audio.

Dialog is usually recorded by using a microphone on a boom that's held over an actor's head, just out of the picture. The microphones are directional, to focus on the performer's voice and to exclude as much other sound as possible. On occasion, more than one microphone is used, sometimes to pick up a second actor or to serve as an alternative to the first mike. Wireless microphones come into play here, although they can be plagued by interference, especially during location shooting.



During the mixdown, dubbers play sprocketed 35mm magnetic film (one for each sound effect) in sync with the picture.

An image familiar to most of us is an assistant director snapping a clapper-board shut at the beginning of a take. This is a vital step for the later processes. It provides a visual identification of what's on that piece of film (and an audio identification, for the person who claps the board also reads its information onto tape). And the clap itself serves as both audio and visual markers that can be lined up in the editing suite so the sound and picture start together. Clappers have mostly given way to devices that use lights and electronic noises, but the principle is the same.

THE FIRST POST

Once filming has been completed, the audio has to be converted into a form that will be usable in post-production. Until very recently, that meant dubbing it to magnetically coated 35mm film stock, using the control track to ensure that the audio corresponded perfectly to the picture, frame by frame.

The two pieces of film could then be loaded into an editing machine, lined up using the clapper information, and then run through the editor with audio and image in perfect sync. By cutting the two in identical places, bits of different shots could be assembled into complete scenes, then reels, while maintaining synchronization throughout.

These analog techniques are still used, but they are rapidly being replaced by digital technology. One popular medium is the DA-88 from Tascam (Teac's pro brand). It uses Hi8 camcorder cassettes to record eight channels of 16-bit digital audio, which can be manipulated by sophisticated audio editing computer programs, such as Pro Tools from Digidesign. Multiple DA-88s can be linked so that any number of tracks can be used to make a final mix.

Although the DA-88 has become very common, it shares with the older analog system some of the drawbacks of being tape-based. That has been addressed by the MMR 8, also from Tascam, which uses removable hard disk drives as the recording medium, again controlled by computer. This machine has huge storage capacity and the virtue of random access.

HERE WE GO LOOP-DE-LOOP

In a perfect world, stringing all the bits of on-set recording together would result in a complete dialog track, but, as noted, a lot of it is unusable. It may have too much extraneous noise, bad microphone placement, or a bad reading of a line on the part of the actor. In extreme cases, it may be necessary to replace a voice completely and use that of another actor. The second step in the audio

assembly, automated dialog replacement (ADR), compensates for these mistakes.

Fixing dialog used to be known as looping. In analog practice, a scene that needed dialog repairs was cut up into short bits—individual sentences, often—and the audio and video film was spliced into loops that displayed the image of the actor saying the particular line over and over. As he listened to the on-set audio through headphones, the actor delivered the line repeatedly, along with the film, until an acceptable version was recorded. The new sound was then spliced into the dialog track to replace the original.

Modern ADR studios offer a variety of microphones to match those used in the field, and acoustics can usually be controlled to some extent to achieve a reasonable match. Again, digital technology is now used for these functions, but the process is similar, if somewhat more easily accomplished. The same techniques, it might be noted, are used for dubbing movies into foreign languages; the originating film company supplies an M&E (music and effects) version of the film, with everything except dialog, and the foreign studio inserts its own.

Except for the salvageable live dialog, almost everything that goes into a movie soundtrack is added after the fact, in post-production. The exception is musicals, where the musical numbers are recorded in advance, the actors miming along as they are replayed on the set.

JINGLE, THUD, SPLASH

The on-set and ADR engineers take considerable pains to see that that the dialog track has nothing but dialog on it, but there are sounds you expect to hear with certain actions—opening a door, walking across a room, slamming a car door, etc. These are supplied at the next stage—called foley, after the man who first practiced it.

A foley studio is very similar to an ADR studio, but its purpose is to add incidental sounds rather than dialog. Again, the picture is cut up into short segments that are shown on a screen, and the foley artist tries to match appropriate sounds to the action on the screen. Foley studios maintain an extensive collection of props and often have low wooden boxes filled with gravel, earth, and other materials, used by the foley artist to re-create the sound of footfalls on paths, country roads, and the like. A scene may need numerous different sounds, each of which is carefully laid down. Multitrack digital recorders can be used for this. Though they are handy for minor timing adjustments (such as a click being a fraction of a second late), many engineers prefer to use 24-track analog tape recorders at this stage because the recording function can be punched in and out.

Foley studios use props, such as actual car doors and boxes of dirt, to re-create ambient sounds.

Only after all the foley sounds for a scene are assembled is the analog tape dubbed to digital (or, where it is still used, to 35mm magnetic film). As with dialog and ADR, the result is a series of tracks in perfect sync with the corresponding pictures.

FROM THE CAN

Over the years, an immense body of recorded sound effects has been amassed. Prerecorded effects are frequently used in films. In many cases, there's no real point in creating an effect if an acceptable one is already available. Which effect is acceptable is not always obvious, however. In several effects samplers I've heard, some of the sounds were so similar that I could barely tell them apart.

Some sounds are used because they're conventional. A real gun, for example, does not sound like much when you record it. But there is a selection of bangs that we *accept* as gun sounds, and they are what is used. Ditto for punches: Slugging someone doesn't make all that much noise (except, perhaps, to the sluggee), but the resounding *thwomps* used in movies have the illusion of reality. Some years ago, a commentator

THE ITALIAN WAY

North American film practice is to use as much sound recorded on a movie set as possible, but other filmmakers have other ideas. In the days of spaghetti westerns and Steve Reeves movies, Italian studios used no live sound at all.

One reason the Italians replaced everything was that the casts were usually multinational, and each actor spoke his own language. In post-production, the actors looped their own dialog for the version going to their own country, where presumably their voices were known. The other parts were dubbed, as in any foreign language film.

That was the practical reason. The other was that Italian directors, following a tradition that went back to silent films, usually shouted instructions to their actors during filming, rendering the on-set audio virtually useless.

THE SEA LION

Movie sound people have access to huge libraries of stock effects that can be dropped into a soundtrack with the click of a mouse, but sometimes the effects need enhancing—or, at least, the audio engineers think they do. In one notable example, a scene in *Indiana Jones and the Last Crusade*, the action takes place on the deck of a ship during a wild storm in the North Atlantic. As waves crash over the ship, moviegoers do indeed hear the sound of sea water, but with the sound of roaring lions mixed in. Seems that an Atlantic storm just isn't ferocious enough.

HIDDEN FUN

Film sound technicians are by no means above the occasional in-joke. One oft-told story may well be apocryphal, though it does have the ring of truth.

As frequently happens, a sound-effects designer needed the murmur of a crowd for the background of a scene. He assembled a number of people in his studio to record the effect, but instead of having them mouth nonsense syllables, he had them mutter obscenities.

The obscenities will never be heard by an audience, because they were added into the soundtrack running backwards and were therefore totally garbled. The effect was not lost on the film editors, however; every time they ran the film in reverse to get to the beginning of the scene, they were greeted by a torrent of blue language in the background.

pointed out that if you can hear frogs during a night scene, you're hearing the sound of California tree frogs—no matter where the movie is set, because that's what viewers expect to hear.

The console at Deluxe Toronto's mixing theater blends music, effects, and dialog into a multichannel movie soundtrack.

Percussive sounds—i.e., gunshots, door slams, explosions—used to be dubbed to 35mm magnetic film and then simply spliced into the effects track at the appropriate frame. Now, computer software lets the engineer select the sound from a menu and paste it into the track at the right moment. These sounds may be in stereo or even surround sound, but many are in mono; it's up to the mixer to place them in the soundstage later on and to add whatever acoustic environment he feels is necessary.

At this stage, all continuing ambient sounds—such as wind, traffic, crowd noises, and tree frogs—are laid down, again to be fine-tuned later in the mixing process. The sound designer will often customize the effect by combining more than one, sometimes surprisingly. In one movie, the sound of train cars being coupled together stood in for a ship breaking up.

After this stage, there may be dozens of separate effects tracks, foley and recorded, all synchronized but not combined in any other way. Some sub-mixing may be done if certain combinations are obvious, but usually that is left for the final mixing stage.

MUSIC, MAESTRO

Virtually every film has music in it to some extent, whether the occasional bit of incidental mood setting or major themes that are vital to the atmosphere of the film. There are two sources of music, existing recordings and a score specially created for a movie.

Some movies are notable for peppering scenes with old recordings, and the technology for this isn't much different from that for sound effects. The same is true of "production music," generic pieces that producers license and use in their pictures (generally low-budget efforts) to avoid commissioning or recording music. Both types can simply be dubbed to whatever production medium is being used and mixed in when appropriate.

Higher-budget movies tend to have original music tracks, which are often recorded in a handful of special studios where the conductor can watch the action on a screen as he directs the musicians. Like dialog, this is recorded on a medium in sync with the appropriate picture. Other music, not as action-specific, might well be recorded in a conventional studio.

The final group of tracks now exists, and the assembly into a single composite soundtrack can begin.

THE MIXMASTER

To this point, the various sound people—from on-set boom man and foley artist to sound-effects specialist and music recorder—have been putting together a set of building blocks. These are the elements of the final track, synchronized and recorded as well as technology allows though still basically raw. Blending them into a coherent whole requires skill and some very distinctive equipment.

First, there's the mixing theater itself. Some mixing theaters are quite modest, for television shows and small-scale productions; they might, for example, have projection video monitors rather than movie projectors. For mainstream films, however, the viewing rooms are as close as possible to full-blown theaters. Some have seats and can even double as screening rooms.

It's important that the characteristics of the room where the sound is mixed be as close as possible to those of real theaters; this ensures that the mix is made in a

AUDIO OPTIONS

During production, the picture and sound of a film are separate. The audio may be on analog 35mm magnetically coated film or on one of the various digital media that are becoming more common. In the end, however, the two have to be joined together. For home theater use, the production house simply delivers the film and the separate audio track to the distributing company and lets the distributor decide how to release it on disc or tape.

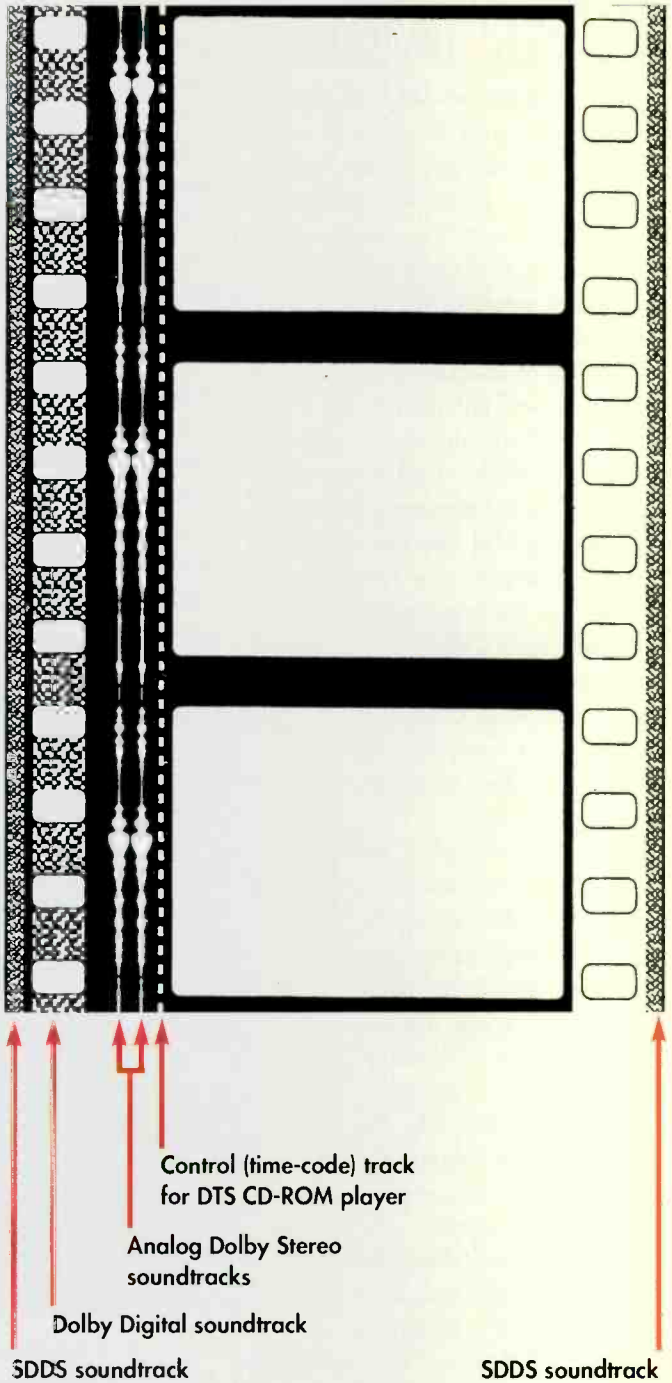
At one time the proponents of the various digital surround schemes touted the fact that certain films were released for theaters in their systems, but movies are increasingly being issued with four separate soundtracks to facilitate showing them in any theater. The four are encoded and exposed onto a piece of 35mm film negative in a single pass, the negative ultimately to be combined with the picture for release. Although other methods of carrying sound, from transcription discs to magnetic stripes, have been tried in the past, optical soundtracks are best because they permit picture and sound to be printed on the final film in a single operation.

At right is a sample of a film print that contains all of the information needed for four different systems of audio encoding.

SDDS: The Sony Dynamic Digital Sound track is the only one recorded on the film twice, outside the sprocket holes on each edge. The two tracks are identical; each acts as backup to the other, because the outer edges are the parts of the film most likely to suffer damage.

DOLBY DIGITAL: The speckled areas between the left-hand sprocket holes contain the compressed Dolby Digital information. A special head in the projector reads this disjointed material, and a decoder reassembles it into a continuous track. If you look closely at a real piece of film, you'll see Dolby Labs' double-D logo printed on the audio track.

DOLBY STEREO: This is old-style analog matrix surround (or Dolby Surround, in home theater parlance). The two tracks are immediately to the right of the left-hand sprocket holes and enable this film to be exhibited in any theater. These tracks are usually Dolby SR-encoded. ("SR" stands for Spectral Recording, Dolby Labs' sophisticated analog noise-reduction system developed for professional use.)



DTS: The compressed soundtrack from Digital Theater Systems actually emanates from a separate CD-ROM player, but it is controlled by a synchronizing time code optically printed on the film and read by a head on the projector. The time code can be seen as a series of vertical dashes just to the right of the two analog tracks.

The picture itself fills the area between the DTS time code and the right-hand sprocket holes. The only bit of unused real estate on the film is between the right-hand sprocket holes. One mixer said to me when I pointed that out, "God! Don't tell anyone!"

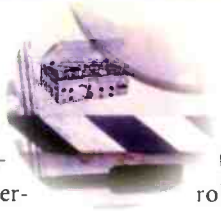
ACCIDENTAL MUSIC

Music and the movies have gone hand-in-hand since film sound was invented, and Hollywood has been a source of hit songs for decades. Though the music has not always been original, until quite recently existing songs would at least be freshly performed for a film.

The idea of using existing recordings is now well entrenched, but one of the earliest and best known soundtracks of this kind happened more or less by accident. Director Mike Nichols had approached Paul Simon to compose the score for a new movie he was making, *The Graduate*, and Columbia Records, assuming there would be lots of new Simon & Garfunkel material in it, snapped up the rights for the soundtrack album.

Simon wasn't fond of the movie, calling its plot "bad Salinger." While waiting for his creative juices to flow, the audio engineers dropped existing S & G songs into the track temporarily. Simon's inspiration never really came; Nichols and, ultimately, the Columbia execs thought the standing material worked and decided to keep it.

Two songs that Simon did write were not used, and even the movie's signature song, "Mrs. Robinson," was actually written for Simon & Garfunkel's *Bookends* album, which they were working on at the time. Simon was inclined to sing it as "Mrs. Roosevelt" until Nichols insisted on Robinson so that the song could be used in the movie. The album that neither Simon nor Garfunkel wanted released—containing only about 15 minutes of their music, none of it new—made them stars. It also paved the way for such landmark records-on-film releases as *American Graffiti* and *The Big Chill*.



matching acoustic environment. Many mixing rooms, by the way, are THX-certified—which is sensible, as the whole reason for THX certification in theaters is to make them as similar as possible to the mixing rooms, where creative decisions are made.

Across the back of the mixing room is usually an immense console that enables the engineers to control numerous audio sources. New rooms have much smaller digital "boards" that do as much, or more, in less space.

Traditionally, the heart of the mixing process, at least in the hardware sense, was a wall full of dubbers. Surely one of the most remarkable machines in all of audio, a dubber is a large tape deck that plays the 35mm magnetic film produced in the earlier post-production phases. In the control room adjoining the mixing theater, a number of these machines are linked together—and linked to a projector—so that all of them start and stop at the same time. This process is impressive to watch, as dozens of machines spring into action at the same instant.

Engineers use computer software to select sounds from a menu and paste them into a track at the right instant.

Each dubber is loaded with one of the raw tracks—dialog, ADR, foley, music—and set at the corresponding beginning frame. Each output is fed to an input on the console in the mixing theater, where the mixer can control the track's level (among other things) and direct it to one of the channels of the final surround sound mix.

A touch of a button starts all the dubbers, the projector, and the final recorder. Mixing engineers have customarily tended to work in short spurts, fine-tuning the mix by trying it out, rolling the tapes back, and trying again until they're satisfied. The process is called rock and roll.

As with other functions in the building of a soundtrack, this final mix has been increasingly digitized. As one engineer told me, the Tascam DA-88 Hi8-based digital decks are now, after about three years of availability, as common as dubbers. And the DA-88s are being supplanted by the MMR 8 disk-based recorder, which offers greater flexibility and 24-bit resolution. Because there's less sense of finality to each element of the mix, creating longer stretches at a time has become the rule, and rock and roll is less a part of the process.

The mixing engineer has a number of visual guides to aid him. For example, long diagonal lines are sometimes drawn on the film itself in grease pencil or scratched into the emulsion, to mark the beginning and end of a fade. When the line projected on the screen reaches the far side of the frame, the fade should be complete. Dark scenes are sometimes temporarily lightened so the mixer can see details better, details that determine what the sound does but that don't necessarily have to be apparent to the audience. This echoes the use of "slash prints"—black-and-white versions of scenes—sometimes used earlier in the post-production chain because their high contrast enables engineers to see details more clearly.

The final mix is the real creation of the soundtrack. If it isn't right at this stage, all the work that has gone before will have failed.

Ultimately, line by line, scene by scene, reel by reel, all the audio elements are blended into a final six-channel surround mix, created in an environment that emulates the place where moviegoers will ultimately experience the film. A

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CONVERGENCE GETS CONVINCING

by IVAN BERGER

My home theater, my main stereo music system, and my PC are all in separate rooms, with little in common except my electric bill. Until recently, I scoffed at talk of "convergence" among the three. Now I'm not so sure. Examples of convergence are starting to cross my desk as frequently as leaves blow across my lawn.

I'm not just talking about the gradual transition of audio (and now video) from analog to digital but also about the computer's influence on A/V equipment design and, to a lesser extent, the reverse. Perhaps the best example of the PC's influence on A/V hardware design is the Meridian 800 CD player. Like my home Pentium PC, which now has none of the parts it had when it was born as a 486 model, the 800 is totally updatable and upgradable.

The use of computer disc drives helped Meridian turn its Model 800 CD player into a DVD player.

To begin with, you can change or add plug-in circuit boards to update or add to the Meridian 800's functions. The same technique is used in such high-end preamps as the Theta Digital Casablanca (reviewed in our April 1997 issue) and the EAD TheaterMaster (reviewed in November 1998). The Meridian 861 preamp (also reviewed in November 1998) employs this technique, too, even using some of the same boards as the 800.

The 800's optical-disc drives are likewise interchangeable. But what really makes this Meridian player the poster child for convergence is that those drives come from the PC parts bin. (This will make it easy for us to upgrade to newer drive designs and give us a wide choice of drives to choose from, including CD changers.) Drive interchangeability has simplified Meridian's job of reworking the 800 into a DVD machine; any of the growing number of computer DVD drives can slide right in where the CD drive was. The only thing delaying the 800's availability, says Meridian, is uncertainty about the audio-oriented DVD format. And that should be resolved, as they say in the computer field, Any Day Now.

THE SYNERGY OF HOME THEATER & HOME COMPUTING

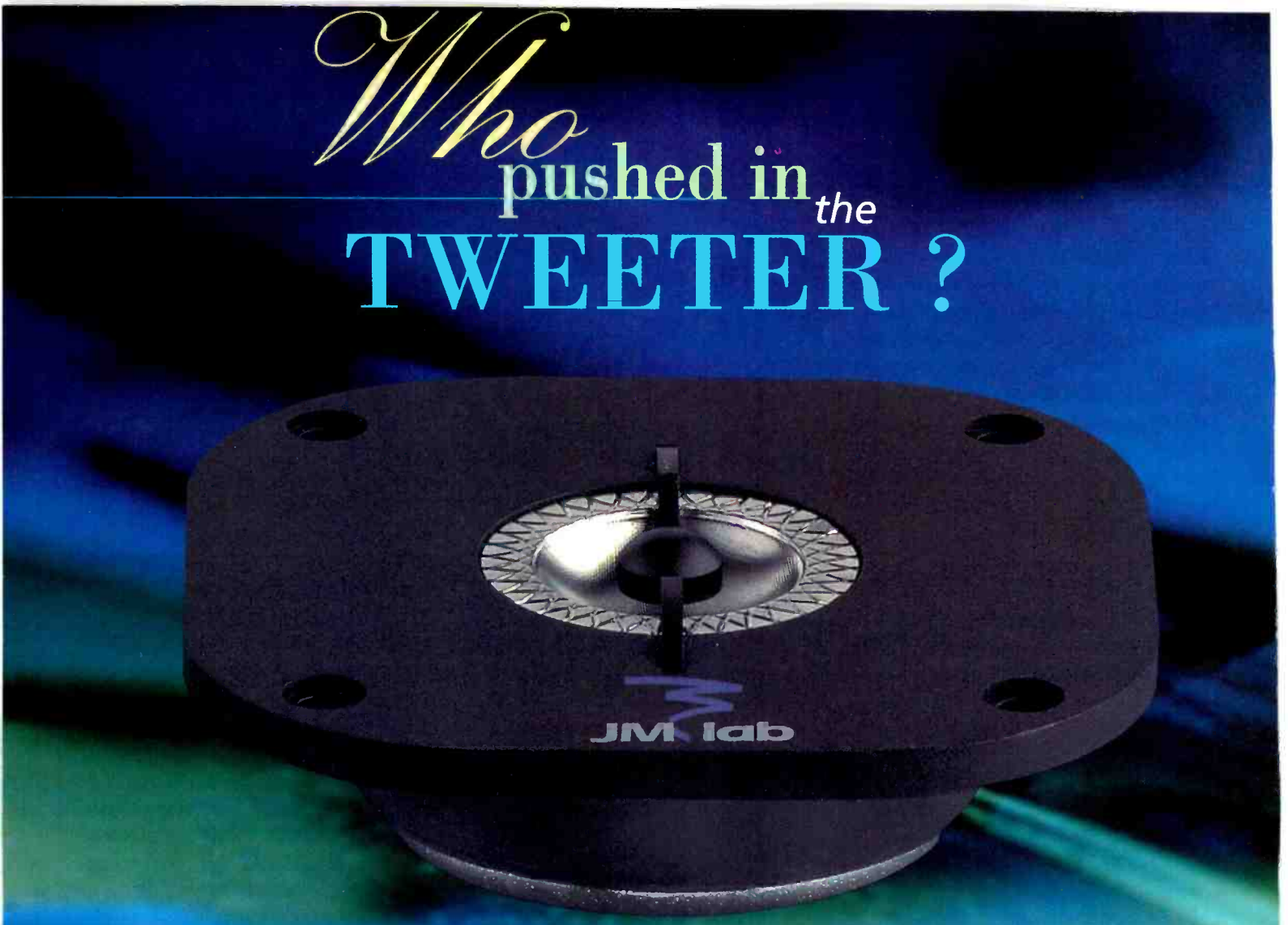
The preamps I mentioned (and, presumably, the 800) can benefit from other computer upgrade and update techniques. Besides changing boards, you can change EPROM firmware or rewrite programs in flash RAM by loading in new software from a computer. (Even some programmable remotes have jacks for downloading new control codes from PCs.) Where will those programs come from? Some will be mailed to us on diskette or the like, some will be downloaded from a dealer's notebook computer, and some—probably most—will come via the Internet.

Local radio stations can now be heard around the world, via the Internet.

Increasingly, music will arrive over the Web, too. You can already listen to radio stations around the world this way. (Some of my European friends, for example, use the Net to hear American jazz stations.) Online CD stores let you audition parts of some recordings to help you decide if you want to order them. And such compression formats as MP3 ("Spectrum," November 1998)—as well as RealAudio, LiquidAudio, and other streaming formats—are being used to distribute music directly. Online music distribution has become so common that Sharp offers a tabletop stereo, the MD-X8, that you can connect to your PC to

Sharp's MD-X8 tabletop stereo can be connected to PCs for making MiniDiscs from music downloaded off the World Wide Web.

Who pushed in the TWEETER ?



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EQUIPMENT PROFILE

EDWARD J. FOSTER

YAMAHA RX-V2095 A/V RECEIVER

In the words of Yogi Berra, it seemed like *déjà vu* all over again. When I unpacked the Yamaha RX-V2095 A/V receiver and plunked it on my bench, I was transported back about nine months, to the time when I unpacked Yamaha's DSP-A1 A/V amplifier for review in the July 1998 issue of *Audio*. At first glance, the two seemed to be clones of one another, and although this is not true in detail, in many respects they are.

Following past tradition, the RX-V2095 features Yamaha's Cinema-DSP Digital Soundfield Processing and includes seven power amplifiers to present it to best advantage. As Yamaha aficionados are aware, Cinema-DSP is designed to work optimally with seven loudspeakers (in addition to one or more subwoofers). The two extra channels are for "front-effect" speakers that, ideally, should flank and be placed higher than the main left and right front pair. With seven-channel Cinema-DSP, signals fed to the front-effect and rear speakers acoustically interact to simulate the sound of an array of side-mounted speakers, similar to what's used in a theater. Yamaha advises that direct-radiating speakers will create the effect to best advantage and suggests that the rear pair be above and behind the listener rather than on the side walls across from the viewing position, the normal recommendation for surround speakers. For those without a seven-speaker listening room, the RX-V2095 offers a five-channel Cinema-DSP mode in which the front-effect signals are merged into the main front channels.

Rated Output, 0.2% THD, 8-Ohm Loads, 20 Hz to 20 kHz: Stereo mode, 100 watts/channel; surround modes, 100 watts/channel in front and surround channels, 25 watts/channel in front effects channels.
Dimensions: 17⅛ in. W x 6¾ in. H x 18½ in. D (43.5 cm x 17.1 cm x 47 cm).
Weight: 44 lbs. (20 kg).
Price: $1,599.
Company Address: 6660 Orangethorpe Ave., Buena Park, Cal. 90620; 800/492-6242; www.yamaha.com.

Photos: Michael Groen

In addition to its 10 Cinema-DSP modes devoted to movies, the RX-V2095 offers 14 that are specifically designed for music. The latter are based on measurements of the early-reflection and reverberation characteristics of music venues in Europe and the United States. Some of these modes use four-channel reverberation to enhance the sense of spaciousness; others do not.

THE RX-V2095 FEATURES YAMAHA'S CINEMA-DSP AND INCLUDES SEVEN AMPLIFIERS TO PRESENT IT TO BEST ADVANTAGE.

The music modes are divided into seven groups: "Concert Hall 1," "Concert Hall 2," "Church," "Jazz Club," "Rock Concert," "Entertainment," and "Stadium." Each simulates two venues of similar ilk. For example, the "Jazz Club" category offers a choice of the sonic signature of the Village Gate or the Bottom Line, while the "Church" category offers simulations of the Freiburg and Royaumont cathedrals. The 10 cinema modes are divided into five groups of two in similar fashion. These include "Concert Video," "TV Theater," "Movie Theater 1," "Movie Theater 2," and "Dolby/DTS Surround." The last offers standard and "enhanced" versions of Dolby Pro Logic, Dolby Digital, and DTS decoding, depending on the program source you've selected.

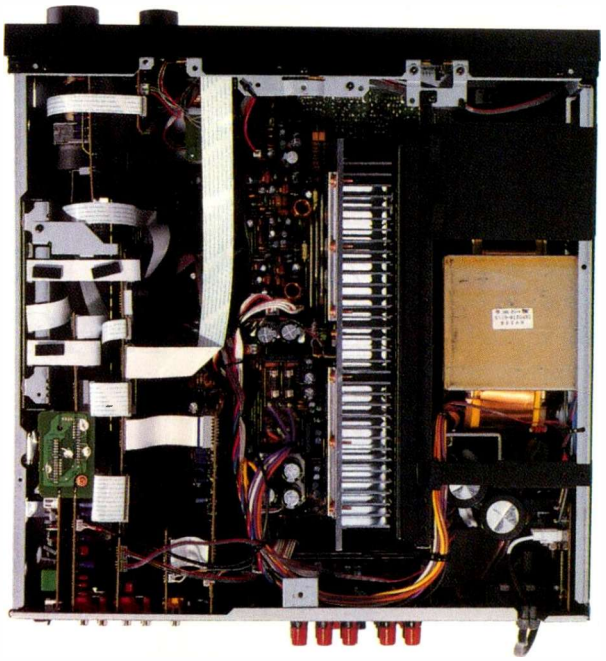
If you don't find the preprogrammed sound fields appealing, you can modify any of them to suit your taste. You have control over every parameter used by the Cinema-DSP algorithm, including "Initial Delay," "Presence Initial Delay," "Surround Initial

Delay," "Surround Delay," "Room Size," "Presence Room Size," "Surround Room Size," "Liveness," "Surround Liveness," "Reverb Time," and "Reverb Level." Some seem to be (and indeed are) quite similar, and not all are used to create each sound field, so it's best to start off with a Yamaha program that comes close to satisfying your desire and then tweak it. You can store your adjustments or return to the factory presets at any time. The owner's manual goes into the specifics in quite some detail.

As regards power, the RX-V2095 specifications are nearly equivalent to the DSP-A1's: 100 watts into 8 ohms for each of the five "main" channels plus 25 watts a side for the front-effect speakers. (The DSP-A1 was rated at 10 watts more per channel.) Distortion ratings are essentially the same as well.

But enough of this head-to-head comparison. The RX-V2095, quite naturally, is not meant to be an exact duplicate of the DSP-A1. The A1's unusually versatile DSP-based "Cinema-EQ" tone controls are beyond the scope of the RX-V2095, although both have analog front-channel tone controls and "Bass-Extension" circuitry to augment the low-end response of small speakers. Nor does the RX-V2095 have the DSP-A1's RF demodulator (used to play AC-3 laserdisc soundtracks). On the other hand, the RX-V2095 has an AM/FM tuner with 40 presets that can be loaded manually or automatically, and it's equipped for dual-zone operation. Neither of these features can be claimed by the DSP-A1. The RX-V2095 even comes with a separate remote for the second zone, although a remote "eye" is available only as an option.

The RX-V2095 handles three audio sources ("CD," "MM Phono," and "Tape/MD") in addition to its tuner and can accommodate five audio/video sources: four ("DVD/LD," "TV/DSS," "VCR 1," and "VCR 2") via the back panel and a fifth ("Video AUX") via connectors behind a flip-down door on the front. Also behind the door are "A" and "B" buttons for main-front speaker selection; "Bass," "Treble," and "Balance" controls; and "Bass Extension" and "Tone Bypass" pads. There's a headphone jack, buttons to select the desired Cinema-DSP program, an "Effect" pad to switch off all special effects, and a button to switch in an external decoder.



DYNAMIC OUTPUT POWER CAME IN ABOVE 400 WATTS PER CHANNEL WITH 2-OHM LOADS IN STEREO MODE.

The tuner controls also are hidden behind the door, which is why the RX-V2095 looks so much like the DSP-A1. These controls include a pad that cycles through five banks of presets, buttons for setting and changing presets, an FM/AM band selector, and a pad that lets you choose automatic or manual tuning. Finally, there's a "Record Out/Zone 2" selector (a Yamaha tradition!) that enables you to choose the recording and second-zone audio feeds independently of the main program selection or have them track the choice made with the main input selector. With the door closed, the controls you see are the same as those of the DSP-A1. There are "Input Selector" and "Volume" knobs at the right, a "Standby/On" pad at the left, a display panel in the middle, and, just to its right, an "Input Mode" button. This last enables you to choose the analog inputs over the digital ones and to lock out any digital signal other than a DTS bit stream. In its default position, "Auto," first priority is given to Dolby Digital or DTS signals (if present), then to PCM digital, and, last, to analog.

Digital (as well as analog) inputs are provided for the "CD" and "Tape/MD" audio program sources and for the "DVD/LD" and "TV/DSS" audio/video sources. The "CD" and "DVD/LD" digital interfaces are outfitted for coaxial and optical connection; "Tape/MD" and "TV/DSS" take Toslink exclusively. (An optical socket also is provided for digital dubbing to MiniDisc.) In Yamaha's world, coaxial connections take precedence over optical when both are used; you can't choose.

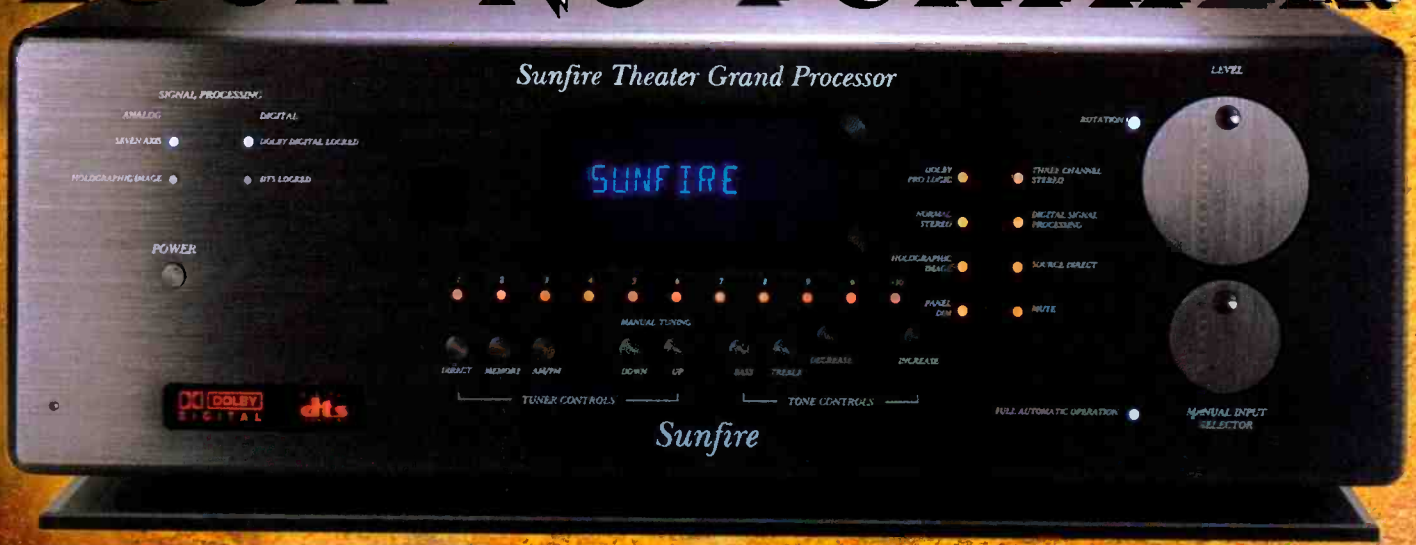
The RX-V2095 is also equipped with six jacks to accept an audio feed from an external decoder. When you select this input, signals from it are routed around the internal decoder and Cinema-DSP electronics.

There are video outputs for one main video monitor, a zone-2 monitor, and two VCRs. Except for the zone-2 monitor, all A/V inputs and outputs have S-video as well as composite-video jacks. All rear-panel jacks are base metal, but Yamaha couldn't resist the urge to flash the front jacks with gold, even though they're concealed behind the flip-down door.

Multiway binding posts are used for speaker connections. All accept bare wire or single banana plugs; the two sets for the main speakers even accept dual banana plugs (so-called "GR" plugs), but the others don't. Yamaha provides preamp outputs for a powered subwoofer and for each of the seven channels, so you can augment system power with external power amps if you insist. (I see little reason to!) Main-front amp inputs also are available. These couple to the main-channel preamp outputs via external links that can be removed and rearranged as you wish. Three switched convenience outlets (100 watts total rating), in/out remote-control jacks to connect a zone-2 infrared sensor and a local IR "blaster" and thereby relay commands from zone 2 to the main system, and a switch that adjusts power-supply voltage on the basis of speaker impedance complete the rear panel.

The Yamaha RX-V2095 is packed with two remote controls: a full-featured, macro-programmable learning remote for your main listening room and a simple but competent zone-2 control that permits se-

LOOK NO FURTHER.



The new Sunfire Theater Grand tuner/preamp/processor is the latest innovation from Bob Carver. It is easy to set up, simple to operate, and delivers superb performance. Features include Dolby Digital® and DTS® decoding, Holographic Imaging, automatic signal sensing, and a versatile LCD remote. The Sunfire Theater Grand is state-of-the-art now and fully upgradable, so it is poised for the future.

It is no wonder that Home Theater magazine concluded: *"If you're in the market for a full-featured controller for your system, look no further than the amazing value you get with the Theater Grand."* — **Jeff Cherun,** *Home Theater, February, 1999*

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MEASURED DATA

AMP SECTION, STEREO MODE

Output Power at Clipping (1% THD at 1 kHz): 8-ohm loads, 155 watts/channel (21.9 dBW); 4-ohm loads, 250 watts/channel (24 dBW).

Dynamic Output Power: 8-ohm loads, 165 watts/channel (22.2 dBW); 4-ohm loads, 280 watts/channel (24.5 dBW); 2-ohm loads, 405 watts/channel (26.1 dBW).

THD + N, 20 Hz to 20 kHz: 8-ohm loads, less than 0.0105% at 100 watts and less than 0.0095% at 10 watts; 4-ohm loads, less than 0.131% at 150 watts and less than 0.0143% at 10 watts.

Damping Factor re 8-Ohm Loads: 330 at 50 Hz.

Output Impedance: 26 milliohms at 1 kHz, 40 milliohms at 5 kHz, 73 milliohms at 10 kHz, and 118 milliohms at 20 kHz.

Frequency Response: Tone controls off, 20 Hz to 20 kHz, +0, –0.24 dB (–3 dB below 10 Hz and at 75.9 kHz); tone controls at "0," 20 Hz to 20 kHz, +0, –0.37 dB (–3 dB below 10 Hz and at 71.5 kHz).

Tone Control Range: Bass, +8, –8.1 dB at 100 Hz; treble, +7.9, –7.8 dB at 10 kHz.

Bass Extension Circuit: +5.1 dB at 53 Hz; approximately 20-dB/octave rolloff below 35 Hz.

Subwoofer Crossover: High-pass, –3 dB at 90 Hz and –6 dB at 68 Hz, 12-dB/octave slope; low-pass, –3 dB at 86.5 Hz and –6 dB at 105 Hz, 18-dB/octave slope.

RIAA Equalization Error, 20 Hz to 20 kHz: +0.18, –0.27 dB.

Sensitivity for 0-dBW (1-Watt) Output: Line input, 15.6 mV; MM phono input, 0.265 mV.

Muting: 57.3 dB.

A-Weighted Noise: Line input, –82.1 dBW; MM phono input, –79.8 dBW.

Input Impedance: Line, 47.8 kilohms; MM phono, 44.6 kilohms in parallel with 170 pF.

Input Overload (1% THD at 1 kHz): Line input, 7.6 V; MM phono input, 125 mV.

Channel Separation: Greater than 59.9 dB, 100 Hz to 10 kHz.

Channel Balance: ±0.73 dB.

Recording Output Level: Line input (0.5 V), 490 mV; MM phono input (5 mV at 1 kHz), 290 mV; FM tuner (100% modulation at 1 kHz), 460 mV.

Recording Output Impedance: 960 ohms.

AMP SECTION, DOLBY PRO LOGIC MODE

Output Power at Clipping (1% THD at 1 kHz), 8-Ohm Loads: Main front channels, 150 watts/channel (21.8 dBW); center channel, 165 watts (22.2 dBW); surround channels, 150 watts/channel (21.8 dBW).

THD + N at 100 Watts/Channel Output, 8-Ohm Loads: Main front channels, less than 0.144%, 100 Hz to 20 kHz; center channel, less than 0.147%, 100 Hz to 20 kHz; surround channels, less than 0.063%, 100 Hz to 7 kHz.

Frequency Response: Main front channels, 90 Hz to 20 kHz, +0.05, –0.6 dB (–3 dB below 10 Hz and at 22.8 kHz); center channel, "Large" speaker mode, 50 Hz to 20 kHz, +0.06, –0.66 dB (–3 dB below 15 Hz and at 22.8 kHz); center, "Small" speaker mode, 91 Hz to 22.8 kHz, +0.03, –3 dB; surround channels, below 10 Hz to 7 kHz, +0.04, –3 dB.

A-Weighted Noise: Main front channels, –78.8 dBW; center channel, –80.4 dBW; surround channels, –77 dBW.

Channel Separation: 50.5 dB or greater (77.1 dB maximum) at 1 kHz.

DOLBY DIGITAL MODE

Channel Balance: 1.65 dB or better.

Frequency Response: Left front, 22 Hz to 20 kHz, +0.07, –0.29 dB; right front, 22 Hz to 20 kHz, +0.06, –0.3 dB; center, 21 Hz to 20 kHz, +0.06, –0.41 dB; left surround, 21 Hz to 20 kHz, +0.06, –0.39 dB; right surround, 22 Hz to 20 kHz, +0.06, –0.34 dB; LFE channel, 20 Hz to 68 Hz, +0, –1 dB (–3 dB at 85 Hz and –8.4 dB at 120 Hz).

THD + N at 1 kHz for 0-dBFS Signal: Main front, 0.0107%; center, 0.0085%; left surround, 0.00635%; right surround, 0.00665%; LFE (at 30 Hz), 0.00705%.

THD + N, 20 Hz to 20 kHz, for –10-dBFS Signal: Main front, 0.143%; center, 0.146%; left and right surround, 0.147%.

Channel Separation: 58.6 dB or greater (78.9 dB maximum), 100 Hz to 10 kHz.

D/A CONVERTER SECTION

Frequency Response: 20 Hz to 20 kHz, +0.05, –0.28 dB.

THD + N at 0 dBFS: Less than 0.192%, 20 Hz to 20 kHz.

THD + N at 1 kHz: Below –80.3 dBFS from 0 to –90 dBFS and below –88.2 dBFS from –30 to –90 dBFS.

Maximum Linearity Error: Undithered signal, 0.86 dB from 0 to –90 dBFS; dithered signal, 0.47 dB from –70 to –100 dBFS.

S/N Ratio: A-weighted, 92.3 dB; CCIR-weighted, 83.1 dB.

Quantization Noise: –78.2 dBFS.

Dynamic Range: Unweighted, 88.5 dB; A-weighted, 91.1 dB; CCIR-weighted, 81.5 dB.

Channel Separation: Greater than 54.2 dB, 125 Hz to 16 kHz.

FM TUNER SECTION

50-dB Quieting Sensitivity: Mono, 18.8 dBf; stereo, 42.2 dBf.

S/N Ratio at 65 dBf: Mono, 78.3 dB; stereo, 70.4 dB.

Frequency Response, Stereo: 20 Hz to 15 kHz, +0.36, –1 dB.

Channel Balance: ±0.01 dB.

Channel Separation: Greater than 37.3 dB, 100 Hz to 10 kHz:

THD + N at 65 dBf, 100% Modulation: Mono, 0.074% at 100 Hz, 0.136% at 1 kHz, and 0.301% at 6 kHz; stereo, 0.108% at 100 Hz, 0.139% at 1 kHz, and 0.437% at 6 kHz.

THD + N at 65 dBf, 50% Modulation: Mono, 0.05% at 100 Hz, 0.079% at 1 kHz, and 0.203% at 6 kHz; stereo, 0.082% at 100 Hz, 0.1% at 1 kHz, and 0.347% at 6 kHz.

Capture Ratio at 45 dBf: 2 dB.

Selectivity: Adjacent-channel, 14.3 dB; alternate-channel, greater than 76.8 dB.

Image Rejection: 51.9 dB.

AM Rejection: 62.9 dB.

Stereo Pilot Rejection: At 100% modulation, 74.8 dB; at 0% modulation, 78.6 dB.

Stereo Subcarrier Rejection: At 100% modulation, 72.9 dB; at 0% modulation, 90.3 dB.

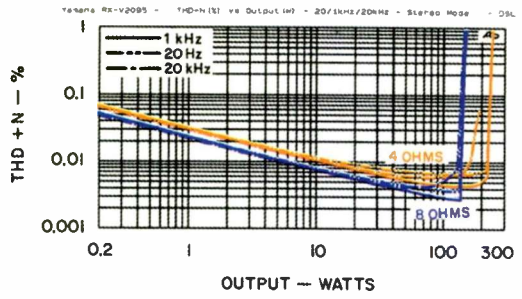
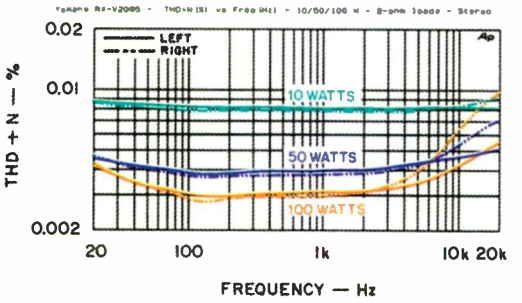


Fig. 1—THD + N vs. output, stereo mode.



A

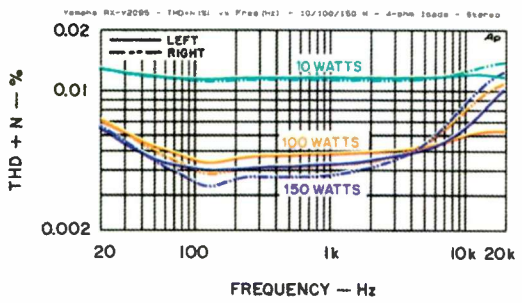


Fig. 2—THD + N vs. frequency, stereo mode, for 8 ohms (A) and 4 ohms (B).

B

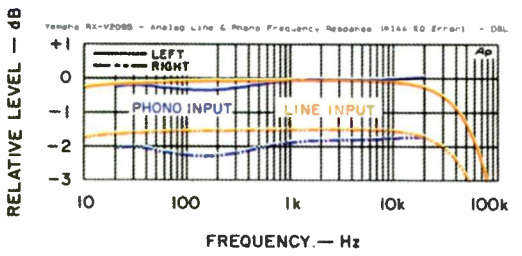


Fig. 3—Frequency response, stereo mode.

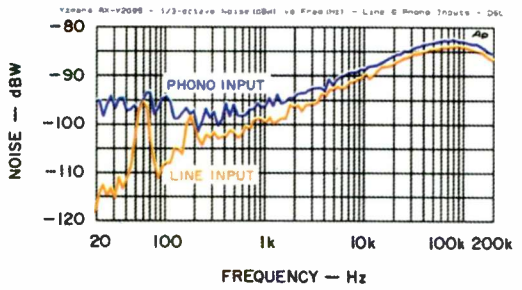


Fig. 4—Noise analysis, stereo mode.

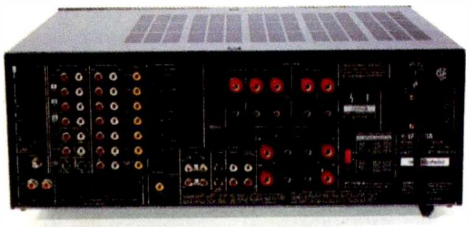
lection of the zone-2 program and listening level separately from those in the main room. (Both remotes can be seen on the first page of this review.) The zone-2 remote also controls the RX-V2095's tuner and such other program sources as a laserdisc player, a tape deck, and a CD player or changer.

The main remote is similar to those included with other top-of-the-line Yamaha gear. At first glance, it's beguilingly simple: 12 selector buttons on the right and, below them, a four-pad "Operation Control" cluster, a master volume control, a muting switch, and buttons to control power to the TV, to the VCR, and to the system as a whole. The upper 10 of the 12 buttons select the program source; the bottom two switch the external decoder and "Effects" in and out.

A pad on the side of the remote momentarily backlights the 12 buttons and the "Operation Control" cluster so that you can see what you're doing in dim light. However, if you have a good sense of touch, you won't need to backlight often. Although they're of identical shape, the 12 pads can be identified by a Braille-like pattern that's embossed on the panel. It's a simple three-dot, two-dot, one-dot code that repeats three times for the upper nine pads and isn't used on the lowest triplet.

The other controls on the front of the remote are identifiable tactilely, too. It seems very straightforward, until you open the lid and get a whiff of what's inside! Behind that seemingly innocent panel are two more four-pad clusters—one in a purple-colored region, the other in a green area—with each surrounded by four square buttons. Then there's a row of three pads in a pink area and a 12-pad array backed in orange. Four other pads and a "Parameter/Set Menu" slide switch have the natural silver background of the remote itself.

Well, I'm not about to describe the function of each of these controls in detail. Suffice it to say that there's method in the madness of the background colors and in the (unmarked) three-position slide switch on the side of the remote. The switch selects one of three memory areas: A, B, or C. When set to area A, all controls are dedicated to Yamaha products: Purple-area controls handle Yamaha tape decks, the green-area ones deal with Yamaha CD players, and the pink triplet works the tuner. When memory area B is chosen, the green group is dedicated to Yamaha laserdisc players, but the purple and pink groups can learn the control codes of a VCR and TV/DBS tuner, respectively. Memory area C enables you to download codes for a second VCR into the purple area, a DVD player or third VCR into the green area, and whatever is connected to the "Video AUX" input into the pink area. The 12 orange-backed pads select Cinema-DSP programs, while the non-color-coded group is for system setup, on-screen display control, the sleep-timer function, and so forth.



THE RX-V2095 IS EQUIPPED WITH SIX JACKS TO ACCEPT AN AUDIO FEED FROM AN EXTERNAL DECODER.

Yamaha's remote also supports macro operation—that is, the ability to issue a string of commands by pressing one button. Along the side of the remote, there's a three-position slide switch that permits you to turn off macro operation or to adjust the speed at which commands are issued. The remote comes loaded with 11 preset macros, so you can, for example, turn on the main power, activate a Yamaha CD player, and begin playback simply by pressing the "CD" selector. Needless to say, the preset macros are all designed for Yamaha equipment, but you can teach the remote

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new ones for essentially any collection of equipment.

As usual for A/V components, the RX-V2095's on-screen displays are far more informative than the front panel when it comes to setting up the system or adjusting processing parameters. In addition to the usual test signals for adjusting speaker balance, there's a special test for setting the relative level of the front-effect speakers.

Bass management options are comprehensive. Choose the sizes of the center, main front, and rear speakers independently, and bass reroutes accordingly. There's also a center-off mode for phantom-center operation and separate adjustment of center-channel delay over a 0 to 5-millisecond range. Furthermore, you're given separate choices of LFE level for the Dolby Digital and DTS modes and can choose to route the LFE channel to the subwoofer, to the main front speakers, or to both. And the dynamic range of Dolby Digital programs can be reduced, if desired, for late-night viewing.

Measurements

I made all power tests on the Yamaha RX-V2095 with the impedance selector set for loads of 8 ohms or higher on all channels. I could have used the alternative position (suggested for loads of 4 ohms or more), but doing so usually penalizes an amp by operating the output stage at reduced voltage. More than one company has asked me to ignore the manual and test its products using the higher supply voltage, even though it might not get by FTC preconditioning with 4-ohm loads. Since I don't FTC precondition (a more ludicrous idea I know not of!), I comply unless I run into problems. So even though Yamaha didn't ask, I made the measurements with the higher supply voltage and let the chips fall where they might.

STRONG POINTS—AND THERE ARE MANY—INCLUDE UNUSUALLY FINE POWER AMPS AND A VERSATILE REMOTE.

And as it turned out, they fell pretty well. When I used the IHF tone burst to simulate music, stereo dynamic output power came in above 400 watts per channel with 2-ohm loads and 280 watts per channel with 4-ohm loads. I doubt if either of those figures could have been achieved at lower rail voltages. With 8-ohm loads, the RX-V2095 cleared its 1.46-dB dynamic headroom spec by a wide margin, too. The main amps had no apparent difficulty supplying short-term continuous power into 4-ohm loads either, at least at low and middle frequencies. In fact, continuous power with 4-ohm loads (250 watts per channel at 1 kHz) is only a half decibel less than the dynamic power. When I tried the same test at 20 kHz, the amps shut down at the 200-watt/channel level, but once the signal was removed, they came back to life undamaged. The pertinent curves (total harmonic distortion plus noise versus output at 20 Hz, 1 kHz, and 20 kHz with 4- and 8-ohm loads) are in Fig. 1.

Since Yamaha doesn't rate continuous power into 4-ohm loads, I assigned a rating of 150 watts per channel, based on the measurements of distortion versus output; for 8-ohm loads, I used Yamaha's 100-watt/channel spec. Curves for THD + N versus frequency at rated power are shown in Figs. 2A and 2B, along with similar measurements made at output levels of 10 watts per channel and at an intermediate point—50 watts per channel into 8 ohms and 100 watts per channel into 4. From these curves, it's clear that THD + N is dominated by noise to 30 or 40 watts and that distortion in the midrange is exceedingly low: about 0.003% with 8-ohm loads and not much more (0.004%) with 4-ohm loads. Even with the power-supply switch at its high-impedance setting, the RX-V2095's amps have no problem driving low-impedance loads until both frequency and power get pretty high. It's also noteworthy that their damping factor is quite high and that their output impedance is reasonably uniform to 10 kHz—marks of pretty good output stage design. No particular tricks here; Yamaha uses a straight Class-AB output, but a good one!

From high-level analog inputs, frequency response is very flat over the audio band

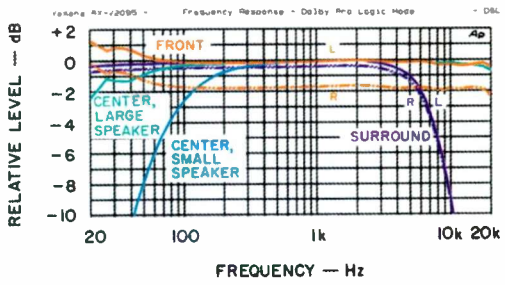

Fig. 5—Frequency response, Dolby Pro Logic mode.

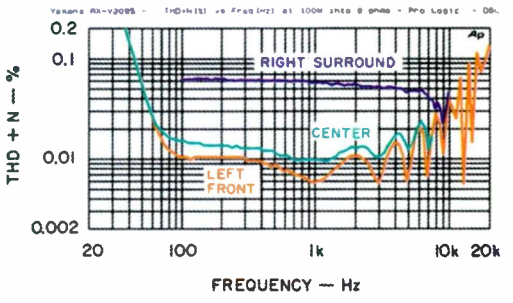

Fig. 6—THD + N vs. frequency, Dolby Pro Logic mode.

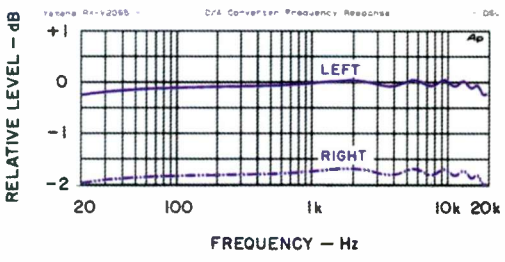

Fig. 7—Frequency response, D/A section.

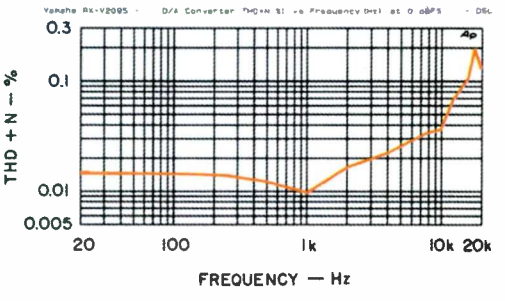

Fig. 8—THD + N vs. frequency at 0 dBFS, D/A section.

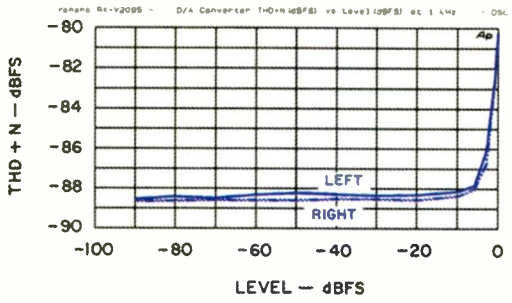

Fig. 9—THD + N vs. level, D/A section.

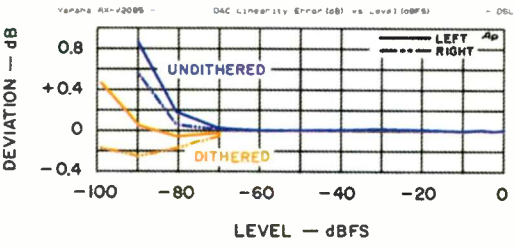

Fig. 10—Linearity error, D/A section.

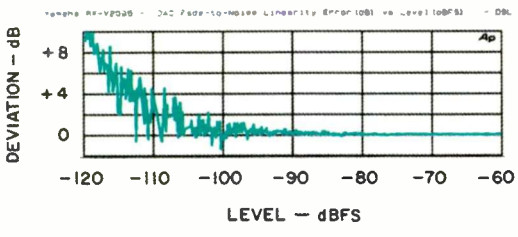

Fig. 11—Fade-to-noise test.

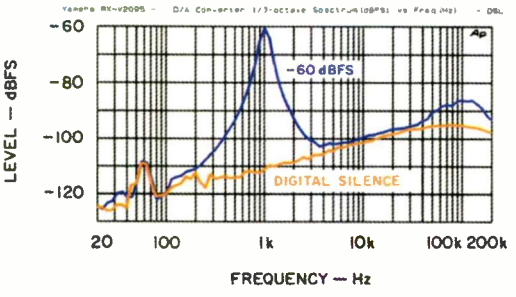

Fig. 12—Noise analysis, D/A section.

whether the RX-V2095's tone controls are defeated or are active and at their detents. Off is better, but the difference is far less than with many other receivers. The RIAA phono equalization error is reasonably small, too, although there's a slight midbass dip in the response of both channels. The substantial channel imbalance that's apparent in Fig. 3 is of greater concern. Although it could be corrected with the balance control, imbalance of this magnitude is unusual in a product of this quality. I hope that it was a peculiarity of my sample and is not indicative of general production.

The RX-V2095's bass and treble tone controls had unusually symmetrical curves that reached ±10 dB at the frequency extremes (about ±8 dB at my standard test frequencies of 100 Hz and 10 kHz). The curves shelved, the bass more obviously so than the treble. The two curves overlapped in the midrange, but even at full boost or cut, the effect at 1 kHz was only 1 dB or so. The "Bass Extension" feature provide a mild, 5.1-dB, boost at 53 Hz (a frequency well chosen to extend the low-end response of small speakers) and then a sharp rolloff of about 20 dB/octave below 35 Hz, to protect small drivers from cone and suspension damage caused by excessive bass energy.

The subwoofer crossover point is not adjustable, but it's well chosen for general use. With –3 dB points close to 90 Hz, Yamaha's filters ought to suit most speakers of decent quality. The slopes are not those that Lucasfilm prescribes (this is not a THX-certified product), but they're reasonably steep.

Figure 4 compares third-octave noise spectra made using the high-level and phono analog inputs. Notice how similar they are! (And the A-weighted noise figures listed in "Measured Data" differ by hardly more than 2 dB.) The phono curve barely differs from the line-level curve except in the bass, and that's because of the RIAA equalizer in the phono preamp. The phono preamp also seems free of the 60- and 180-Hz hum components found in the line-level curve. Together with the overall closeness of the curves, this leads me to conclude that most of the noise arises in the power amps. Although that's unusual, the level of the noise is too low to be a concern.

Channel separation, while not stellar, should be adequate for all practical purposes. Separation measurements made via an analog input differed by only a few decibels from those made with a digital input signal, which suggests that the crosstalk occurs after the RX-V2095's D/A converter, probably in the power amp section.

Input impedances and sensitivities were perfectly normal, and recording output levels and source impedance were just fine, too. Muting was near total (Yamaha claims that it is total), and phono overload level was adequate. I was particularly impressed by the line input's overload voltage. This was rarely a concern until digital/analog hybrid components became the norm, but now it is. When analog signals are digitized internally, it's important that the input circuitry and A/D converters not clip prematurely. No worry about that with the Yamaha RX-V2095.

YAMAHA'S DSP ALGORITHMS CAN DO SOME REALLY NEAT THINGS TO OPEN UP LARGE MUSICAL WORKS.

To check this receiver's Dolby Pro Logic performance, I used line-level analog inputs and terminated each power amp output with an 8-ohm load. Figure 5 shows frequency response under these conditions. I usually present only the curves taken on the left-front and left-surround channels, overlaid with that of the center channel using "Large" and "Small" speaker settings. This time I've also included curves for the right-front and right-surround channels because of the level discrepancy.

Except for the level imbalance, the curves are typical of a good Pro Logic decoder. Ignore the front-channel curves below 100 Hz; Dolby Pro Logic cannot steer continuous low-frequency tones when the levels are identical in the left and right inputs, as they are for this test. The surround-channel response falls off above 7 kHz, as it should, and there's little imbalance between the left and right sides in the rear. Center-channel response rolls off below 90 Hz with the "Small" speaker setting, and bass energy is rerouted to the subwoofer output. Some anti-aliasing and reconstruction filter ripple can be seen in the front-channel treble

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response, but it's quite modest. Overall response is essentially flat to 20 kHz and plunges above 22.8 kHz, a byproduct of the digital domain Pro Logic decoding.

Maximum output power with Dolby Pro Logic decoding was about the same in all channels. There seemed to be a little more poop available in the center, but that's just because it was the only channel delivering power in this test and therefore had the power supply pretty much to itself. In any event, with 8-ohm loads and a 1-kHz test frequency, I measured 150 watts per channel or more, the same result I got in stereo operation. (That's about 1.8 dB better than spec!) At lower power levels, however, THD + N in Pro Logic mode was a bit higher, much of the small difference due to noise.

At Yamaha's specified output rating of 100 watts/channel, THD + N is less than 0.05% from 50 Hz to somewhat above 10 kHz in the three main front channels. Over a good portion of the audio range, distortion in these channels remains well under 0.02%! (It was even lower in stereo, as seen in Fig. 2A.) However, the distortion curves become quite erratic in the treble, as you can see in Fig. 6. That's not because of harmonic distortion but because of intermodulation ("beats") between the sampling carrier and high-frequency signals, which generate crossproducts below 22 kHz, the cutoff frequency of the analysis filter. This often occurs in DSP-based Dolby Pro Logic decoders unless exceptionally good anti-aliasing and reconstruction filters are used.

THE TUNER SECTION QUIETS QUICKLY AND IS SOMEWHAT MORE SENSITIVE THAN THOSE IN MOST RECEIVERS.

Don't get the wrong impression: Analog Pro Logic decoders usually generate more distortion than this, just of a different nature. Furthermore, analog Pro Logic decoders rarely provide the degree of channel separation that I found in the RX-V2095. Worst case (surround to right front), I measured steady-state separation at 1 kHz of more than 50 dB. Output noise wasn't much worse in Pro Logic than it was in stereo, either!

As mentioned above, there's a trace of filter ripple in the D/A converter response curves (Fig. 7). These were plotted on a far more sensitive scale than the ones of Fig. 5, which is why the ripple is more apparent and the channel imbalance seems greater. Overall response is admirably flat, considering that it's taken at the output of the power amp. Although the response ripples are not of great concern, the rather high THD + N that you see in the treble region of Fig. 8 is. At 18 kHz, there's nearly 0.2% of garbage that I suspect also is the result of inadequate digital filtering. It is not harmonic distortion; rather, a beat with the 44.1-kHz sampling rate produces a 26.1-kHz crossproduct of such magnitude that it amounts to 0.2% of the fundamental even after it has been "removed" by my test analyzer's 22-kHz low-pass filter. This is somewhat more than I think is warranted, but I must say it's not unusual to find rather shoddy digital filters in A/V receivers that must sell in a highly competitive market.

In comparison to Fig. 8, the THD + N versus level curves of Fig. 9 look pretty good. This data was taken using 1-kHz (actually, 997-Hz) signals and corresponds to the point of lowest THD + N in Fig. 8. In these tests, THD + N falls from –80.3 dBFS at 0 dBFS (0.009%) to –88 dBFS at –6 dBFS, and it remains below that at all lower levels. Not the best I've seen, but not bad for a receiver. This suggests that, whatever their shortcomings, Yamaha's converters are linear. Indeed, Figs. 10 and 11, which plot linearity error versus level, are quite respectable.

Signal-to-noise ratios were reasonably good for a receiver, as were the dynamic range numbers, but quantization noise could stand improvement. Figure 12 shows the spectrum analyses on which S/N and dynamic range are based. Comparing the curves suggests to me that most of the noise is introduced in the power amp, not in the converter. I say this because the curves almost merge from 5 to 30 kHz (and in the bass) yet are quite different at very high frequencies. The difference in the ultrasonic region indicates that the converters mute on the "silent code." But if the converters mute and there's almost no change in noise in the audible region, that noise must originate elsewhere.

Frequency responses of the main channels in Dolby Digital mode were almost identical to each other and essentially the same as the response of the D/A converter, seen in Fig. 7. The response of the "worst" channel (which happened to be the center) is plotted in Fig. 13 along with the response

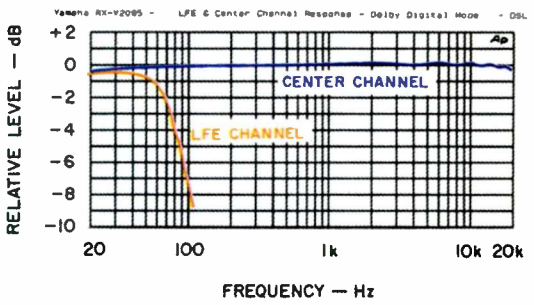


Fig. 13—Frequency response of center and LFE channels, Dolby Digital mode.

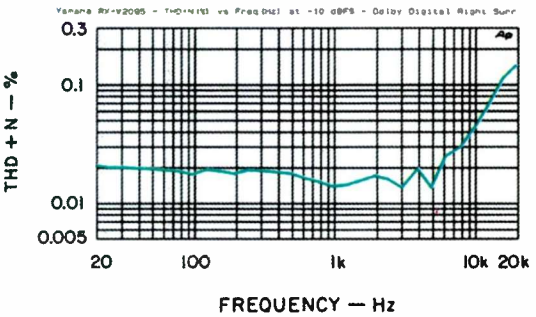


Fig. 14—THD + N vs. frequency, worst channel, Dolby Digital mode.

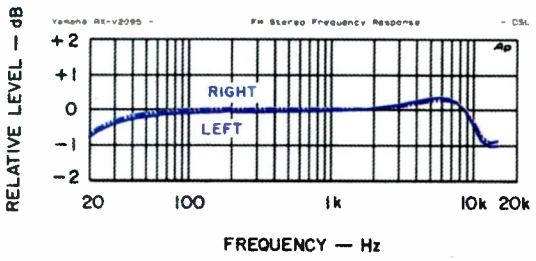


Fig. 15—Frequency response, FM tuner section.

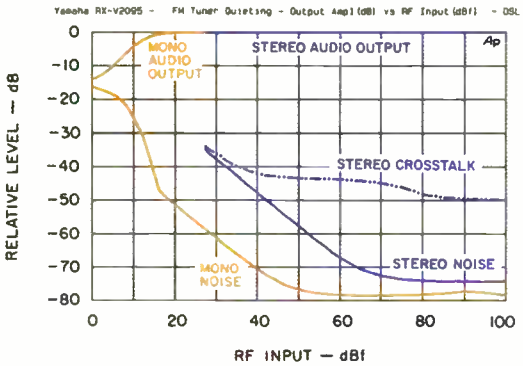


Fig. 16—FM tuner quieting.

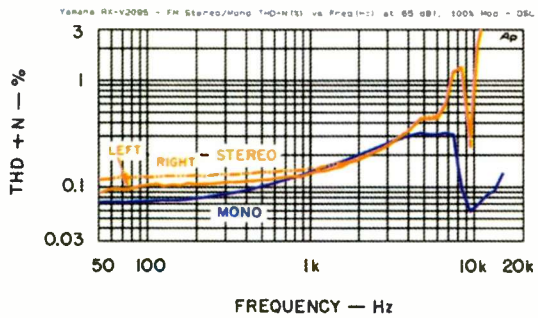
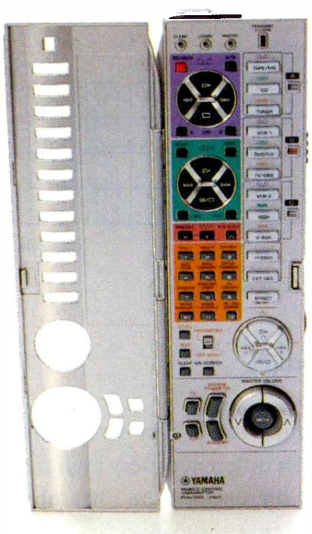


Fig. 17—THD + N vs. frequency, FM tuner section.



Comfortingly simple when closed, the main remote offers a bevy of control functions when you open it.

of the LFE (low-frequency effects) channel. I used a different vertical scale for this plot to accommodate the LFE curve, which is down 3 dB at 85 Hz and 8.4 dB at 120 Hz, the highest frequency on the THX test disc's LFE sweep.

The Yamaha receiver's THD + N versus frequency in Dolby Digital mode is almost identical in each main channel, too. The worst-case curve (the left surround) is shown in Fig. 14. When comparing this curve to the one in Fig. 8, bear in mind that the THX Dolby Digital test disc uses a different level (–10 dBFS as opposed to 0 dBFS) and different sequence of frequencies from the CBS CD-1 disc I use when I test D/A converters.

The RX-V2095's channel separation in Dolby Digital mode may not have set new records, but it should be more than adequate for all practical purposes. Even worst-case (left surround to right surround), crosstalk rose only from about –91 dB at 100 Hz to about –53 dB at 20 kHz. However, there was substantial imbalance in the output levels of the five main channels (see "Measured Data").

The RX-V2095's tuner is impressive. I measure tuner sections at receivers' tape recording outputs, so I can check pilot and subcarrier rejection where they count. As you can see in the frequency response curves of Fig. 15, the left and right channels prove virtually identical in both level and response. Channel separation was better than usual in this tuner (and was pretty much the same from right to left as in the opposite direction), as were signal-to-noise ratio and pilot-tone and subcarrier rejection.

When operated in the "Auto" mode, the RX-V2095's FM tuner remains fully muted until it senses a signal of 27 dBf (Fig. 16). At that point, it unmutes into full stereo, but the S/N ratio is only about 35 dB—too noisy for enjoyable listening. If you want to receive weak broadcasts in mono, you must switch to the manual mode. The RX-V2095's tuner section does quiet quickly and is somewhat more sensitive than the tuners in most present-day receivers. Both mono and stereo signal-to-noise ratios were first-rate!

Figure 17 shows THD + N versus frequency with 100% modulation of mono and stereo carriers. Second-harmonic distortion seems to predominate (note the hole in the curves at 9.5 kHz, the second harmonic of which lies at the pilot frequency and is being removed by the pilot-notch filter). Since second-order distortion is acoustically rather benign, the sound is quite good despite relatively high measured level. Yamaha apparently chose to trade capture ratio and distortion (neither of which was outstanding) for selectivity (which was). This should prove valuable in crowded metropolitan areas. AM rejection was quite good; image rejection was only fair, but that's not often a problem.

Use and Listening Tests

Since my music room isn't equipped for five-channel—much less seven-channel—listening, I did most of the hands-on evaluation in my home theater. Even this required a good deal of rearranging to meet

THE REMOTE SUPPORTS MACRO OPERATION, THE ABILITY TO ISSUE A STRING OF COMMANDS BY PRESSING ONE BUTTON.

Yamaha's instructions. I dug out a pair of Paradigm Titans to use as front-effects speakers and mounted them high on the front wall, as far apart as possible. I then moved the Paradigm 9se MkIIIs that I use as main speakers closer to the screen so the Titans would flank them. I found another pair of small direct-radiators to use in the rear, mounted them on the back wall opposite the front-effects pair, and dropped the side-wall dipoles out of the system. A Paradigm CC-300 served in the center, and I fleshed things out by hooking up a Paradigm powered sub.

Although Yamaha provides a way to time-compensate the center channel relative to the main front pair ("Center Delay"), the RX-V2095 has no way to do the same with the rear channels relative to the front. At least, I couldn't find one. Fortunately, my viewing/listening seat is about halfway back and thus is naturally "time correct," but others might not be so lucky! The only way I could find of adjusting front left/right balance was with the knob on the RX-V2095's front panel. That could have been annoying even if my sample weren't

unbalanced, because rooms and loudspeakers often differ enough to warrant touching up front balance for best results. While I have on my complaint hat, I'd also like to have seen better DACs in such a versatile and otherwise well-equipped product. Strong points—and there are many—include unusually fine power amps, the useful "Bass Extension" circuit, competent bass management, a good tuner, a versatile remote, and two-zone operation. On to the listening!

Regular readers of my reviews surely know by now that I am not a great fan of "ambience simulation" and other "enhancement" schemes. It's not that these things can't be done—you'd be surprised at how much hanky-panky goes on in recording studios every day—but doing them well, i.e., with reasonable realism, requires experience, competence, and a deft hand. Yamaha is one of the few consumer electronics companies with that experience and competence; the deft hand is up to you.

As I've found in almost every other similar product I've used, the preset parameters are overdone. I understand why; store demos sell products like this, and it's far easier to demo a whiz-bang you-gotta-be-deaf-not-to-hear-the-difference sound than a subtle enhancement that goes unnoticed until it's turned off. Goosing parameters is great for demos, and everybody does it, but it wears thin when you get the product home. Fortunately, Yamaha lets you tame things down. When I backed off the RX-V2095's effects, chose a smaller venue than I would have thought for the material, and sat back and tried to forget that I'd heard the disc a thousand times before with drier, more antiseptically clean sound, I rather got to like what was happening—at least on a lot of programs.

Therein lies the rub. Ambience simulation or sound enhancement—call it what you will—works better with some material than with other. Much also depends on the recording, but in general, I liked Yamaha's DSP effects best on big works—orchestra, chorus, etc. I also got to like them on rock and pop, though I'm not really into those genres so I'm not the best judge here. Solo classical music, even two-instrument sonatas and small chamber works, are where I start having problems with the RX-V2095's DSP, but it's certainly among the best I've heard.

When a violinist shifts position slightly, favoring one mike over another, and the system runs with this difference and starts to do strange things with the image and ambience, I cease thinking that the result is an improvement. Ditto for pianos that get too fat for their own good. But I repeat: Yamaha's algorithms can do some really neat things opening up large works, if you're willing to coax those sounds out of them. Again, a lot depends on how the recording was made and your willingness to experiment.

Almost the same arguments can be made for movie viewing as for music listening. The more shoot-'em-up the movie, the more spectacular Yamaha's special effects sound. However, wasn't discrete 5.1-channel sound supposed to provide the director with all the creative tools that were needed? Is it a good idea to tamper with the sound field he laboriously created? I leave such philosophical judgments to you, dear reader. Suffice it to say that if you like to play sound director, the Yamaha RX-V2095 gives you a great toybox! A

EQUIPMENT PROFILE

D. B. KEELE, JR.

PLATINUM AUDIO STUDIO 2 SPEAKER

Founded only five years ago, Platinum Audio is no baby when it comes to the size of its product line, which currently numbers 12 speakers. The Studio 2 falls near the middle of the company's price range, which runs from $300 for the PT-806 center-channel speaker to the Trio Series II ($5,000 per pair) before leaping to $150,000 per pair for the Air Pulse 3.1 (for more on this all-horn system, which weighs about 900 pounds, check Platinum's Web site). I reviewed the company's Duo system (now the Duo II) quite favorably in the May 1996 issue.

The Studio 2, part of Platinum Audio's Studio series, is a vented-box design with two 5-inch drivers flanking a 1-inch dome tweeter; all three are magnetically shielded for use near a TV screen. The Studio 2 is a two-and-a-half-way system: Both 5-inch drivers operate together up to 200 Hz; a series inductor then rolls off the lower driver at 6 dB per octave, leaving the upper one to cross over to the tweeter at 2.5 kHz.

The sturdy and attractive cabinets of the pair I got for review were covered in a handsome, dark wood-grain vinyl wrap that Platinum Audio calls Amari; their top and bottom plates were covered with black goatskin vinyl. The sides, front, and back of the cabinet are made from inch-thick MDF, braced within by a horizontal shelf of the same thickness. A curved grille of punched metal covers the entire front of the cabinet and is not designed to be removed. Behind the grille are foam fillers, above and below the tweeter, which help keep the grille from being forced against the tweeter. A cast aluminum backplate covering two-thirds of the Studio 2's rear panel holds the bi-wirable terminals (gold-plated five-way binding posts spaced for double-banana plugs), the crossover's finned heat sink, and two flared ports that are 1½ inches in diameter x 6 inches long (they remind me of the dual exhausts on the '64 Chevy Impala Super Sport 409 I once owned).

Platinum Audio supplied me with a set of its PS-20 metal stands ($329 per pair). These are truly heavy-duty, with massive top and bottom plates of cold-rolled steel, ¼ inch thick. The PS-20s can be filled with lead shot or dry sand to make them even heavier and to damp vibrations. You can rest the Studio 2s on optional spikes ($79 per set of six) atop the stands or bolt them in place. Rubber feet are supplied for use on more delicate surfaces.

The Studio 2's 5-inch drivers have polypropylene cones, butyl rubber surrounds, and die-cast aluminum baskets. Their voice coils have aluminum bobbins, 1¼ inches in diameter, wound with two layers of round wire made of oxygen-free cop-

Rated Frequency Response: 37 Hz to 20 kHz, ±2 dB.
Rated Sensitivity: 89 dB at 1 meter, 2.83 V rms applied.
Rated Impedance: 7 ohms.
Recommended Amplifier Power: 50 to 300 watts.
Dimensions: 21½ in. H x 8 in. W x 13 in. D (54.6 cm x 20.3 cm x 33 cm).
Weight: 34 lbs. (15.5 kg) each.
Price: $1,295 per pair; available in Amari vinyl veneer with black goatskin vinyl top and bottom panels or in black vinyl.
Company Address: 250 Commercial St., Unit 4002, Manchester, N.H. 03101; 603/647-7586; www.platinumaudio.com.

Photos: Michael Groen

per claimed to be 99.9999% pure. Magnetic shielding is provided by metal cups over each driver's ferrite magnet. The tweeter's one-piece aluminum dome doubles as a bobbin for a two-layer voice coil, also of oxygen-free copper, and is attached to a butyl rubber surround. A round foam ring is placed around the tweeter to reduce edge diffraction and reflections. The tweeter is cooled with magnetic fluid.

The Studio 2's crossover incorporates a 6-dB/octave low-pass filter with a resistor-capacitor impedance compensator for the lower woofer, a 12-dB/octave low-pass filter for the upper woofer, and an 18-dB/octave high-pass filter driving the tweeter. The crossover's resistors are attached to the rear panel, behind the fins, in order to dissipate excess heat.

Measurements

The Platinum Audio Studio 2's on-axis frequency response (Fig. 1) fits a fairly tight, 5-dB, window from 50 Hz to 17 kHz (±2.5 dB referenced to 800 Hz), only a little looser than this speaker's rating of ±2 dB over a slightly wider frequency range.

FEW OTHER BOOKSHELF SPEAKERS CAN EQUAL THE STUDIO 2'S LOW-FREQUENCY OUTPUT.

Above 300 Hz, the curve exhibits several moderate departures from flatness, including a depression between 350 and 900 Hz, two minor peaks at 1.1 and 2 kHz, dips at 6.3 and 13 kHz, and a final rise above 16 kHz. Above 22 kHz, the response made its last gasp and fell very rapidly. I did not remove the speaker's grille for testing because Platinum doesn't want it removed. (The curve in Fig. 1 combines a 2-meter on-axis measurement above 100 Hz with a low-frequency measurement made 0.5 meter from the cabinet's side, equidistant from the woofers and the ports. The curve was smoothed with a tenth-octave filter.)

Averaged from 250 Hz to 4 kHz, the Studio 2's sensitivity was a moderate 86.3 dB. The right and left speakers matched fairly closely, within ±1 dB.

To check crossover frequency and phasing, I bi-wired the Studio 2's inputs and fed the high- and low-pass sections with signals of opposite polarity. Doing so produced a sharp response dip at 2.6 kHz, 25 dB deep and about 1½ octaves wide. This indicates that when the speaker is wired normally, the tweeter and upper woofer will be solidly in phase throughout the crossover range, which should minimize lobing.

The Studio 2's phase and group-delay responses, referenced to the tweeter's arrival, are shown in Fig. 2. The phase curve's shape, a descending slope that flattens out above 6 kHz, is typical of direct-radiator systems with drivers on a common baffle. Averaging the group delay between 700 Hz and 3 kHz reveals that the output from the upper woofer is delayed by about 0.22 millisecond.

In the Studio 2's horizontal off-axis responses (Fig. 3), the curves for the main listening window, within ±20° of the axis, are nearly identical all the way to 20 kHz. This indicates excellent off-axis response in the horizontal plane.

This speaker's vertical off-axis responses (Fig. 4) are not as smooth and uniform as the horizontal off-axis responses. But in the main listening window, 15° above and below the forward axis, the responses are quite symmetrical and exhibit hardly any aberrations in the 2.5-kHz crossover region. More than 15° above axis, the response drops about 5 to 6 dB between 400 and 800 Hz.

The Studio 2's 7-ohm impedance rating is unusually accurate in that over the full audio spectrum, 20 Hz to 20 kHz, the impedance averages 7.05 ohms (Fig. 5A). But from 30 to 500 Hz, where you'll find most of the energy in typical recordings, it averages 5.7 ohms. Thus, 6 ohms might be a more meaningful, as well as less offbeat, rating. The dip at 45 Hz indicates the speaker's approximate tuning frequency. The Studio 2's maximum impedance variation, 3.8 to 12.8 ohms, implies that to keep response variations from cable impedance interactions to 0.1 dB or less, you should use wire with no more than about 0.06 ohm of series resistance. This corresponds to 14-gauge (or heavier), low-inductance cable for a 10-foot run.

The variation in impedance phase (Fig. 5B) is fairly low, ranging only from +38.7°

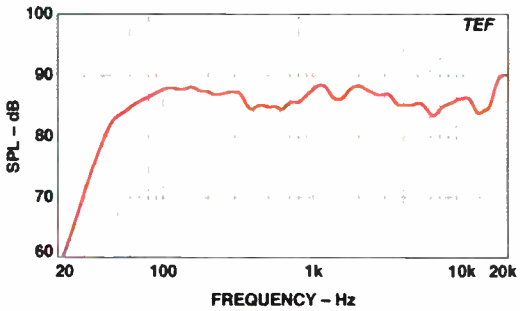


Fig. 1—On-axis frequency response.

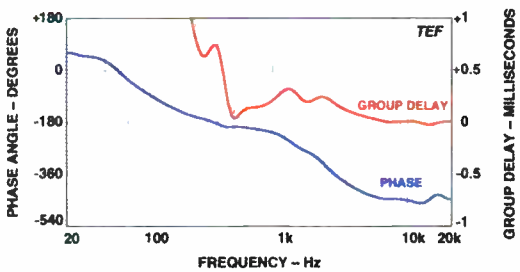


Fig. 2—On-axis phase response and group delay.

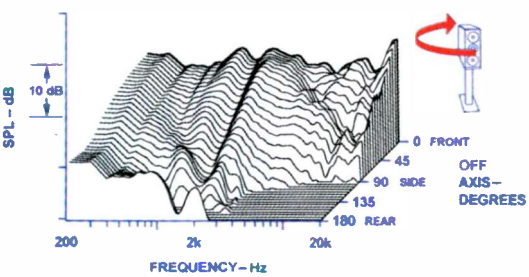


Fig. 3—Horizontal off-axis frequency responses.

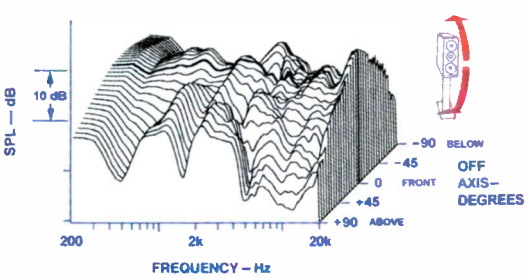
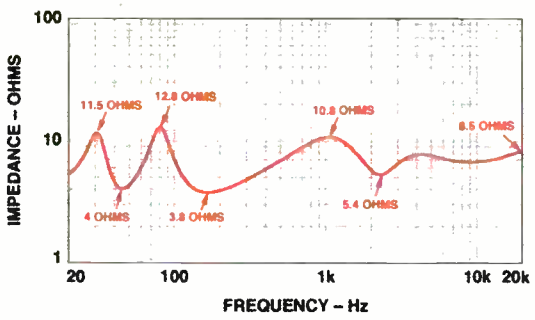


Fig. 4—Vertical off-axis frequency responses.



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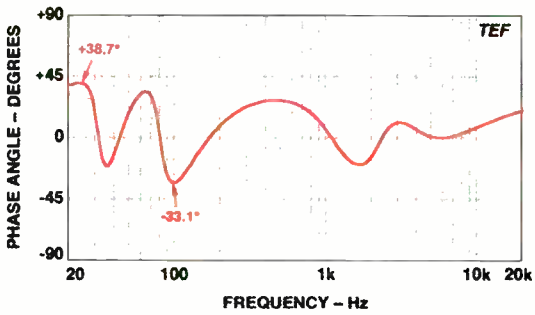


B

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

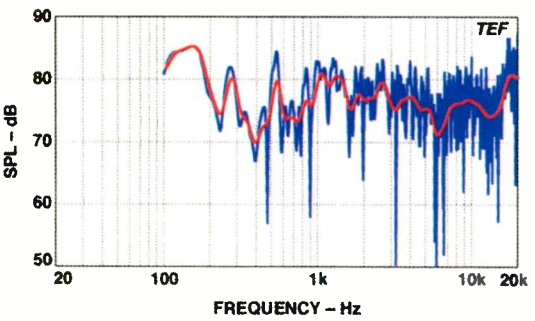


Fig. 6—Three-meter room response.

(inductive) to –33.1° (capacitive), with both extremes in the bass range. There's even less variation at higher frequencies, +28° to –18°. Thanks to its impedance magnitude and its impedance phase, the Studio 2 will not be a difficult load for any amplifier, but you shouldn't use more than one of them per amp channel because the impedance in the bass range is so low.

The Platinum's woofers had a fairly generous excursion capability (about 0.5 inch, peak to peak), did not sound harsh when overdriven, and exhibited no dynamic offset. Their excursion reached a minimum at about 47 Hz, the apparent vented-box tuning frequency. High-level sine-wave sweeps caused no cabinet vibrations and revealed no significant side-wall resonances.

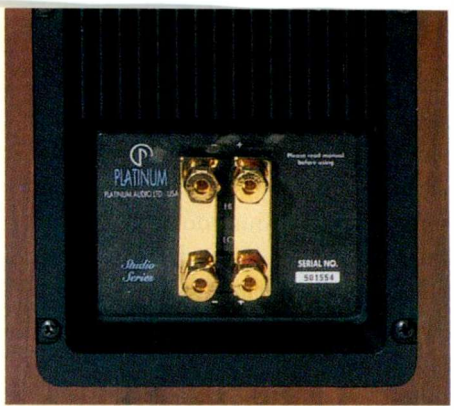
For Fig. 6, the raw and smoothed 3-meter room response, I placed the Studio 2 in the right-hand stereo position and aimed it at the test microphone, which was in the listening position. If you exclude the peak at 150 Hz, the smoothed curve fits a somewhat tight window, 11 dB. Above 1 kHz, the response window narrows to about 6.75 dB except for the dip at 6 kHz.

At power levels up to 50 watts (18.7 volts rms into the rated 7-ohm load), a tone at 41.2 Hz (E_1) elicits only moderate second- and third-harmonic distortion from the Studio 2 and not much significant output at higher harmonics (Fig. 7). At this level, the Studio 2 sounded fairly clean while generating a healthy 97 dB SPL at 1 meter in a free field. At 110 Hz (A_2), second- and third-harmonic distortion is fairly low (Fig. 8); higher-order harmonics fell below the floor of the display. Free-field output at 1 meter was a loud 104 dB SPL with a 50-watt input at this frequency. Two octaves higher, at A_4 (440 Hz), second-harmonic distortion fell to 0.5% and third-harmonic to 0.8%, both quite low.

Intermodulation distortion rises gradually with increasing power (Fig. 9). It reaches a moderate yet clearly audible 13% at 50 watts.

The Studio 2's short-term peak power input and peak output are shown in Fig. 10. The peak input power is low, 14 watts, at 20 Hz and then rises quickly to a peak of 230 watts at 50 Hz, near the speaker's tuning frequency. Next it dips, then rises smoothly to a high of 6.6 kilowatts above 3 kHz. The last Platinum Audio speaker I reviewed, the Duo, could handle only 60 watts at 4.5 kHz because the iron core of an inductor in its crossover saturated. Platinum has certainly fixed that problem! Having iron-core inductors in a crossover is not inherently wrong; you just have to have large enough cores, as the Studio 2 does. (The company says the Duo's inductors were changed soon after my 1996 review was published.)

The Studio 2's peak acoustic output with room gain is a low 79 dB at 20 Hz but rises very quickly, to 111 dB, at 54 Hz and is in the mid-120s (which is very loud) above 1 kHz. The Platinum's low-frequency output is matched by few other bookshelf speakers I've tested.



THESE SPEAKERS HAVE A HEAVY-DUTY, NO-NONSENSE, HIGH-PERFORMANCE LOOK AND FEEL.

Use and Listening Tests

The Studio 2s, which are shipped two to a carton, were surprisingly heavy for their size. I was quite impressed with their no-nonsense, heavy-duty, high-performance look and feel. The drivers are flush-mounted, which I discovered when I ignored Platinum Audio's instructions and removed a grille. (I teased its edges with a small screwdriver, then gently pulled it off.) After assembling the PS-20 stands, I bolted the speakers to them.

Platinum Audio's owner's manual, which covers the whole Studio line, suggests placing the Studio 2s at least 4 feet from your room's side walls and no closer than 3 inches from the wall behind them. The manual also suggests toeing the speakers in toward you.

My equipment included an Onkyo Integra DX-7711 CD player, a Krell KRC preamp, a Crown Macro Reference amp, and Straight Wire Maestro cabling. As usual, B&W 801 Matrix Series 3s were my reference speakers. I did not bi-wire the Studio 2s for the listening tests.

My initial listening session with the Platinums was a pleasant surprise. I was quite taken with their bass response, which extended below 40 Hz. They sounded like larger speakers, and their bass compared

quite favorably with the B&Ws' unless I turned the volume up high or the music had high levels of bass below 35 Hz.

I was also struck by how well the Studio 2s compared to the reference speakers in overall sound, smoothness, and tonal balance. One way I make such comparisons is by standing up and turning my back to the speakers. This makes it harder to identify them by location and focuses my attention on room sound and reflections, which are functions of a speaker's total sound power output. The Studio 2s were one of the few systems that handily passed this test; facing the rear, I was hard-pressed to tell which speaker was which. I didn't even have to adjust levels for comparative listening, as the Studio 2s' and 801s' sensitivities were essentially the same.

On Amanda McBroom's *West of Oz* (Sheffield 10015, an old favorite), the Studio 2s reproduced McBroom's voice with plenty of clarity and projection. I didn't notice any harshness or undue emphasis on sibilants. The harmonica on track 1 was very realistic, while the percussion on other tracks was very dynamic and blended well with the rest of the instruments.

The bass lines of the contrabass and pipe organ pedal notes on *Adagio d'Albinoni* (King Record Co. K33Y 236, a Japanese recording) were reproduced very evenly and smoothly. The Studio 2s handled the massed unaccompanied vocals on Rachmaninoff's *Vespers* (Robert Shaw Festival Singers, Telarc CD-80172) with ease, smoothness, and minimum strain, blending the voices very well with the reverberations of the performing space. On Shenandoah's lighthearted "Next to You, Next to Me," one of my all-time favorite country tunes (it appears on *Extra Mile,* Columbia CK-45490), the Studio 2s re-created the vocals and accompaniment with great cohesiveness, warmth, and detail. Each vocal part was distinct but fit well in the total mix, although the Platinums emphasized the fiddles slightly more than the B&Ws did. The Studio 2s' imaging accuracy was outstanding. On string quartets, I could tell exactly where each instrument was, and center-panned soloists stayed dead center; there were no frequency-related position shifts.

THE STUDIO 2s PERFORMED BEYOND MY EXPECTATIONS ON ROCK, POP, AND JAZZ.

On pink noise, the Studio 2s exhibited some midrange and upper-frequency tonality. (Pink noise is very good for revealing tonal differences between speakers. Frequently, speakers that sound quite similar on music will sound significantly different on pink noise.) The Platinums weathered the stand-up/sit-down test perfectly; I heard no significant tonal changes when I stood up, equalling the excellent performance of the B&Ws on this test.

When I tested bass response with band-limited noise, the Studio 2s produced no usable output in the 20- and 25-Hz bands, some usable output at 32 Hz, and strong output from 40 Hz up. However, there was significant port noise when I played the 32- through 50-Hz bands.

With rock, pop, and jazz, which call for loud playback levels, the Studio 2s performed beyond my expectations. They played loudly and cleanly, with quite satisfying levels of bass and only slight congestion at the highest levels. They also handled loud orchestral music very well but could not play quite as loud if the music had high levels of low bass tones.

The Platinum Audio Studio 2s offer very good value for the money. Few small speakers can match their bass impact and extension, not to mention their pinpoint imaging, excellent overall performance, and strikingly good looks. Unless you're a bass freak, they'd be a good choice for small to moderate-sized rooms. And if you are, just add a reasonably competent subwoofer and they'll take on all comers. A

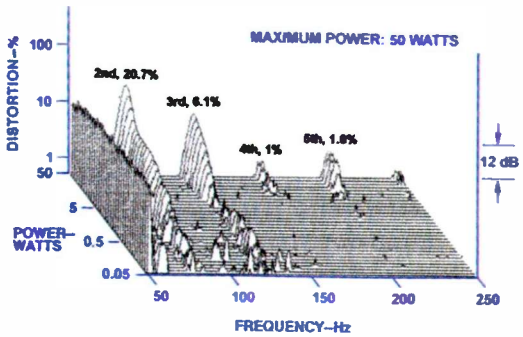


Fig. 7—Harmonic distortion for E_1 (41.2 Hz).

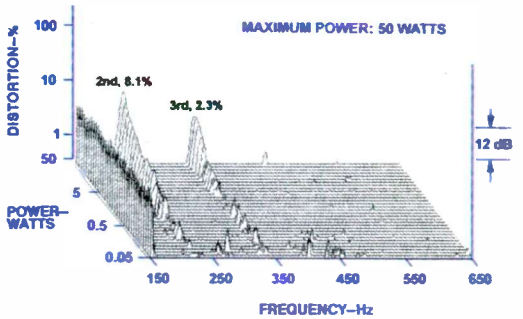


Fig. 8—Harmonic distortion for A_2 (110 Hz).

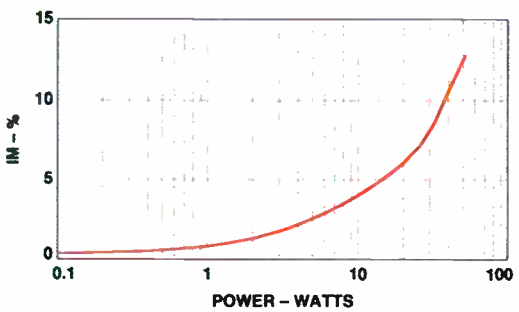


Fig. 9—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

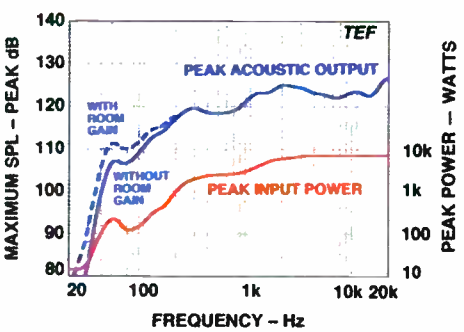


Fig. 10—Maximum peak input power and sound output.

RECAPTURE THE EMOTION.

RELIVE THE EXPERIENCE.

QUINTET

the world's only horn-loaded microsystem,

delivering marquee theater sound

and concert hall acoustics.

THE POWER *of* KLIPSCH.

DESIGN & ENGINEERING SHOWCASE HONORS 1999 INNOVATIONS CONSUMER ELECTRONICS SHOWS

Klipsch @ the Orpheum.
The 3000-plus-seat Orpheum Theatre in Memphis, TN, was recently chosen by Turner Broadcasting to show the digitally remastered movie, "Gone with the Wind." Recapturing the film's every nuance required a significant sound system upgrade. The speaker of choice? Klipsch.

It's Alive. And exhilarating. Experience the wonder of big cinema sound and the electricity of a command performance with the Klipsch Quintet Micro Theater. Quintet integrates the science of Klipsch Professional speakers—featured in movie theaters and concert halls worldwide—to transform your home into a spectacle of theater-sized proportion. Designed to optimize Dolby Digital, DTS and all 5.1 surround formats, Quintet is the world's only horn-loaded microsystem that flawlessly embodies cinema & music. Visit your local Klipsch audio specialist to experience microsystem performance like you've never heard before. Quintet. It's Alive.

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A LEGEND IN SOUND.

EQUIPMENT PROFILE

EDWARD J. FOSTER and IVAN BERGER

BLAUPUNKT ALASKA CAR CD RECEIVER

Digital signal processors run rings around their analog ancestors. A tuner is basically an analog signal processor. "Hmmm. . .," thought Blaupunkt, which came up with the DigiCeiver, a two-chip system that digitizes radio signals as soon as they're tuned in and then extracts stereo and Radio Data System (RDS) information in the digital domain.

The idea is simple—and revolutionary. Until now, "digital" AM/FM tuners were entirely analog except for their numerical station displays and the circuits that controlled their analog tuning oscillator's frequency. In all modern tuners (including the new Blaupunkts), that frequency is mixed with the incoming RF signal to produce an intermediate frequency (IF). In other tuners, the IF is filtered and demodulated in the analog domain (see "A Quick Guide to Superhet"). In the DigiCeiver, however, the IF signal goes straight to an A/D converter, and all filtering and demodulation is done digitally.

The response curve of an ideal IF filter would be virtually square, with a flat top and straight sides. The response curves of analog filters have sloping sides that let in undesired signals and rounded corners that attenuate a bit of the desired signal at high modulation levels. The response curves of digital filters aren't perfectly square, but they come a great deal closer. In this and other ways, doing things digitally should improve performance. It certainly makes it simple and economical to include complex features like equalizers.

What's more, digital systems are simpler to manufacture, which cuts costs. In Blaupunkt's DigiCeiver, a custom IC takes the place of a conventional tuner's IF filters, IF amplifier, stereo detector, multiplex filter, RDS detector, and FM de-emphasis circuit. Even the Alaska, Blaupunkt's top DigiCeiver model, is priced at only $369.95, and the same basic circuitry is used in the $329.95 Nevada and the $299.95 Florida.

Rated Output: 17 watts x 4 into 4 ohms at 1% THD + N, 30 Hz to 15 kHz; maximum power, 40 watts x 4.
Price: $369.95.
Company Address: 2800 South 25th Ave., Broadview, Ill. 60153; 800/950-2528; www.blaupunkt.com.

Photos: Michael Groen

The three models have more than tuning circuitry in common. Each has four 3-volt preamp outputs plus four-channel amplifiers with a "car stereo" rating of 40 watts/channel maximum and a real-world rating of 17 watts/channel. Their tuners have presets for 18 FM and 12 AM stations (including the six strongest AM and FM stations, automatically programmed by a "Travelstore" feature), and they can decode RDS signals. Their tone and loudness controls work in the digital domain; the loudness controls have six selectable levels of action. There's also a clock (which can be automatically set by RDS stations) and a detachable front panel.

All three DigiCeivers share a new CD transport, in which a single structure holds the laser diode that projects light onto the disc, the photodiodes that read the reflected laser light, and a holographic beam director. This should be more rigid than the separately mounted laser, photodiode, and beam splitter of other designs. The transports can be mounted at extreme angles, from −10° for a van's overhead console to +105° to fit between a car's seats. According to Blaupunkt, the transport's design and

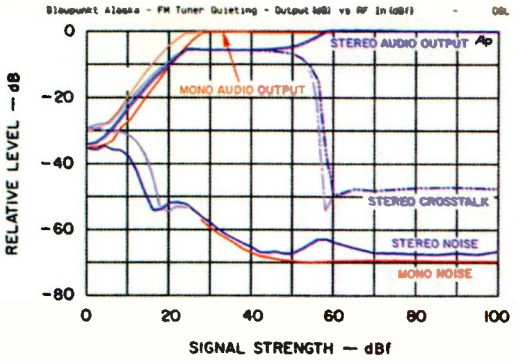


Fig. 1—FM tuner quieting; performance without Sharx shown in lighter tone.

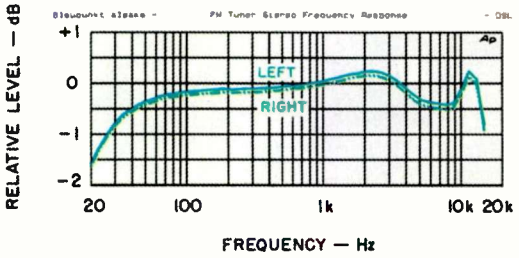


Fig. 2—Frequency response, FM tuner section.

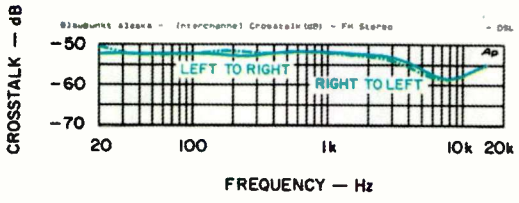


Fig. 3—Crosstalk, FM tuner section.

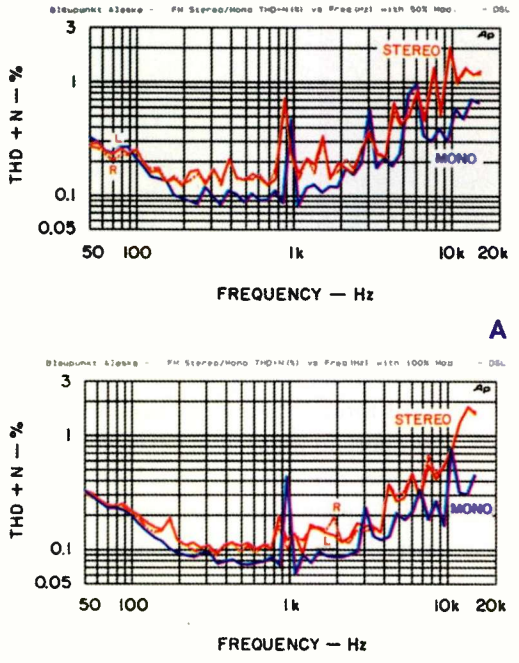


Fig. 4—THD + N vs. frequency at 50% modulation (A) and at full modulation (B), FM tuner section.

a proprietary spring suspension should lead to improved disc tracking while on the road.

The more expensive models have more features, of course. Stepping up from the Florida to the Nevada gets you a low-frequency quasi-parametric equalizer (in addition to the former's bass and treble controls), separate tone-control and loudness-compensation settings for each source (CD, FM, and AM), an AUX input for an external analog source, and the ability to control a 10-CD changer and mute the sound automatically when your car phone is in use. You can play the Nevada for an hour with the ignition off and control it with the optional Thummer III remote ($59.95). Yellow, blue, or red faceplates are available for this model, as well as the standard black.

The Alaska, which Ed Foster tested in the lab and I took on the road, is not available in colors, though its station-preset buttons are cobalt blue instead of the other models' black. Its step-up features are a digital selectivity-enhancement circuit called Sharx, another quasi-parametric EQ band (this time for the treble), and the ability to enter CD titles.

Some of the functions I've described are programmed in via menus, called up by pressing the "DSC" (Direct Software Control) button on the Alaska's front panel and using the arrow keys. You use the same routine to call up quite a few other handy features. For example, you'd use "DSC" to set the radio to bypass the AM band, to set a tuner high-cut filter to any of three levels, to change the sensitivity of the station search, to turn Sharx on and off, to adjust how long scan lingers (5, 10, 15, or 20 seconds) before moving to the next radio station or CD track, to toggle the clock between 12- and 24-hour modes (and set it manually if there are no RDS stations to set it for you), to keep the clock display on when the Alaska is off, to change the muting level, to set the loudness of control-confirmation beeps or turn them off, and to set the unit's volume level at turn-on. *I.B.*

Measurements

It warms the cockles of my techie heart when something new and potentially better hits the street, and I drooled at the thought of having the Blaupunkt Alaska on my bench. Before the DigiCeiver, nothing much had happened in tuner design for a decade. (Yes, yes, RDS and all that, but RDS doesn't affect reception; it's a convenience.) And most of today's tuners test or sound no better than their predecessors; many, especially those in A/V receivers, are a darned sight worse!

Arguably, the Alaska's major technical advantage over its DigiCeiver siblings is Sharx, a variable-bandwidth IF filter that adapts to reception conditions, narrowing when it finds interference and widening when it doesn't. This is possible because the Alaska's IF filter is implemented digitally, so its characteristics can be modified by simply adjusting the appropriate parameters in its stored instructions. Because the IF filter affects most tuner characteristics, I tested the Alaska with and without Sharx.

Self-adaptive systems like Sharx are best evaluated in actual use. But because bench tests (except for selectivity) are conducted under interference-free conditions, Sharx shouldn't affect the results. Still, I had to make sure, so I tested the Alaska with and without this circuit. Where the difference was slight, the results with Sharx are presented. My first sample's CD player didn't work, so the CD, preamp, and amp measurements presented came from a second sample. I didn't rerun all the tuner tests, but I did a few spot checks to make sure performance was consistent with the first unit's.

It's apparent from the Alaska's mono and stereo quieting curves (Fig. 1) that its tuner remains in mono until it receives a signal of 50 dBf; it then rapidly shifts to stereo and attains full separation when signal strength reaches 56 to 58 dBf. (The symbol for stereo begins to appear in the Alaska's display at 11 dBf, so it indicates only that the signal is in stereo, not necessarily that you're hearing it that way.) Sharx seems to make no difference in the level at which the tuner switches to stereo, nor does it seem to affect the signal-

to-noise ratio at 65 dBf by more than a few tenths of a decibel (presumably because of the narrower IF), which is hardly significant.

Although Sharx has little effect on noise, audio output, and separation with strong signals, it does with weak ones. In Fig. 1, note how much more rapidly the tuner opens up with Sharx off, its audio output rising and its noise level dropping. This also affected the results in "Measured Data" for IHF usable sensitivity and 50-dB mono quieting sensitivity; they were much better with Sharx off than with it on. (I couldn't measure 50-dB quieting for stereo, because the Blaupunkt did not switch to stereo until its S/N far exceeded 50 dB.)

The Thummer III remote fits on your steering wheel; its infrared sensor mounts in your dash.

ONCE I FIGURED OUT THE THUMMER REMOTE, I USED IT NEARLY ALL THE TIME.

While I was conducting the tests for Fig. 1, the Alaska's tuner generated random bursts of noise (similar to the "popcorn noise" that sometimes affects op-amps). The resulting blips in the noise curve didn't correlate with signal strength, so I thought it would be best to average them out and smooth the mono noise curve above 40 dBf (the blips in the stereo curve were too small to need smoothing). I suspect that this noise is related to the Alaska's digitization process.

The tuner's FM frequency response (Fig. 2) is quite decent, despite some bass rolloff, and channel balance is excellent. Channel separation is extraordinarily good throughout the audio range (Fig. 3).

The tuner's distortion curves (Fig. 4) are the strangest I've seen. Distortion jumps considerably at specific frequencies, is sometimes worse in mono than in stereo, and is often worse with 50% modulation (Fig. 4A) than with 100% modulation (Fig. 4B). Weird! I suspect this, too, has something to do with the digitization process. Among the frequencies where distortion increased were two of the standard tones used in this test (1 and 6 kHz). Including these results in "Measured Data" would have implied that overall distortion was far higher than it was, so I omitted them; the graphs tell the whole story.

Capture ratio, which reflects a tuner's ability to distinguish the stronger of two signals on precisely the same frequency, was the same with and without Sharx, indicating that co-channel interference does not make Sharx change IF bandwidth. But for adjacent-channel selectivity, the ability to tune out a signal 200 kHz from the desired one, there sure was a difference! Even with Sharx off, adjacent-channel selectivity measured 16 dB, which is unusually high (i.e., good). With Sharx on, however, the tuner seemed totally immune to signals on adjacent channels, no matter how high I cranked the generator that was providing the adjacent-channel signal! When it was receiving signals 400 kHz from the desired station (alternate channels), the Alaska had better selectivity than I could document, whether I used Sharx or not.

The Alaska's FM tuner had great AM rejection. The DigiCeiver's combination of superior AM rejection and good capture ratio bodes well for performance in the face of multipath. Image rejection—which is unaffected by Sharx, as it does not depend on the IF filter—was not outstanding. But images are rarely a problem unless you're near an airport, anyway. The AM tuner was sensitive and its frequency response (Fig. 5) better than usual.

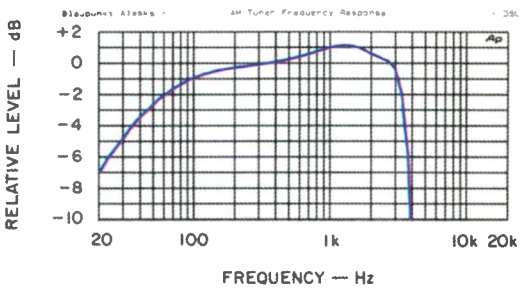


Fig. 5—Frequency response, AM tuner section.

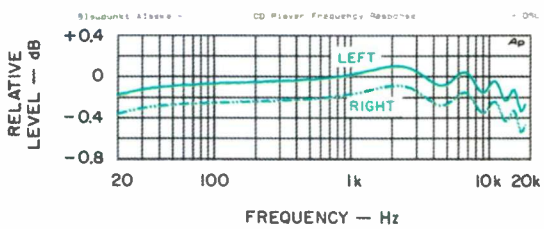


Fig. 6—Frequency response, CD section.

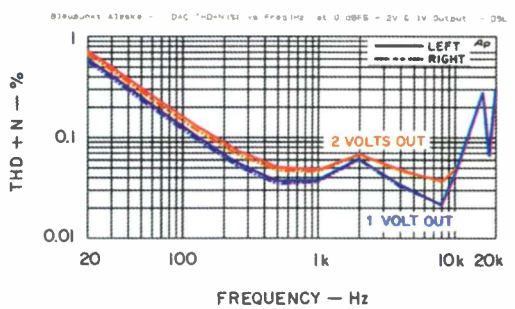


Fig. 7—THD + N vs. frequency, CD section.

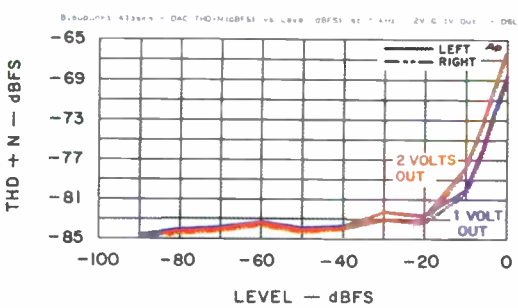


Fig. 8—THD + N vs. level, CD section.

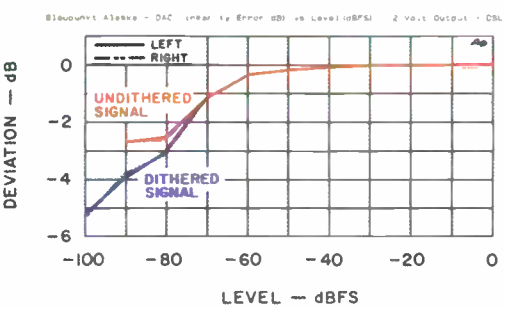


Fig. 9—Linearity error.

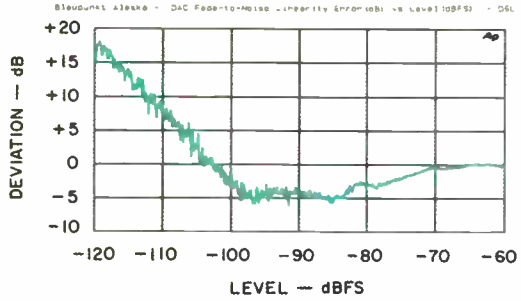


Fig. 10—Fade-to-noise test.

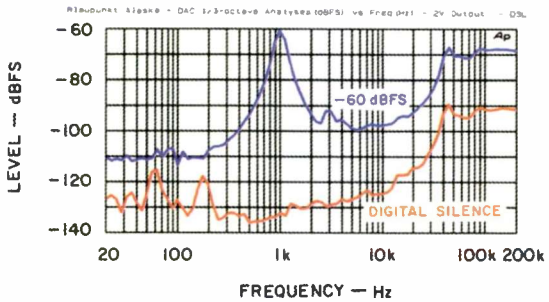


Fig. 11—Noise analysis, D/A converter.

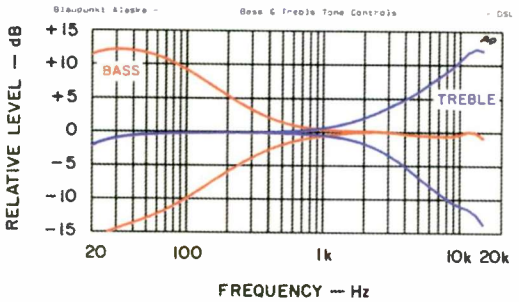


Fig. 12—Tone-control characteristics.

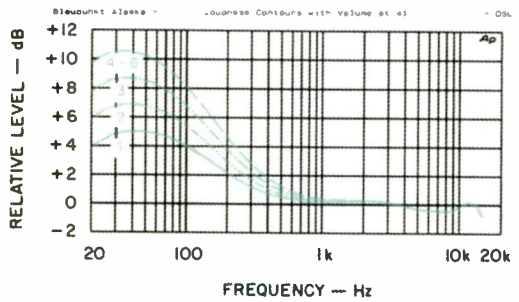


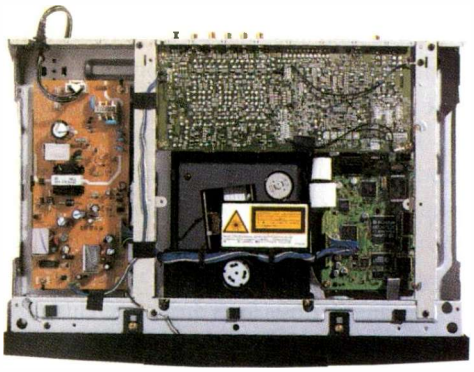
Fig. 13—Loudness compensation with volume adjusted for 30-dB attenuation. At this level, the contours for three of the six compensation settings were the same.

As you'd expect, the CD player's frequency response (Fig. 6) is wider and smoother than the tuner's, with channel balance everything one could hope for in a car player. The same was true of channel separation (see "Measured Data"). The digital filters in the Blaupunkt's CD section are not as sharp as those in most top-of-the-line home players, but I doubt this will be apparent on the road. You can see evidence of the filter's modest nature in the treble response ripples in Fig. 6 and in the peaks at 16 and 20 kHz in Fig. 7, the CD section's THD + N versus frequency.

Figure 7 also reveals why I listed the CD section's distortion at two output levels in "Measured Data." I began measuring the player's characteristics with the Alaska's volume control at its 66th (highest) step, only to encounter signs of distress from the analog circuitry. I therefore reran my tests, cutting back volume to the 63rd step (which yielded 2 volts from a 0-dBFS recording, or as close to 2 volts as its steps would let me get) and to the 58th step (which yielded about 1 volt). Save for distortion, there was no meaningful difference between the results at the two settings, so I've used the 2-volt data for everything else.

As you can see in Fig. 7, distortion is lower with 1-volt output than 2-volt except above 10 kHz (where intermodulation with the carrier determines the distortion reading). This suggests that the distortion occurs in the Alaska's analog output section rather than in its digital-to-analog converters. When I plotted THD + N versus recorded level (Fig. 8), the higher volume setting produced more distortion at high recorded levels for the same reason. But at low recorded levels, the higher setting yielded slightly better results because it improved S/N.

If the Alaska were a home CD player, I'd call the linearity of its D/A converters poor. Figures 9 and 10, deviation from linearity and fade-to-noise performance, respectively, reveal significant departures from linear performance even at levels as high as –60 dBFS. At –70 dBFS, the DACs are 1 dB off, and matters degrade from there. By –100 dBFS, the error reaches 5 dB. (Below



BLAUPUNKT'S DIGICEIVER IS THE WAVE OF THE FUTURE IN TUNER DESIGN.

about –100 dBFS, noise within the tracking filter's passband causes a rise in the fade-to-noise curve that obscures actual linearity.) But though Blaupunkt's DACs are far from the most linear I've seen, it's questionable whether you can hear this in a car; on the road, background noise is likely to mask ambience details at –60 dBFS.

It's clear from the spectrum analyses in Fig. 11 that the Alaska's D/A converters mute on the "digital silence" code, equivalent to the unmodulated segments between CD tracks. This explains the unusually high S/N numbers in "Measured Data," which are taken with a "silent" track. But if there's any modulation present, as there is throughout recorded tracks, residual noise will be no lower than the –110 dBFS produced below 100 Hz on the curve with –60 dBFS modulation. The results for dynamic range and quantization noise were less impressive, but here again, I doubt that means very much amidst the noise of a moving car.

To assess the effects of the Alaska's digital bass and treble controls, loudness contours, and low- and high-frequency equalizers, I turned the volume down to the 41st step. This produced the 30-dB attenuation I like to use for measuring loudness contour and ensured that I'd not overload the output stage with full tone or EQ boost. The bass- and treble-control curves (Fig. 12) are pretty conventional. Despite what the owner's manual says, the loudness control does not affect the high frequencies (Fig. 13; the

slight sag and bump above 4 kHz are part of the tuner's frequency response).

Figures 14A and 14B show the response of the low- and high-frequency equalizers at their lowest, highest, and middle frequencies and with their levels set to +10 dB (maximum boost), –10 dB, and –20 dB (maximum cut). Note the relatively broad, low-Q boost curves and the sharp, narrow, high-Q cut curves. This is unusual behavior, but I think it's a great idea! A high-Q notch might prove useful to eliminate a standing wave in a car (certainly a broad notch wouldn't do), while a low-Q boost is far more appealing to the ear than a sharp peak. Another interesting difference in an unusually interesting product. *E.J.F.*

Behind the Wheel

For my road tests, I decided to bypass the Blaupunkt Alaska's four built-in amplifiers and fed its preamp outputs to the Canton and Linear Power amps already in my car. The DIN-sized unit was installed, quickly and competently, by Sound Effects in New York City.

The Alaska looks deceptively simple for a head unit with so many features because the things you rarely change are activated via the "DSC" menus, using the arrow keys. The procedure's a bit cumbersome, but these are one-time adjustments—best done when not driving. With little-used controls buried in the "DSC" menus, I was able to operate the Alaska's other controls by touch within hours after it was installed.

As soon as I turned on my ignition, the on/mute/off button in the center of the Alaska's volume-control ring glowed a cobalt blue, enabling me to find it quickly in the dark. Once the Alaska is powered up, all its controls are easy to find, though its CD slot isn't illuminated. The display is very clear at night, on or off axis, and reasonably so by day except when direct sunlight strikes it or there's a bright haze.

The Alaska's volume control is a flat ring you turn with your fingertip—not as useful as a knob but much better than rockers. The control's 66-step range allows very fine adjustment—so fine, in fact, that I could barely distinguish a one-step change. "Volume" appears in the display when you change that setting, but only for a mercifully brief 2 or 3 seconds.

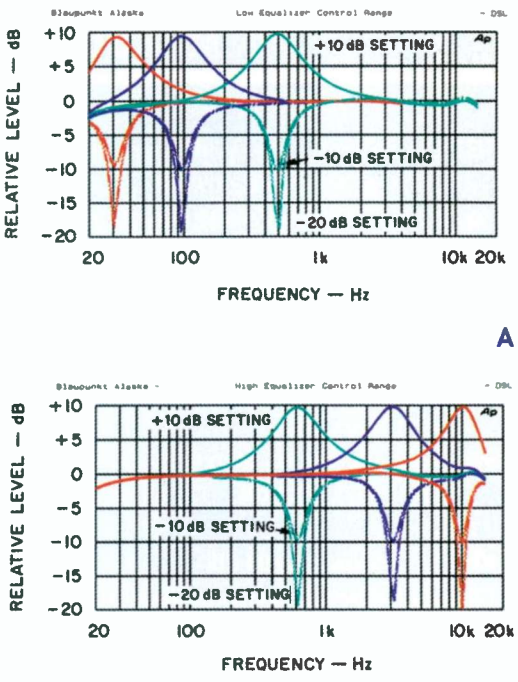


Fig. 14—Response of low-frequency equalizer at 32-, 100-, and 500-Hz settings (A) and of high-frequency equalizer at 630-Hz, 3.2-kHz, and 10-kHz settings (B).

The tuner's chief controls are simple: six station buttons, up/down buttons for station search, a left/right rocker for manual tuning, a small button for scanning, and another to switch bands. The controls for CD play are equally simple. In this mode, the arrow keys control forward/back track selection and audible fast forward and fast reverse (cue and review), the scan button plays the start of each track, and the middle three preset buttons handle pause/play, repeat, and random play. When you use a CD changer, you use the up/down arrow keys to select discs; you can choose random play for as many as 10 CDs or for just the tracks on the disc currently playing.

The arrow keys are also used, in conjunction with an "AUD" button, to adjust bass and treble, set the balance and fader controls, and turn loudness compensation on and off. The low- and high-frequency equalizers are controlled via a "DSC" menu rather than the "AUD" button; Blaupunkt figures you'll set the equalizer to compensate for your car's acoustics, then leave it alone.

Most of the time, I controlled the Alaska from its optional remote, the handy Thummer III, which my installer attached to my steering wheel. At first, I found myself switching tuner bands inadvertently; soon I realized that the Thummer's "<<" and ">>" buttons worked differently from those on the front panel. (The owner's manual doesn't mention this.) On the front panel, they control manual tuning (or, in

A QUICK GUIDE TO SUPERHET

The air is full of radio signals; a tuner's job is to filter out those you don't want and demodulate the signal you do. Early radios did this by the tuned radio frequency (TRF) system, which used a cascade of increasingly narrow filters that had to be tuned by hand. You'd adjust the first filter to pass the desired frequency and a few neighboring frequencies, then pass its output through a second filter, which you also tuned, and so on. That's why old radios had so many tuning dials.

Long before he invented FM, Major Edwin Armstrong came up with a brilliant tuner design, the superheterodyne circuit, on which all modern tuners are based. Its cascaded filters have fixed tuning, set to an intermediate frequency (IF) outside the radio band. The radio frequency (RF) input is not sent directly through these filters. Instead, it's combined with a high-frequency sine wave from a "local oscillator" to produce beat frequencies. You tune a superhet radio by varying the oscillator frequency until it and the desired station produce a beat at the intermediate frequency (normally 455 kHz for AM, 10.7 MHz for FM). That beat frequency passes through the IF filters; beats produced by other stations don't.

In a superhet, you turn just one knob, which controls the oscillator. And because their frequency is fixed, the filters are simple to make and more likely to be tuned correctly. *I.B.*

MEASURED DATA

TUNER SECTION

IHF Usable Sensitivity: With Sharx on, 27 dBf; with Sharx off, 18.9 dBf.

50-dB Mono Quieting Sensitivity: With Sharx on, 24.5 dBf, with Sharx off, 19.4 dBf.

S/N Ratio at 55 dBf: Mono, 69.1 dB with Sharx on and 68.9 dB with Sharx off; stereo, 66 dB with Sharx on and 65.7 dB with Sharx off.

Frequency Response, Stereo: 30 Hz to 15 kHz, +0.2, –0.9 dB; –1.7 dB at 20 Hz.

Channel Balance: ±0.04 dB.

Channel Separation: Greater than 51.3 dB, 100 Hz to 10 kHz.

Capture Ratio: 1.6 dB at 45 dBf.

Adjacent-Channel Selectivity: With Sharx on, greater than 95 dB; with Sharx off, 16 dB.

Alternate-Channel Selectivity: With Sharx on or off, greater than 95 dB.

Image Rejection: 45.2 dB.

AM Rejection: 73.6 dB.

AM Tuner Sensitivity: 1.85 µV.

AM Tuner Frequency Response: 25 Hz to 3.72 kHz, +2.1, –6 dB.

CD SECTION

Frequency Response: 20 Hz to 20 kHz, +0.09, –0.36 dB.

Channel Balance: ±0.095 dB.

THD + N at 0 dBFS: At 2 V out, less than 0.29% from 61 Hz to 20 kHz and less than 0.5% at 31 Hz; at 1 V out, less than 0.303% from 61 Hz to 20 kHz and less than 0.315% at 31 Hz.

THD + N at 1 kHz: At 2 V out for 0 dBFS, below –55.5 dBFS from 0 to –90 dBFS and below –82.6 dBFS from –30 to –90 dBFS; at 1 V out for 0 dBFS, below –68.5 dBFS from 0 to –90 dBFS and below –82.2 dBFS from –30 to –90 dBFS.

Maximum Linearity Error: Undithered recording, 2.55 dB from 0 to –90 dBFS; dithered recording, 5.25 dB from –70 to –100 dBFS.

S/N (Infinity Zero re 0 dBFS): A-weighted, 112.9 dB; CCIR-weighted, 105.2 dB.

Quantization Noise: –83.5 dBFS.

Dynamic Range: Unweighted, 87.8 dB; A-weighted, 90.3 dB; CCIR-weighted, 81.5 dB.

Channel Separation: Greater than 83.6 dB, 125 Hz to 16 kHz.

AMP & PREAMP SECTIONS

Line Output Level: For fully modulated FM mono signal, 1.69 V; for 30% modulated AM mono signal, 0.51 V; for 0 dBFS from CD, 3.14 V.

Line Output Impedance: 27 ohms.

Tone-Control Range: Bass, +9.3, –9.9 dB at 100 Hz, treble, +10.6, –11 dB at 10 kHz.

Loudness Compensation: 50-Hz Boost with Volume at –30 dB: 4.9, 6.7, and 8.4 dB, respectively, for settings 1 through 3; 10.1 dB for settings 4 through 6.

Output Power at Clipping, 4-Ohm Loads: 15.6 watts x 4 at 1% THD, 16.4 watts x 4 at 3% THD.

CD mode, audible fast forward and fast reverse), whereas on the Thummer, the right-pointing chevron button cycles the tuner through the preset stations while the left-pointing button cycles through the tuner bands. Once I understood this, I found it wonderfully convenient.

The Thummer III will prove handier in some cars than others; it happened to fit better in the Nissan Maxima of an Alaska-owning friend than in my Scorpio. Before deciding to buy this remote, you need to make sure there's a place on your steering wheel where the Thummer will be easy to reach yet not so easy that you activate it by mistake. You should also make sure there's some place on the dash where the Thummer's infrared receptor will be able to read the remote's beam even when you turn your car's steering wheel.

The Alaska in my friend's Maxima got sensational reception. It produced a listenable signal at almost every frequency on the FM band, including some I don't think I've ever picked up in my area. But a failure in my car's antenna system drastically reduced the signal strength available to the Blaupunkt and to my Pioneer reference head unit. On those few strong stations I could get, the Blaupunkt's sound was excellent, but not enough strong signals came through to let me evaluate Sharx's effect on selectivity.

When I turned to the Alaska's CD section, I found its sound too crisp, even edgy. The edginess abated, though it didn't disappear, when I replaced my unit with the one Ed Foster had used for his CD measurements. It was conspicuous on Lou Reed's "Walk on the Wild Side" (from *Transformer*, RCA PCD1-4807) but more subtly present on other music. A recording of Haydn's Opus 76 by the Orlando Quartet (Philips 410053) sounded as if everyone was bearing down hard with freshly rosined bows. On several tracks of *Folk Duets* (Vanguard 79511), sibilance became excessive and some high plucked strings sounded jangly on the first unit I road-tested but not on the second. Although I initially tried rolling off the treble with the Alaska's high-frequency equalizer, it also affected FM sound. In the replacement unit, I was able to tame the edginess with the treble control (whose settings are stored separately for each source). Ed suggested that the edginess may have stemmed from intermodulation he'd noted between the carrier and high-frequency audio signals.

Blaupunkt's engineers in Germany were overly optimistic about FM-station practices in the United States. Many of our RDS stations pay little attention to the clock signals they broadcast—bad news for a clock like the Alaska's, which is set by them. You can set the Alaska's clock manually, but an RDS clock signal will override those settings. One of the RDS stations I listen to kept resetting the Alaska's clock an hour and 7 minutes fast, although another set it right again. I couldn't trust the clock unless I remembered which RDS station I'd last tuned in.

Despite this minor annoyance, I would have really liked the Blaupunkt Alaska—were it not for the edgy CD sound. After all, it does have a very full and well-thought-out set of features, terrific FM reception, and decent AM. Its digital circuitry should prove far more stable over the years than analog equivalents. And its price is far from forbidding.

I think the DigiCeiver concept is the wave of the future in tuner design. It gets good results, makes it possible to include extra features at minimal cost, and should lead to even lower prices in the future. When the next DigiCeiver arrives, I'd like to try it. *I.B.*

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AURICLE

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THETA DIGITAL JADE CD TRANSPORT

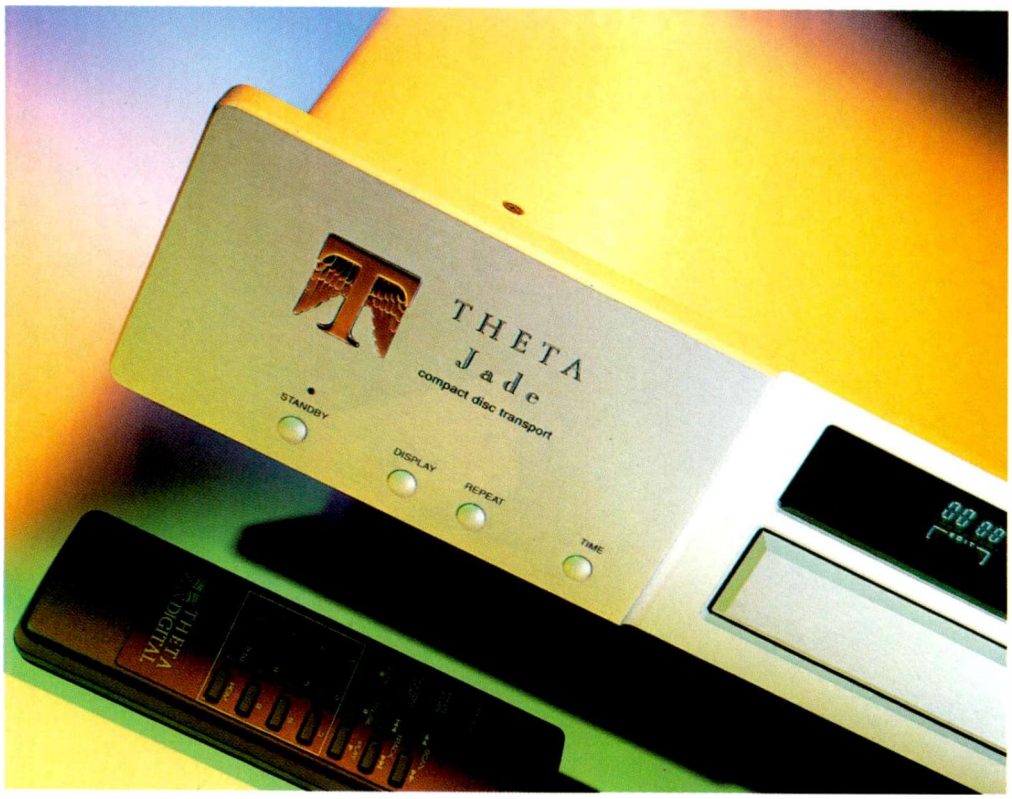

Photo: Michael Groen

I have no reservations about the performance or the cost of Theta Digital's Jade CD transport. A price of $2,495 brings you sound quality that would have cost twice as much a few years ago. And despite an array of control, display, and programming features befitting a high-end transport, the Jade's ergonomics make it (and its remote control) easy to operate. Its styling matches that of Theta's D/A converters, but it is clean enough to harmonize with D/A converters from virtually any other manufacturer.

Company Address: 5330 Derry Ave., Suite R, Agoura Hills, Cal. 91301; 818/597-9195; www.thetadigital.com.

The Jade has three standard outputs: a high-quality Cardas p.c.-board-mounted RCA jack, a shielded metal RF-grade BNC socket, and a Neutrik AES/ EBU socket. All of these utilize a proprietary custom-wound pulse transformer that is very fast. Theta Digital's proprietary Laserlinque single-mode optical and AT&T optical connections are available as options.

THE JADE IS AN EXCEPTIONALLY MUSICAL AND CLEAN-SOUNDING CD TRANSPORT.

The Jade uses the Pioneer Stable Platter mechanism, said to be one of the best available, for its drive but incorporates improvements in its digital control section. Extensive shielding prevents emissions from the noisy transport clocks from polluting the clocks driving the digital signal processing and digital output circuitry. The signal from the Stable Platter drive is sent to an EFM (eight-to-fourteen modulation) decoder and then to a 24-bit DSP.

One of the Jade's most striking aspects is its new clocking topology, which is centered around a custom-manufactured, low-jitter crystal oscillator and DSP chip. A Motorola DSP 56004 runs a proprietary Theta algorithm that isolates and buffers digital data. The reclocking section uses high-speed C-MOS logic gates and ground planes to prevent digital noise from affecting the pure clock signal that emerges from this circuit.

The evolution of CD transports, D/A converters, and CD players has led to a steadily greater emphasis on power supplies. In the Jade, four separate, regulated power supplies isolate the constituent parts of the output clocking section. There are six custom-wound transformers: Three supply critical components in the output section, a fourth supplies the front-panel display, one feeds the motor/servo section, and the sixth operates the laser-control mechanism. Using separate power supplies and transformers provides a high degree of isolation; moreover, AC filtering helps keep noise from the transport's control circuitry and display from contaminating the critical digital sections. Audio-grade Nichicon electrolytic capacitors are utilized in the power-supply, clock, and DSP sections.

This transport's technology and sound quality approach those of transports in the $10,000 range, about four times the Jade's price. Indeed, it is hard to say how nuances of the Jade's performance compare to

those of far more expensive transports because so much depends on external variables, such as the interface between the transport and the D/A converter. (For example, such brands as Linn, Mark Levinson, and Wadia optimize their own transports and D/A converters to work well together.) I can say that I could not find a more expensive transport from another manufacturer that worked better than the Jade did with the Theta DS Pro Generation V-a Balanced D/A converter I use as a reference.

Interconnects and interfaces can also make it difficult to predict sonic nuances. While a fully shielded I^2S bus connection seems to have the best jitter specifications, so few components have this interface that its merits are largely irrelevant. In practice, the AES/EBU interface usually produces the best sound, particularly with an interconnect made strictly to spec and that does not involve trickery in terms of grounding or termination to "improve" the sound. The AT&T optical connection usually ranks second in sound quality, BNC-terminated coaxial connections rank third, and RCA-terminated coaxial connections rank fourth. The Toslink optical connector, in my opinion, has no place in high-end equipment.

With the Jade and the DS Pro Generation V-a Balanced D/A converter, Theta's proprietary Laserlinque single-mode optical interconnect sounded better than an AES/EBU connection. I have no idea why, because the AES/EBU interface should reduce jitter. Similarly, when I used the new Kimber KS-2020 digital interconnect and hooked it up to RCA jacks, I got exceptional performance. The explanation may simply be that both the Laserlinque and the unusual design of the Kimber provide excellent isolation between the Jade and the DS Pro. Above all, this demonstrates why you must experiment to find out which interface sounds best. And the best-sounding interface and interconnect can vary from system to system.

One thing was clear, however: The Jade is an exceptionally musical and clean-sounding transport. Much of the time, what I heard was as transparent without a Genesis Digital Lens jitter reducer as it was with it. Still, in my quest for the best, I eventually reverted to using the Digital Lens with AES/EBU connections. The Jade delivered a more transparent signal than the digital output of Theta's Miles CD player (which I reviewed in the April 1998 issue and which has the same Pioneer mechanism as the Jade), and it sounded notably cleaner than my older transports.

I must stress that you should keep these comments in perspective. I have read reviews implying that one top CD transport will provide radically different sound from another or that going from a relatively good to a high-quality transport will somehow alter the musical experience. I have never been able to hear such sweeping differences and do not believe they exist. No transport changes the essential character of CD sound. You have to use professional digital equipment or 96-kHz/24-bit systems to hear clean digital sound that retains the virtues of analog. Many CDs are so poorly recorded that the quality of the transport makes little difference. A bad recording is a bad recording, and no playback component can add information that isn't there.

THE JADE WILL ALMOST CERTAINLY PROVIDE MORE MUSICALLY NATURAL SOUND THAN OLDER CD TRANSPORTS.

What a fine transport like the Jade *can* do is reveal a little harmonic detail here, slightly reduce upper-midrange glare there, or provide a bit more bass detail and speed. Sometimes imaging improves, sometimes depth. And occasionally the improvements seem almost intangible: The listening experience simply becomes more involving and natural.

Some CDs benefit from a great transport more than others, especially the latest high-quality discs from Chesky, Mobile Fidelity, Sony, Telarc, and Reference Recordings. Sound quality from such CDs is almost always enhanced by the cleanest possible reproduction. Older recordings that have lots of strings, upper woodwinds, cymbal, solo piano, and harpsichord are also more likely to benefit from a transport as good as the Jade. Older CDs from the 1980s and early 1990s are a bit of a gamble; sometimes you win, sometimes you don't. But when you do win here, the improvement is often more noticeable than with more modern recordings. Go figure!

I also have found that much of the perceived improvement depends on the listener. Several women I know who are not audiophiles could discern the improvements the Jade made over the Miles CD player fairly consistently in blind listening tests. A couple of my male audiophile friends did not do as well. One man consistently selected the hardest and least detailed sound, perhaps because he has a slight hearing loss in the upper midrange.

I can promise you that the Jade is an excellent transport and that it will almost certainly provide cleaner, more musically natural sound with most CDs than older or less advanced transports. I can also assure owners of Theta D/A converters that the Jade makes a natural match and is a real improvement over the company's Data III. The differences lie, however, in a mix of nuances heard over time—not in some startling revelation.

One caution: We are in the middle of a format war. On one side are Sony and Philips, who are advocating what they call Super Audio CD, based on wide-bandwidth bitstream encoding. Opposing them is the DVD Forum, which has endorsed up to 192-kHz/24-bit PCM coding, with or without lossless compression, for DVD-Audio. No one knows which will win, but it is clear that new transports and new D/A converters will be mandatory.

You will have to devise your own investment strategy. One component you may want to consider in the interim is Theta's David DVD player rather than the Jade. The David can provide the same advanced CD reproduction as the Jade, it can play DVD video and audio superbly, *and* it can reproduce the new 96-kHz/24-bit audio DVDs from Chesky and Classic Records. Still, the David does cost $2,000 more than the Jade. And though it can't play the Sony/Philips Super Audio CDs, nothing currently on the market can.

My advice is to put the music first. I own well over 1,000 CDs, and I don't intend to freeze the sound quality of my system for several years until the fog of the format wars has lifted. But you'll have to consider your own needs and the size of your bank account. We live in interesting times! A

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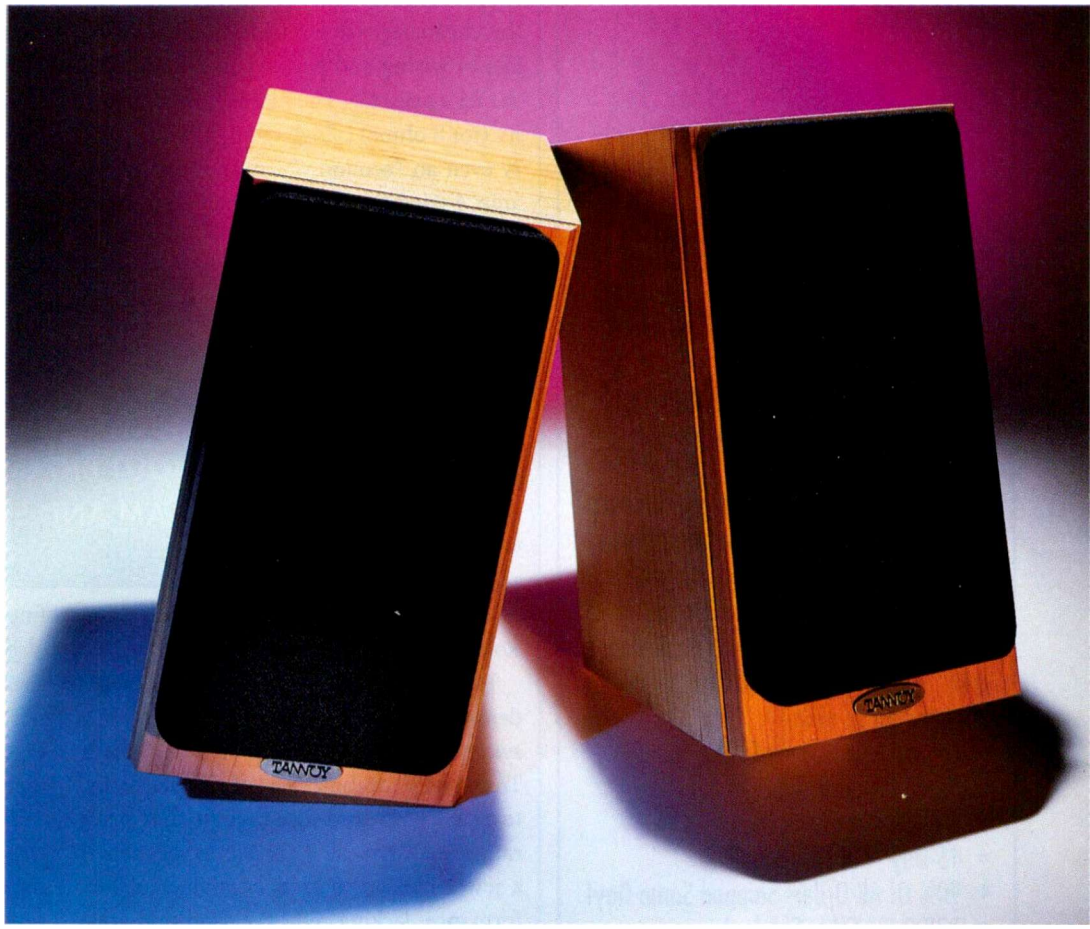

Photo: Michael Groen

Tannoy is moving with the times—has been for 20 years. In the minds and hearts of many audiophiles, the company's still known for horns, for dual-concentric drivers, for speaker cabinets that use enough wood to panel a year's worth of Rolls-Royce dashboards, and for high sensitivity that appeals to the single-ended triode brigade.

Yet while some of us are in the thrall of the large and luscious Churchill (auditioned by Bascom H. King for the March 1999 issue), Tannoy has been capitalizing on another, more widespread trend: smaller speakers. After decades of sniping at the British audiophiles' focus on small speakers, Americans are starting to see the merits of speakers no larger than a loaf of bread. Living rooms in the United States are not shrinking to European proportions, but home theater calls for five speakers and a sub, where two speakers used to suffice. So it's a good thing the performance of today's best small speakers seems to defy the laws of physics.

Despite its reputation for big speakers, Tannoy owes much of its current stature and success to manageable models that trace their lineage back to the original Mercury of some 20 years ago. The company has been reveling in the success of the Mercury series' dirt-cheap M1, yours for $250 per pair in the U.S.

The R1, at $500 per pair, is part of Tannoy's new Revolution series. It's an M1 that's been hot-rodded—the same thinking that turned the Mini into the Mini-Cooper or the VW into the Porsche. The R1 also follows in the tradition of Marantz's Europe-only K.I. Signature versions of certain CD players and amplifiers, converting them from budget brilliance to entry-level high-end status. And, as Tannoy and Marantz share distribution in the United Kingdom, it seems sensible that Tannoy would make a speaker that would appeal to the customer who'd opt for the deluxe versions of Marantz's budget CD player and amp.

Company Address: c/o TGI North America, 300 Gage Ave., Suite 1, Kitchener, Ont. N2M 2C8, Canada; 519/745-1158; www.tannoy.com.

Like the M1, the R1 is a two-way bass reflex system measuring just 7 x 12 x 8 inches. But it adds new ingredients to the M1 recipe. The R1's cabinet is of MDF rather than the M1's chipboard and is finished in a handsome veneer of real cherry wood. That finish will encourage purists to use the R1s *au naturel*, without their grilles. (Both models' grilles, of black cloth stretched over a molded frame, stand a good quarter-inch out from their baffles.) Although the R1 and M1 have the same drivers, a 1-inch soft-dome tweeter and a 5-inch long-throw woofer with an inverted dustcap, I've heard that the R1's drivers are selected for closer tolerances.

The R1's crossover network, a second-order design, incorporates upgrades. It has an auto-transformer tweeter level control rather than the M1's resistive type; this is said to provide a better impedance match and improve high-frequency damping. The nominal crossover point is 2.5 kHz. Two pairs of gold-plated

multiway binding posts enable the R1 to be bi-wired.

Like the M1, the R1 arrives with a plug of reticulated foam in its port. Whether you leave it in or take it out will depend on the size of your room and the R1s' proximity to its walls. The foam plug damps the port resonance "to reduce bass energy and 'speed up' the sound presentation," Tannoy says.

This speaker is a textbook example of what currently qualifies as high-end-on-the-cheap, right down to audiophilic fillips like bi-wiring and performance that belies the R1's price tag. The rated 89-dB sensitivity (for 8 ohms) is high enough not to worry even an "economy" single-ended triode amp. I tried the R1s with solid-state amps rated as low as 20 watts/channel, with elderly Quad IIs (15 watts each from KT66s), with an exotic 80-watt/channel integrated from Gryphon of Denmark, and—more likely to be teamed with the Tannoys—with a couple of affordable 50-watt/channel solid-state integrated amps from Roksan and Musical Fidelity.

WHAT THE TANNOY R1 BRINGS TO THE TABLE IS HIGH-END PERFORMANCE WITHOUT BIG SPEAKERS' SLAM AND SCALE.

Factor in the sort of stand these speakers demand, and you can see them serving in a system whose total price is $1,500 to $2,000. True, many combinations of CD player, integrated amp, and speakers fit that price range. But what the R1 brings to the table is a jewel-like intimation of high-end performance, lacking only the slam and scale associated with (and available only from) larger speakers.

This same trade-off, quality over quantity, has allowed impoverished audiophiles over the decades to delight in speakers like the AR-4ax, the Baby Advent, the myriad versions of the BBC LS3/5A, and the smallest Sonus Fabers. It's an intelligent compromise that never becomes oppressive as long as you don't expect a speaker this small to do justice to a room much larger than, say, 15 x 18 feet and you don't assume that it can convey the sound levels and scale of a live Pearl Jam gig.

A speaker this small assumes that you value sonic purity over bass for its own sake, image positioning over absolute soundstage size, finesse over force. Try though the R1 might to pretend that its volume is 16.5 rather than 6.5 liters or that the woofer is a 10-incher, this speaker is no substitute for a huge box. But even when the R1 is driven hard, its misbehavior is tolerable rather than alarming, like the inherently soft clipping of tubes. You soon discover that the R1 can go "loud enough," that it can satisfy nearly all sane demands, that its bass gives the music enough of a foundation to preclude thoughts of the speaker acting as a high-pass filter. But a Cerwin-Vega clone it ain't.

Within its limitations—and as long as its owner pays attention to such matters as positioning, the need for solid stands, and the advantage of bi-wiring over single wiring (biamping is better still)—the R1 is high-end in miniature. In some ways, it reminds me of the original Wilson WATT, before the Puppy subwoofer section turned that mini into a high-end classic. The Tannoy shares the Wilson's ability to retrieve the finest of details and its sense of precision; it also has a modicum of the far costlier speaker's three-dimensionality. The R1 is not a cost-no-object thoroughbred, however, so it lacks the Wilson's ultimate refinement and transparency.

Not that the R1 is too colored or too crude; it isn't. But it was designed to optimize the sound of like-priced amps or receivers, with no expectation that it would be used with amplification beyond its social standing. Nevertheless, given a burst of Krell power, the R1 rises to the occasion.

For decades, the British have taken the opposite approach from the Americans, preferring to spend more on an audio system's front end than on its speakers—the garbage in/garbage out mind-set. If you follow this approach, your speakers are the last items you upgrade—so your first speakers, though modest, had better be good enough to live with while you're upgrading everything else. The R1s, judging by my weeks with them, should outlast all manner of amplifier upgrades. I had no qualms about using them with over-$4,000 amplification, nor about making them my new sub-$500 reference speaker. A

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Souvenir
Marcel Grandjany, harp; the Budapest String Quartet
BRIDGE RECORDINGS
9077, 64:42
Sound: A, Performance: A+

Thanks to improvements in technology during the last decade, the restoration of old recordings has vastly improved. But successfully removing all the pops and crackles is still a painstaking, intricate undertaking. Nevertheless, hearing master performers of an earlier era on clean issues makes the arduous effort worthwhile.

The many concerts held over the years in the Library of Congress's intimate hall have set a high standard for chamber music performance. Hundreds of them were recorded, but few of the tapes have been heard. David and Becky Starobin of Bridge Recordings have taken on the commendable task of listening to the many hours of music, selecting the best, and skillfully rejuvenating the masters. The results in this volume are very impressive.

Anyone who experienced the Budapest String Quartet's many concerts at the Library of Congress from 1940 to 1962, when the group was in residence, can testify to its matchless authority. The quartet often was joined by some of the world's finest musicians, as witness this recording featuring the renowned harpist Marcel Grandjany. This CD, Volume 8 of Bridge's Great Performances from the Library of Congress, was culled from tapes made in 1941, 1942, 1943, 1948, and 1949. I can only imagine what antiquated recordings the Bridge engineers must have initially worked with, yet the tone here is remarkably clear. The sound is quite live but does not have the unnatural shading found in some restorations. And the Budapest's musicianship is of such high caliber that it should be appreciated by younger listeners.

I hope that Bridge Recordings will have the patience to continue this labor of love for many years. Like a musical time machine, technology and skill have brought the past into the present for us to enjoy anew.

Patrick Kavanaugh

danzón

Dances by Márquez, Álvarez, Nobre, Buxtehude, Revueltas, Caturla, Chávez, and Fernández
Simón Bolívar Symphony Orchestra of Venezuela, Keri-Lynn Wilson
DORIAN RECORDINGS
xCD-90254, DDD, 58:53
Sound: A, Performance: A

With its abundance of swaying, lyrical melodies and undulating rhythms, *Danzón* is one of the most enchanting, engaging new CDs around. The overall feeling is one of pulsating elegance. That a Canadian-born conductor, Keri-Lynn Wilson, can lead a South American orchestra in performances that seem so thoroughly idiomatic says a lot about our shrinking globe, the talent involved, and the universal appeal of good music. The sound is refined and pure, allowing every nuance to emerge clearly. *Rad Bennett*

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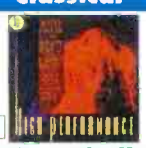

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Goldenthal: Othello (Suite from the Ballet)

San Francisco Ballet Orchestra, Emil de Cou
VARESE SARABANDE VSD-5942, 71:00
Sound: A+, Performance: A

Lar Lubovitch choreographed this recent coproduction of Elliot Goldenthal's *Othello* by the San Francisco Ballet and the American Ballet Theatre. The same conductor and forces from the ballet's premiere are presented here. The recording was made in San Francisco's Davies Symphony Hall because its acoustics are better than those of the city's Opera House (the San Francisco Ballet's usual performance hall).

Goldenthal is known for his film scores and a recent large-scale symphonic work, *Fire Water Paper* (Sony Classical SK 68368). In *Othello*, his first ballet, he uses unexpected sounds within the symphonic framework. The ballet opens, for example, with a lovely sarabande on glass harmonica; a synthesizer and alto sax also insinuate their way into some passages. Unusual chamber-like combinations of instruments are heard during the lengthy suite, with contrasts of diatonic melodies against more jagged harmonies that often represent Iago's dastardly schemes. Percussion is a vital part of the often harsh but accessible score. One of the high points is the increasingly wild tarantella that concludes the second act.

The sound is exemplary, offering especially good spatial placement of individual instruments with a matrix surround system. The orchestra draws heavily on the San Francisco Symphony Orchestra members, and the ballet obviously has benefited from more rehearsal time than most new music is given for premiere recordings. *John Sunier*

Lost Music of Early America: Music of the Moravians

Cyndia Sieden and Sharon Baker, sopranos; Boston Baroque (chorus and orchestra), Martin Pearlman
TELARC 80482, two CDs, DDD, 1:27:18
Sound: A, Performance: A

According to conductor Martin Pearlman's notes for this CD, there are more than 10,000 manuscript scores of Moravian music in the collections at Bethlehem, Pennsylvania, and Winston-Salem, North Carolina, the two largest Moravian settlements in America. Because it has been cataloged, Moravian music cannot be considered forgotten, but it is surely, and unjustly, neglected. Reminiscent of Bach, Mozart, and Haydn, this music—written for performance in Moravian churches—was fashioned for talented amateur performers and is most charming in its naive economy of style and direct delivery of devotional text. Most of the anthems were written for modest forces, which usually meant chorus, strings, and organ.

For this album, Pearlman and the Boston Baroque, an ensemble of chorus and orchestra, offer sincere, heartfelt, idiomatic performances that are recorded in a warm, yet not overly resonant, acoustic. Any church musician searching for a Sunday morning anthem might derive inspiration from this collection, while everyone should enjoy the generous sampling of attractive music. On a bonus CD, Pearlman discusses the pieces. *Rad Bennett*

SERGEI PROKOFIEV

The Stone Flower

Radio-Philharmonie Hannover des NDR, Michail Jurowski
CPO 999 385, three CDs, DDD, 2:31:05
Sound: A, Performance: A

Considering the great success of his earlier works *Romeo and Juliet* and *Cinderella*, it seems strange that Sergei Prokofiev's last ballet, *The Stone Flower*, remains largely ignored in the West. *The Stone Flower* is almost their equal musically, revealing a directness and simplicity engendered by Soviet officials who demanded more popular "folk" appeal from their composers. This CPO set is the first complete recording of the 1950 ballet's four acts.

The story is about Danilo the gem-cutter, who yearns for the stone flower, a symbol of perfection in his art. An evil official, Severyan, threatens Danilo and his love, Katerina. But the powerful Lady of the Copper Mountain, who alternately helps and hinders Danilo, eventually brings him together with Katerina for a happy ending. All of these principals have their own leitmotifs, and they are all tied together musically in a generally uncomplicated manner during the lengthy score. The orchestration is in a supercharged Rimsky-Korsakov style, impressing one with its brilliance yet still allowing Prokofiev's distinctive piquant/satirical style to show through. The recorded sound ably supports the wide dynamic range and varied music. *John Sunier*

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DVD REVIEWS

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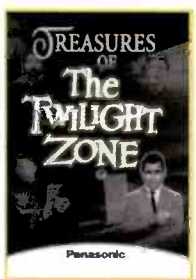
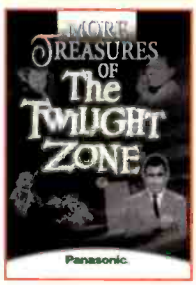
THE TWILIGHT ZONE

The Twilight Zone: Treasures, More Treasures, and Vols. 1-5 *1959-1964; no rating; one-sided (1.33:1 aspect ratio); black-and-white; Dolby Digital two-channel mono.* CBS/PANASONIC, seven discs, 80 to 110 minutes each, $24.98 each
Picture: A, Sound: A, Content: See text

Consider this: "You're travelling through another dimension, a dimension not only of sight and sound, but of mind; a journey into a wondrous land whose boundaries are that of imagination. That's the signpost up ahead—your next stop, *The Twilight Zone*." Is there a person alive who hasn't heard that familiar introduction? It's one of several that introduced *The Twilight Zone* during its five-season run on network television from 1959 to 1964. The show was far more than entertainment; it became, and remains, part of our cultural lexicon. (Just say you're drifting into *The Twilight Zone*, and chances are that everyone will know exactly what you mean.)





What made this, Rod Serling's brainchild, successful was that it put everyday people into situations that heightened both the fears and wonders of contemporary life. Before *The Twilight Zone*, Serling had been an Emmy Award-winning writer who wanted to zero in on contemporary and controversial social issues, but he was constantly censored by fearful advertisers and network executives. He could, however, slyly address these issues in futuristic or fantastic settings.

The entire series of 156 episodes has never been released in an optically read medium. There were several laserdisc boxed sets that are quite good, but they pale before the video quality of Panasonic's initial DVD volumes. The sharpness and contrast of many of these episodes are astonishing. The detailed opening pan shot of a tenement apartment full of memorabilia in "Nothing in the Dark" (from Vol. 1), for example, looks as good as the interior shots of Rick's always bustling nightclub in *Casablanca*—a testament to the original photography as well as to the power of DVD reproduction. "The Invaders" (also on Vol. 1) has such awesome contrast that the episode's patterns of light and shadows let you readily forgive its low-budget, puppet-like spacemen.

The audio quality is also quite strong. *The Twilight Zone* featured music by well-known and up-and-coming composers; much of it comes across well on these DVDs. Jerry Goldsmith's jazzy tracks for "The Four of Us Are Dying" (Vol. 4), for instance, have unexpected bass and driving punch, and Bernard Herrmann's contribution to "Walking Distance" (Vol. 3)—arguably one of this distinguished composer's very best scores for any medium—sounds quite good, too.

On other fronts the presentation is a shambles. Episodes appear willy-nilly, in no logical order; sometimes there are three per disc, sometimes four. Navigating the menus is clunky and time-consuming, making access to each show's notes especially difficult. Most of the special features are repeated from volume to volume, such as a Mike Wallace interview with Serling.

Since *The Twilight Zone* has doubtless paid for itself over and over in syndication, I question the high price tag on these DVDs. It may be a bit late to retreat and put the shows in a more logical order, but it's not too late to correct the menus, the organization of information, and the pricing of future installments. The programs themselves merit an unqualified A, always bordering on A+. However, my overall rating of this presentation is considerably lower, closer to a C+ but raised a notch to a B+ thanks to the stunning video. *Rad Bennett*

THE ROLLING STONES

The Rolling Stones: Bridges to Babylon Tour, '97-98 *1998; no rating; one-sided (1.33:1 aspect ratio);* Dolby Digital 5.1. WARNER HOME VIDEO 36440, 120 minutes, $19.98
Picture: A, Sound: A–, Content: B+

This latest Stones concert on video starts out a little stiff, but by the time Dave Matthews joins Mick Jagger for "Wild Horses," things start to mellow. Eventually the energy level catches up with all the pyrotechnics and flashing lights of the elaborate set. The sound is better than usual for a live 5.1 pickup, with sufficient bass and nice crowd wraparound, though there's a curious lack of presence at times, as if too much caution was exercised with the five-channel mix. The DVD layout is Spartan, containing no subtitles, bios, extra languages, or anything else except chapter stops. But because the price of this two-hour concert is about the same as your average one-hour CD, no one is likely to complain. *R.B.*

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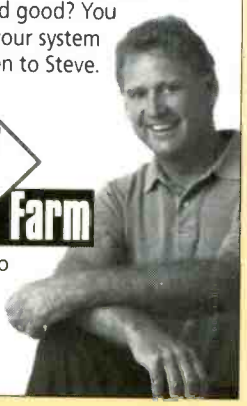

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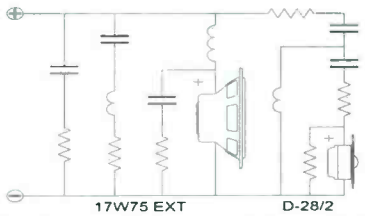

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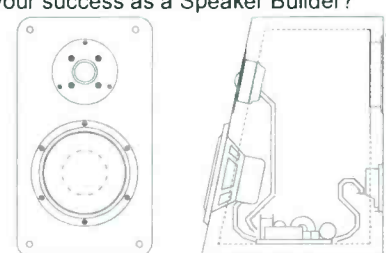

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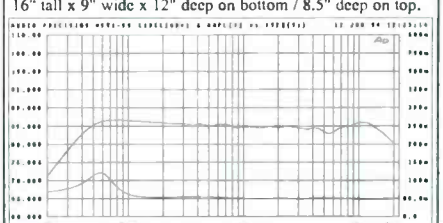

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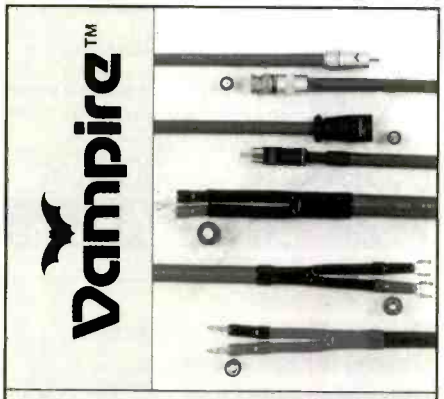

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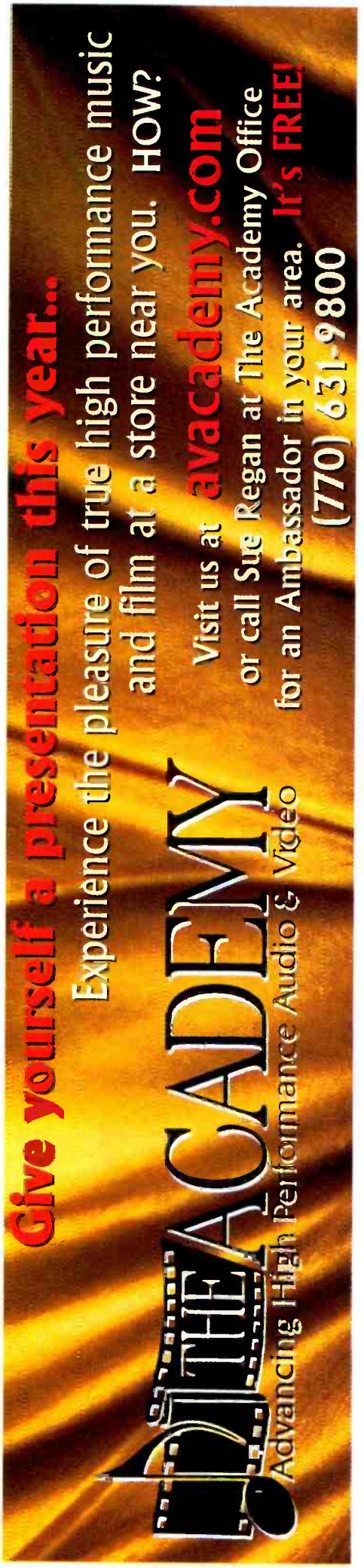

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PlayBack

Jolida JD 301A Integrated Amplifier

Jolida is a scrappy company with a near-evangelical passion: making tube gear for the masses. A couple of years ago it brought out the JD 102B, a tube integrated amp, for a ridiculously low $550; now it has broken the price barrier again with the JD 301A, an integrated amp with a 12AX7 input stage and MOS-FET output, priced at $350. This stereo hybrid amp is rated at 30 watts/channel.

With its brushed, black-anodized front panel, the JD 301A is a handsome little jewel. Controls are minimal: on/off toggle switch, four-position input selector, balance, and volume. If you need more than that, such as a headphone jack or a tape loop, Jolida's not your kind of beer-budget high-end audio company.

GRADE: A

Every JD 301A is fully inspected and burned in for 24 hours before it leaves the factory. Jolida encourages owners to pop the cover and sample other brands of 12AX7s—a season-to-taste deal. The company predicts a 10,000-hour life for the tubes but warrants them for six months; the warranty on everything else is one year for parts and labor.

I found the sound, from its slighty ripe bottom end to its transparent middle and sweet top, to be unfailingly musical. This compact little amp (11 x 6¼ x 2⅞ inches) would be perfect for an office, kitchen, or dorm room. The JD 301A is a charmer! (Jolida: 10820 Guilford Rd., Annapolis Junction, Md. 20701; 301/953-2014.)

Steve Guttenberg

Eminent Technology LFT-11 Computer Sub/Sat System

When a high-end audio company makes computer speakers, the results are not only better but different. The LFT-11, a sub/sat system from Eminent Technology, has oak cabinets and trim instead of molded plastic. The satellites' drivers are push-pull planar magnetics, not cones. And because the bass unit isn't self-powered, you can use the amp of your choice (10 to 50 watts/channel, tube amp territory). The unusually complete owner's manual includes response and impedance graphs and instructions for crossover modifications. The system's price is high-end, too: $499 without an amp, $599 with one, plus shipping. (If your PC's sound card has surround, you can upgrade the LFT-11 to four channels for an additional $250 or $350 for the version with an amp.)

GRADE: A+

The LFT-11's sound was exceptionally clean, focused, and musical. Although the sweet spot was small, I could tilt the drivers to get the imaging and the treble just the way I wanted them. Sonically, the LFT-11s edged out the Monsoon Multimedia MM-1000s ("PlayBack," November 1998), which are based on Eminent Technology's design. The satellites' width, 7 inches, may cause problems on some crowded desktops; however, their depth, only 3½ inches, may solve problems on others. (Eminent Technology: 225 East Palmer Ave., Tallahassee, Fla. 32301; 850/575-5655; www.eminent-tech.com.)

Ivan Berger

Sharp MD-R3 MD Recorder/CD Changer

It's hard to find prerecorded MiniDiscs in this country; mostly you have to record your own. Sharp's MD-R3 ($499) gives you plenty of options for doing that: It's got a three-CD changer and lots of inputs for dubbing music from other sources, a stereo microphone input (when did you last see a cassette deck with a mike jack?), and controls that take full advantage of the MD format's inherent editing capabilities.

The MD-R3 has analog and optical digital inputs and outputs as well as a coaxial digital input. A sampling-rate converter enables you to record from digital sources that don't use the 44.1-kHz rate of CD and MD. And a jog/shuttle wheel makes it easier to perform such MiniDisc editing functions as dividing, moving, and combining tracks and entering disc and track titles. For easier recording from CDs, you can program the MD-R3 to play specific tracks from any or all of the discs in its changer. A remote control is included.

After using the Sharp MD-R3 for several weeks, I was impressed. I easily compiled my own "hot hits" MDs from three different CDs. Acoustic guitar recordings I made with a Sennheiser dynamic mike had none of the tape hiss I'd get from cassette. My only complaint is that the CD trays are made of much thinner plastic than you find in good single-drawer players. Still, Sharp has packed a lot of value and performance into this MD/CD deck. (Sharp Electronics: Sharp Plaza, Mahwah, N.J. 07430; 800/237-4277; www.sharp.usa.com.)

GRADE: B+

John Gatski

"Do you really need new speakers?"

Matt Polk, Speaker Specialist

"Maybe you don't need new speakers. Maybe you do. Here are some tips on how to know whether or not it's time for a change.

Do they work right?

The first thing to check is the woofer surround – the rolled edge of the driver. If it's made of compressed foam and more than 5 years old, it may be shot. Are there any holes or tears? Gently touch the surround, if it feels brittle, stiff and ready to crumble, you need new woofers. If the surrounds are rubber they're probably perfect.

The next thing to check is whether all the drivers are making sound. Play the speakers with the grilles off. Lightly touch all the drivers to feel if they're moving. Cup your hand over the tweeter, remove it. Does the sound change? If not, the tweeter is dead. Play a solo piano recording at a moderate loud level. If you hear scratchy sound or a buzz, the midrange or tweeter may be damaged.

If you have any doubts, bring the speakers in to a local audio store and ask them to check them out. Most dealers will be happy to help.

Are you happy with the sound?

Do they sound great with all the kinds of music you're listening to today? Some speaker companies voice their speakers to sound good with certain types of music (a bad policy in our opinion). If your musical tastes have changed since you bought your current speakers, it might be time for something better. But if you're really happy with the sound – stick with what you've got.

Do they look good? Do you care?

Do your current speakers look appropriate and fit comfortably in your room? Has your significant other banished them to behind the couch? Don't laugh, I know a household where that happened. Today's speakers are generally smaller and better looking, with better performance than speakers of ten years ago.

What will you do with the money you save?

If looks and size are not an issue, if everything's working OK and you like the sound, save your dough. Buy some new CDs or a DVD player or some flowers for your partner.

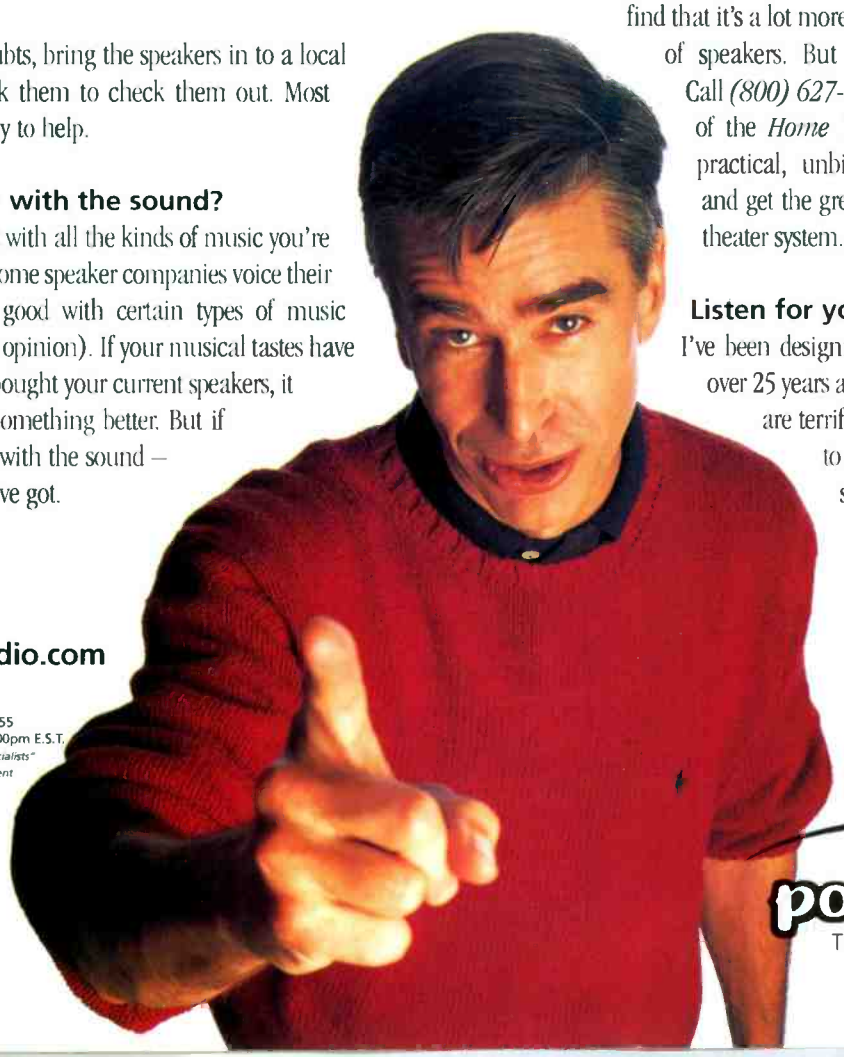
NEW! Polk bookshelf speaker models are now at Polk Audio retailers

Free stuff!

If you're shopping for a home theater system, you're going to find that it's a lot more complicated than buying a pair of speakers. But the rewards are greater, too. Call *(800) 627-7655 ext. 101* for your free copy of the *Home Theater Handbook*. It's full of practical, unbiased advice on how to select and get the greatest performance from a home theater system.

Listen for yourself.

I've been designing award-winning speakers for over 25 years and naturally I think my speakers are terrific. Don't take my word for it. Go to a store and listen to Polk Audio speakers and decide for yourself.



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