

AUDIO

THE EQUIPMENT AUTHORITY

Articles by:

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KEN KANTOR,
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DAVID LANDER,
FLOYD TOOLE, *and*
COREY GREENBERG

MAY 1997



ANNIVERSARY

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You Need More Than Just Cable.

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

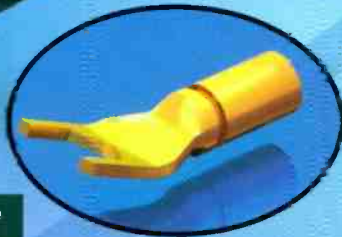
That's why MIT's founder literally invented high-performance interconnects and speaker cables, creating a new category of components called Interfaces. MIT's fundamental patents in high-performance cable design mean that only MIT can bring you Interfaces scientifically designed to eliminate the non-linearities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

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

Patented MIT Terminator Network

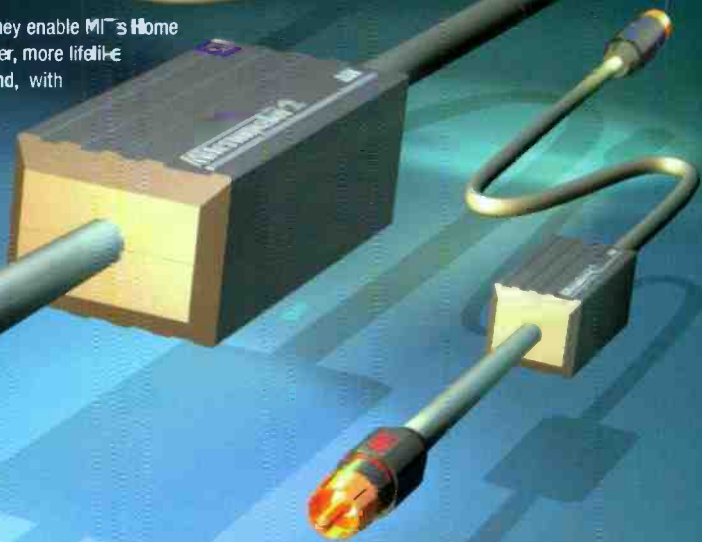
MIT's patented Terminator Networks are the heart of MIT's performance superiority. They enable MIT's Home Theater Terminator System interconnects and speaker cables to deliver sharper, clearer, more lifelike pictures and to provide better bass, clearer midrange and smoother treble sound, with enhanced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

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



iconn™ interchangeable connector system

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



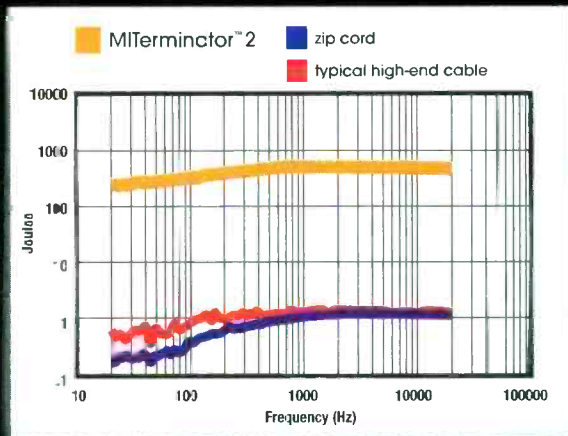
New RCA connector

MIT's Home Theater Terminator System interconnects feature new high-performance RCA-type connectors. These machine-made gold-plated connectors feature bifurcated center-contact pins and multi-contact shield connections for unimpeachable signal integrity. They properly match the cable for highly efficient energy transfer and outstanding picture and sound quality.

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Why MIT Home Theater Terminator System Interfaces perform better



Superior Final Energy Component

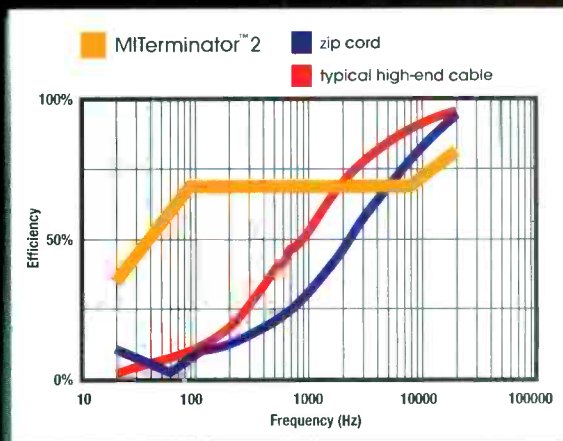
Cables transmit most of the audio signal energy passing through them directly to the next component or to the speakers. They also briefly store and then release small amounts of energy that have huge effects on sound quality. MIT calls this stored and released energy the Final Energy Component. As shown in this representative plot of speaker cables (which are normalized to .1 Joule for clarity) the Final Energy Component in ordinary 12-gauge "zip cord" and a typical high-end cable is non-linear — It changes value with signal frequency. This nonlinearity inevitably causes distortion and the loss of both tonality and image integrity.

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

Superior Efficiency

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

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



Superior Imaging

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

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

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

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



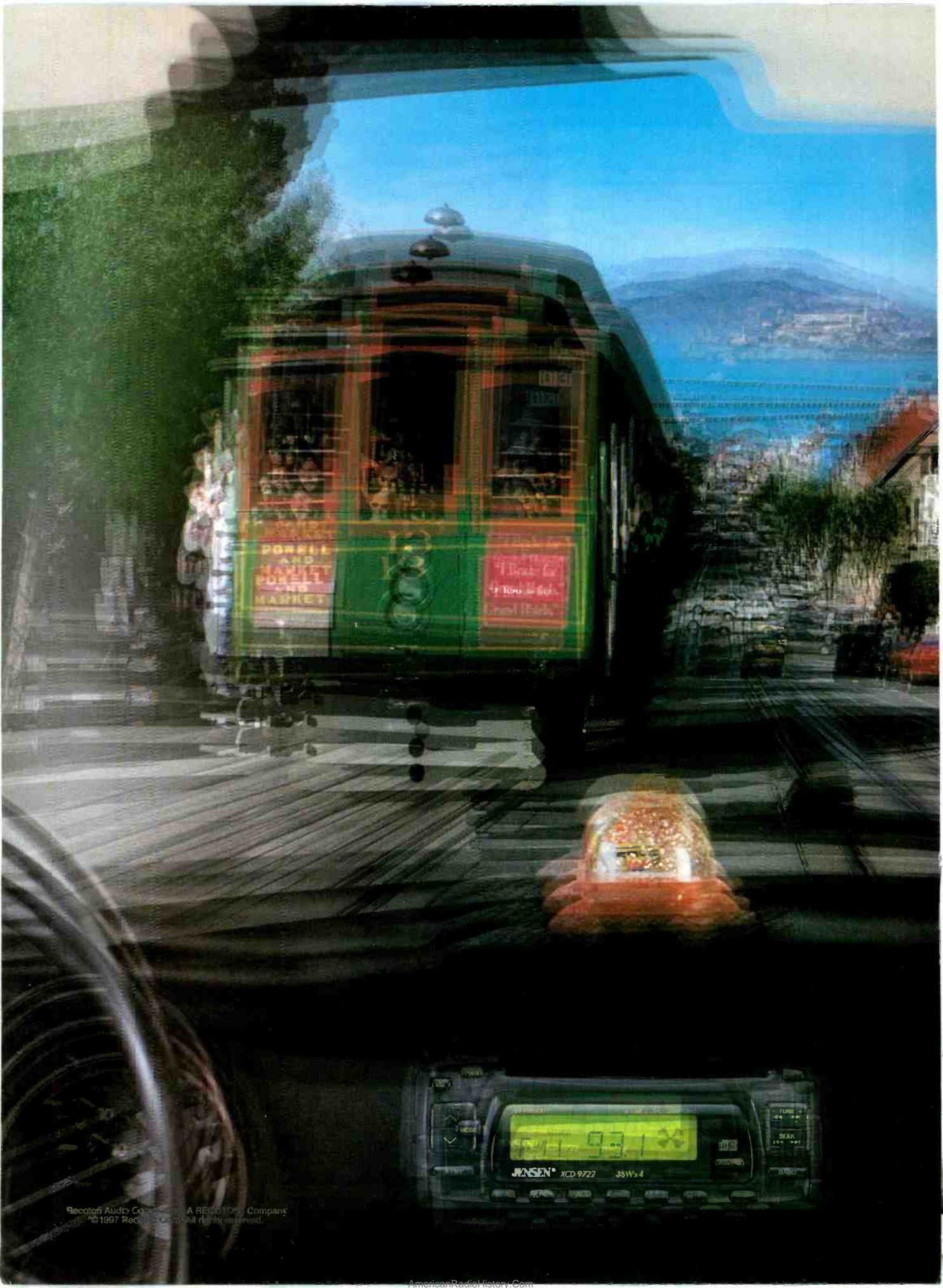
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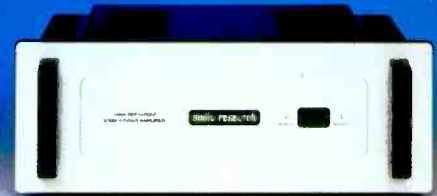


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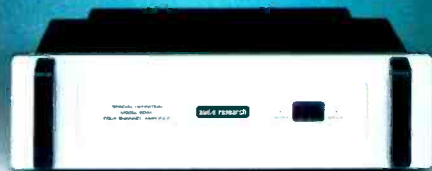


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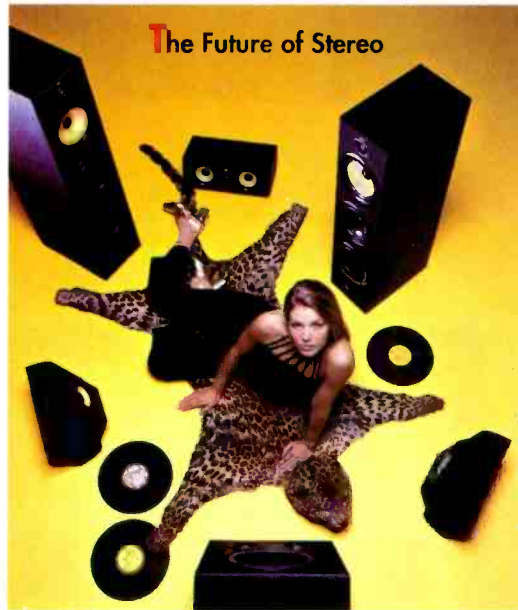
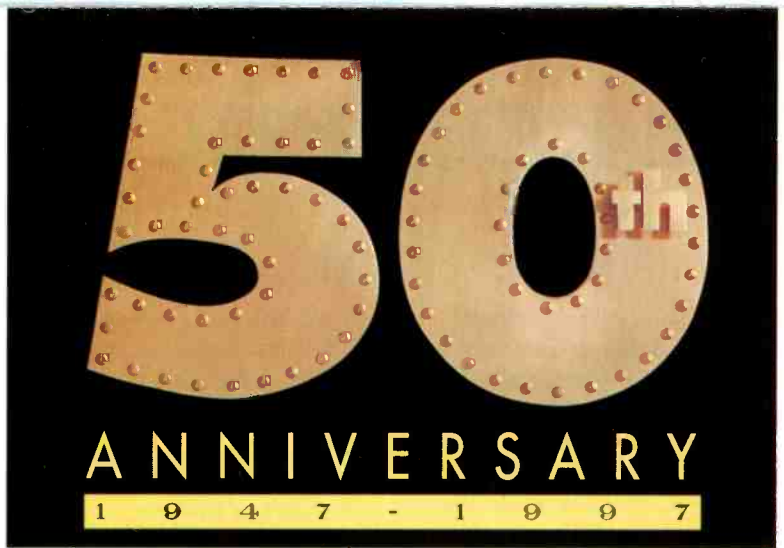
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Newsstands are so jammed with magazines, and so many new ones spring up every year, it's easy to lose sight of how few survive as long as *Audio* has. Fifty years is quite a run, and if you add the magazine's preceding history under the *Radio* banner, there's another couple of decades on the calendar.

The men who started *Audio* clearly had great prescience, as its history very neatly overlies the history of high fidelity itself, which starts not much earlier. The Audio Engineering Society was founded just as *Audio* (then *Audio Engineering*) was getting its legs under it, and the two were initially very entwined with one another. That was logical, since in the beginning *Audio* was written primarily by and for professional engineers working in the fields of recording, broadcasting, studio design, film sound, public address, and, incidentally, high-quality sound reproduction for the home. The first issues featured articles on subjects such as distortion measurement, alignment of magnetic recording heads, control-room design, optical film soundtrack pickups, and loudspeaker design. Many of the advertisements were for things like high-power radio transmitter tubes or studio microphones.

Given the current popularity of home theater, it's fascinating to see the attention devoted to television sound in the magazine's first decade. The January and February 1949 issues, for example, feature a construction project for a "two-way speaker system housed in an attractive modern corner cabinet, with a 12-inch television tube in the optimum position with respect to the loudspeaker for realistic sound." For a time, *Audio* even

incorporated a monthly section devoted to television engineering.

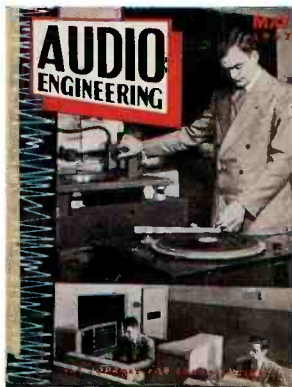
But perhaps the most important single thing the magazine did at the outset was to crusade for the idea of high-fidelity sound. As David Lander notes this month in "Glorious Beginnings," the early audiophile movement had to overcome the notion, promoted by some established companies in broadcasting and sound reproduction, that people actually preferred the restricted bandwidth already available to them.

It would not be the last time. Many of the important later advances in audio technology have had to push through similar resistance.

It is a great honor for me to be *Audio's* editor at the time of its Golden Anniversary, and our staff has worked long and hard to assemble this special commemorative issue. In addition to our usual features, you'll find

a section of articles devoted to important people, events, and signposts in the history of high-fidelity sound. You will also find in that section a series of special advertisements, tying the history of the companies represented to the coverage of their most significant products in *Audio* magazine. It's been a great ride. Enjoy it all.

Next month, we return to chronicling audio's current events, which we hope some future team of editors can look back over with similar pride 50 years hence. The material is surely there if we have the skill to work it, for these are still exciting times in audio.



AUDIO

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To produce this remarkable amplifier, Adcom started with an enormous toroidal power transformer. Totally separate secondary windings and independent ground connections assure each channel is completely isolated from crosstalk and AC line interference. Lots of clean power for lots of clear and powerful sound. Even the neighbors will enjoy it.

In addition to the GFA-5802's main toroidal transformer, a separate front end transformer is also used. This additional device isolates the front end input stages from the main output section so any peak demands from the output stages will not decrease the operating voltages for the input sections. This design also contributes to improved separation at the inputs for precise soundstaging and imaging.

Adcom's new GFA-5802 power amplifier also has exceptionally large capacitors to store large amounts of DC current for supply to the speakers. This large storage capacity means that the amp won't be starved for power when you're driving low impedance and/or inefficient speaker systems. Now your speakers and your music can sound the way you expect them to. All the time.

The well organized and simple design of the GFA-5802's glass epoxy circuit boards assures outstanding and reliable operation. Class 'A' circuitry in the front end, the Adcom GFA-5802 delivers the pure sound that other amplifiers can only talk about. All devices are precision matched for maximum performance, negligible distortion, and higher output currents.

We use only International Rectifier Hexfets transistors in the signal path of the Adcom GFA-5802. These Hexfet circuits are reference grade, hybrid MOSFET transistors which reproduce all the punch and muscle of bipolar devices but with the musical sound of tube amps. And since the GFA-5802 has only three gain stages it out performs comparable amps which usually have five stages or more. The shorter the path of power resistance, the better the sound.

The GFA-5802 comes with versatile binding posts for easy speaker hook-ups. Accepting either standard stripped or 'tinned' wires, single or dual banana plugs or spade lug connectors, the GFA-5802 is a great match for any system. And since it can drive virtually any speaker system regardless of its impedance, even the most demanding speakers will sing beautiful music. Additionally, the GFA-5802 also comes equipped with two sets of binding posts for each channel. These extra binding posts allow the GFA-5802 to accommodate speaker systems that have 'bi-wire' capability.

Adcom makes sure that the sound created by your other components can be flawlessly transferred to the GFA-5802's balanced power and optimum circuit technology. The GFA-5802 is equipped with two types of input connectors for complete compatibility, high quality gold-plated RCA jacks and XLR jacks. The GFA-5802's professional grade three pin XLR jacks provide both positive, negative and shield properties. The result is a balanced line connection between the GFA-5802 and your other components. This connection is essentially immune to electromagnetic and radio frequency interference and provides a significant reduction in 'common mode noise'.

Dependable technology and efficient use of the highest quality parts make the GFA-5802 one of the most sought after audiophile products in recent years. And because it's an Adcom component it will benefit from a high resale value and an outstanding dealer service network. After you hear the GFA-5802 you'll agree that it's an incredible value in high end audio.

The most important detail to look for before you buy your next amplifier is the Adcom name. Adcom audio and audio/video components are designed to be second to none. It's this driving passion for accurate, musical sound and performance that has made Adcom components sought after by the discriminating audiophile. Through a combination of technology and innovative engineering techniques, the Adcom GFA-5802 is quite possibly the best amplifier you may ever hear. From its toroidal transformer and giant capacitors to its reference grade Hexfet circuitry, the Adcom GFA-5802 is built to be the best amplifier money can buy.

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High Wire Act

Dear Editor:

I am writing in response to the "Interminably Bad Ads" letter in the December 1996 issue. For many years I relied on No. 16 speaker wire and generic connectors, thinking, as Mr. Colin indicated in his letter, that it made no difference. And it didn't—until I bought a new Home THX receiver with a subwoofer amp and added five Optimus Pro 5 speakers and an unpowered subwoofer. The speaker wire was brittle and dirty, so I decided to replace it. A nearby audio dealer had a special on Monster XP Basic cable. I bought a 50-foot roll, forgetting that I had five speakers. I wired the front three with the Monster cable and used new No. 16 for the surrounds (35 feet each) and on the sub. My system, which was pink-noise-balanced on the old No. 16 wire, was out of balance, needing a 3-dB increase in the surrounds and a slight increase on the sub (according to the system meter and listening tests).

I now have XP Basic cable all around and medium-priced gold interconnects for my entire A/V system. There was a very noticeable increase in audio and video quality after the changes. I am sold on the idea of high-quality interconnects and speaker wire, but I'm not sure that I will ever be able to bring myself to pay for top-of-the-line.

Gene Burke
Manchester, Ga.

Trumpeting the Horn

Dear Editor:

Matthew Holup's letter on horn loudspeakers (February) evoked strong recollections of similar experiences. In the 1960s, I was an electrical engineering student and the sound engineer for the campus theater. The theater's sound system consisted of a custom-designed 10-channel mixer (four-stage cascode tube preamp each, with DC heater supplies and vacuum tube series B+ regulators), tube line amps, and a one-of-a-kind power amp using a

pair of 6146 transmitter tubes in a "near Class-A" push-pull topology ("near Class A" meant we increased the plate current of an ultralinear design until the plates glowed red). The system had distortion levels below the residuals of the instruments then available but was limited to less than 100 watts of output—underpowered by today's kilowatt theater sound standards. Sound pressure level, however, was not a problem because we had a secret weapon: an Altec Voice of the Theatre. It was a *monster*, with a horn-loaded, bass-reflex 15-inch low-frequency driver and a cast-plaster multicellular horn tweeter. This thing was solid, big, and heavy; even the crossover was as big as a 6-inch bookshelf system. And, as Mr. Holup points out, these systems are ever so efficient.

So what happens when you extend a good idea to the ridiculous? One evening with nothing going on in the theater and a fresh supply of ¾-inch plywood for the next set sitting on the stage, we decided to extend the Altec's horn from center stage out to the proscenium arch—about 35 feet. We didn't do any fancy calculations and there were no PCs then (the only computer on campus had its own building), but we built something that looked about right. And the sound? Using a recording that complemented our theater's acoustics, *Overtures in Spades*, with the New Symphony Orchestra of London (RCA LM-2134), we were able to achieve such realism that numerous people walking down the hall of the building stopped and remarked that they didn't know a concert was scheduled for that night. The looks of astonishment on those people's faces was worth all the effort. For many of them, this was their first exposure to true high fidelity reproduced at lifelike levels and scale (and the lively acoustics of an empty 800-seat auditorium didn't hurt either).

My experience with more diminutive horns intended for smaller spaces is that they usually are cut down to the minimum size, where the speaker just barely stops yelling *horn* at you. I understand the limitations that

domestic life imposes in order to maintain wedded bliss (that's why I have a satellite speaker system now), but nothing yet has matched the sheer bigness of the sound from a generously designed horn.

Richard Lee
Centerville, Ohio

No Snap, Crackle, or Pop

Dear Editor:

Alan Lofft's article "Buried Treasure" (March) rather abbreviates the history of CBS Records' remastering of 78s, giving the impression that the company had eliminated ticks and pops entirely by manual tape editing prior to its adoption of digital processing.

CBS Records acquired a Packburn Transient Noise Suppressor in 1976, after John Hammond and Eric Porterfield (the chief engineer) had heard a demonstration of our first model at the Syracuse University Audio Archives.

In the January 1985 *Audio* Interview, John Hammond talked about our unit: "I persuaded CBS to buy one of these machines when we were doing the Bessie Smith reissues many years ago. . . and it's a marvelous machine. Almost all the Time-Life reissues were made with the Packburn." In a brochure promoting the Time-Life Giants of Jazz series, there is a photo of the remastering facility in which the 1976 Transient Noise Suppressor is clearly identifiable.

In 1980 CBS Records bought a Model 303 unit, which had a hiss-reduction processor in addition to the two transient noise-suppression processors of the earlier model. At that time CBS Records was still the only major record manufacturer to be using our device.

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Richard C. Burns and Thomas N. Packard
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DVD
VIDEO

CIRCLE NO. 23 ON READER SERVICE CARD

WHAT'S NEW

MTX POWERED SUBWOOFERS



The PS10, PS12, and PS15 all use magnetically shielded downward-firing woofers in compact enclosures that facilitate

easy placement anywhere in a room, even next to a TV. The PS10 and PS12 have 100-watt amplifiers inside their bass-reflex enclosures; the PS15 is an acoustic-suspension design with a 200-watt built-in amp. All have a remote control, auto turn-on, an LED clipping indicator, a phase-reversal switch, a variable crossover, electronic equalization,

and line- and high-level inputs. Prices: PS10, \$399.95; PS12, \$449.95; PS15, \$599.95. For literature, circle No. 100

The *reQuest*, an improved version of the original *Quest* electrostatic, has a new crossover and long-excursion 12-inch woofer that Martin-Logan says reduces distortion and yields bass with more impact and detail. The *reQuest* is slimmer (it's 71 inches tall) and occupies only 1½ square

martin-logan speaker

feet of floor space. The thin-film electrostatic diaphragm is gently curved, which is said to help the *reQuest* achieve a 30° angle of dispersion. Price: \$4,495 per pair.

For literature, circle No. 102



Paradigm Powered SPEAKER

The biamped Active/20 has an integral electronic crossover and dual power amps that supply 110 watts continuous power to a 6½-inch woofer and 50 watts to a 1-inch dome tweeter. Paradigm says this approach gives very precise control of frequency response, phase response, and distortion. A heat sink, an input level control, RCA and balanced XLR connectors, and high- and low-frequency contour controls are on the rear panel. Response is specified at 48 Hz to 20 kHz, ±1 dB, from 0° to 30° off axis, with bass extension to 35 Hz, -3 dB. Price: \$1,500 per pair in cherry gloss or black ash vinyl. For literature, circle No. 103



KEF SPEAKERS

The RDM one and RDM two compact monitors both use KEF's Uni-Q driver design, wherein the tweeter is located at the apex of the woofer diaphragm. KEF says this acoustical "point-source" configuration produces a more natural tonal balance over a broad range of listening positions, front to sides. The RDM one uses a

6½-inch woofer and 1-inch dome tweeter in an 8-liter enclosure; the larger RDM two has the same drivers in a 12-liter front-ported box. Both speakers are said to be ideal for near-field monitoring or home theater use. Prices: RDM one, \$900 per pair; RDM two, \$1,200 per pair. For literature, circle No. 101

TOTAL ECLIPSE.

Eclipse. At Sonic Frontiers, we continue to outshine our competition with our latest generation of innovative new products - leading the way is our new *LINE 3* preamplifier.

In 1993 we introduced the SFL-2 linestage, a product which redefined the standard for a true reference quality tube preamplifier. However, with the introduction of the *LINE 3* not only have we eclipsed our competition's latest offerings, we've advanced the design significantly over our own Class A rated SFL-2.

The *LINE 3* represents the pinnacle of performance in our *LINE Series* of preamplifiers, giving audiophiles a product with both fidelity and flexibility for their changing home entertainment needs - whether it be a reference 2-channel system, a multi-user home theater installation or the intimate environment of their favorite headphones - using the HeadRoom™ circuit.

The *LINE 3* shares the advanced features of its siblings, the *LINE 1*, and *LINE 2* but additionally offers these following design attributes:

- 2 chassis design (both full size) - 60 lbs net weight
- fully dual mono design, featuring 3 toroidal power transformers and 26 regulated power supply stages (8 of which are high voltage, precision tracking shunt types)
- innovative new 12 tube linestage circuit with active error correction to ensure wide bandwidth, balanced performance and extremely low 75 ohm/150 ohm (SE/BAL) output impedance
- Unique PCB decoupling system
- Highest quality parts, featuring Multi-Cap, Solen & Wima capacitors plus Vishay, Caddock and Mills resistors.

The appearance of such a product is a rare event which comes around but a few times in an audiophile's life. To experience the awe inspiring *LINE 3* for yourself at your local dealer or to receive a complete set of literature, Call, Write, Fax or E-Mail us today.



SONIC FRONTIERS
INCORPORATED

BREAKING THE SOUND BARRIER

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CIRCLE NO. 21 ON READER SERVICE CARD

WHAT'S NEW

✕ Yamaha A/V Receiver ✕



Yamaha's RX-V2092 has Dolby Digital and Pro Logic decoding as well as 13 other DSP music and movie surround modes, many of which exploit the RX-V2092's full seven-channel operation. The five main Dolby Digital channels each receive 100 watts from the built-in amps; the two front effects channels get 25 watts each. Other

features include four analog audio and five video inputs (the latter with both composite- and S-video connectors), three digital inputs (two coaxial and one optical), dual subwoofer outputs, two-zone operation, and separate, dedicated Yamaha ICs for Dolby Digital and Dolby Pro Logic. Price: \$1,599. For literature, circle No. 104

SPECTRAL AUDIO CD TRANSPORT

The SDR-3000, meant to be used in concert with the SDR-2000 D/A converter (which decodes HDCD), has an internal transport mechanism made entirely of metal and mounted on a compliant suspension to eliminate servo action caused by external vibration. A massive,

machined turntable is used for rotational stability, and a brass clamping mechanism holds the CD firmly to the turntable. These design elements, says Spectral, eliminate timing noise (jitter) from the data. Further, a master oscillator relocks the digital audio signal as it leaves the transport, to enhance timing accuracy of the output signal.

Price: \$7,495.

For literature, circle No. 105



Thorens TURNTABLE

The TD 180's belt-drive system can accommodate any record that comes its way: 33 $\frac{1}{3}$ - and 45-rpm discs, and those old shellac 78s. You change speed by using a lever; no belt or spindle need be switched. Rumble is specified at -66 dB or better and flutter at less than 0.05%. The TD-180's tonearm is fitted with



a Stanton 500 MKIII cartridge; a stylus for 78-rpm records is optional. The turntable also has automatic tonearm return and shutoff. Price: \$473.

For literature, circle No. 106

PROTON A/V PREAMP



The AS-2600 provides both Dolby Digital and Dolby Pro Logic decoding. All remote-control functions, including surround- and center-channel delay times, can be monitored on screen. Individual levels for six channels, plus the master level, may be adjusted in 1-dB

increments. The Proton has five analog A/V inputs and four digital audio connections (one RF for laserdisc AC-3, one optical, and two coaxial). Frequency response through all inputs, analog and digital, is specified at 20 Hz to 20 kHz, +0, -3 dB, with S/N at 90 dB. Price: \$1,000.

For literature, circle No. 107

CINEPRO SIX-CHANNEL AMP

Cinepro says its 3k6 is the most powerful six-channel amp in the world. It is rated at 350 watts per channel into 8 ohms (20 Hz to 20 kHz, 0.15% distortion) and

500 watts per channel into 4 ohms, with peak-power capabilities said to exceed 1,000 watts per channel. Any two channels may be bridged to produce 1,000 watts into 8 ohms, and the amp can be configured for three- to six-channel operation. The 3k6 has balanced XLR and unbalanced RCA connectors and switches for soft clipping and ground lift. Price: \$2,995 from custom installers or factory direct.

For literature, circle No. 108



"The M&K S-150 THX surround-speaker system sets the performance standard for the \$5,000 region"

Wes Phillips, *Stereophile Guide to Home Theater, Spring 1997*



And *AV Shopper* said, "This M&K lineup will give many more expensive THX systems a serious run for their money...[it is] the best low-priced THX certified speaker array I've heard yet."

Since 1974, M&K has been at the leading edge of high-performance audio. Numerous technology leaders in the audio and video fields use M&K speakers for developmental work and for critical industry demonstrations.

The new 150 THX system, designed for the playback of Dolby Digital AC-3 and DTS sources, has become a new professional standard, and is currently used in dozens of recording studios,

Hollywood postproduction facilities, and DVD authoring suites.

For under \$4,500, you can now own this Home THX system, including the reference-quality S-150THX front and center speakers; the award-winning "Tripole" surround—with its exclusive combination of enveloping sound and imaging; and the articulate room-shaking deep bass of the extraordinary MX-150THX powered subwoofer.



MX-150THX powered subwoofer
"an excellent subwoofer"
Audio magazine



Tripole SS-150THX
1996 *Audio Video Interiors*
Excellence in Design award

M&K MILLER & KREISEL
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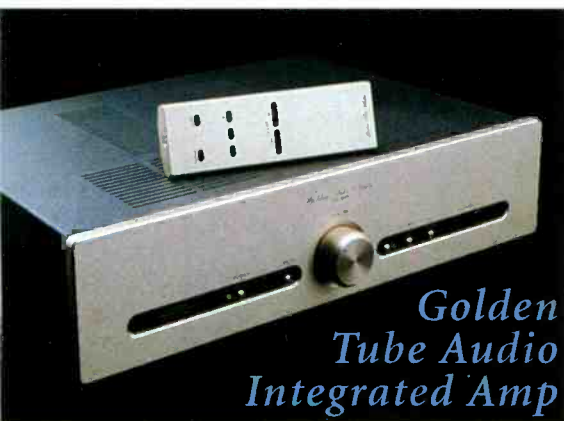
WHAT'S NEW



B&K COMPONENTS A/V TUNER/PREAMP

The AVP1030 has a built-in 40-preset AM/FM tuner, a Dolby Digital (AC-3) and Dolby Pro Logic surround decoder, and switching for audio/video sources. Menu-driven, it uses a 24-bit Motorola 56009 processor for DSP music and surround modes, and favorite

settings can be preserved for later recall at the touch of a button on the 1030's remote control. There's a direct bypass mode for critical listening and a complete set of audio and video input and output jacks. Price: \$1,998. For literature, circle No. 109



Golden Tube Audio Integrated Amp

Aficionados of tube sound on a budget should be pleased with the SI-50. It's a 50-watt-per-channel, push-pull Class-AB stereo integrated amplifier that's affordably priced and

location (thus preventing further damage to the amp), and three inputs that can be independently set to passive or active line-stage mode. Price: \$980. For literature, circle No. 110

remote-controlled. Design features include a fuzzy-logic microprocessor that monitors and adjusts bias voltage automatically, a tube-failure mode that turns off the amp and flashes an LED to pinpoint the bad tube's



SUTHERLAND PREAMP

The C-2000 has Class-A biasing through its main audio signal path and accepts line-level signals. It measures 9½ x 3¾ x 17 inches and is constructed of machined, brushed, and anodized aluminum. Multilayered barriers isolate the power supply and AC power source and are said to preserve

signal purity. THD + N is rated at less than 0.01% at 1 kHz, A-weighted, with frequency response specified at 20 Hz to 200 kHz, ±0.1 dB. A machined-aluminum remote control is included. Price: \$8,000. For literature, circle No. 111



HARMAN KARDON FIVE-CHANNEL AMP

Intended for home theater use, the PA5800 five-channel high-current power amplifier is rated at 80 watts per channel continuous output (at 0.03% THD, 20 Hz to 20 kHz, with all five channels driven). However, Harman Kardon says the

combination of dual pairs of discrete output devices for each channel and a massive power supply lets the PA5800 deliver in excess of 80 amperes, enough to handle the most difficult speaker loads. Price: \$899. For literature, circle No. 112



The TL2.5 tube preamplifier has six line-level inputs (a retrofittable internal phono stage is optional), two outputs, a tape loop, and a surround-processor loop. The supplied remote has volume and muting controls.

VTL says the TL2.5's high-current, low-output-impedance follower circuits enable you to use interconnect cables as long as 35 feet with no adverse effects. Price: \$1,250; phono stage, \$550. For literature, circle No. 113

composite video signal from one VCR or laserdisc player to as many as six TVs or VCRs. Also, Xantech (800/843-5465) has two audio/video distribution amplifiers, the AV-426 and the AV-61. The best source for information about these products is an experienced custom installer. If you cannot find one, call the Custom Electronic Design and Installation Association (CEDIA, 317/599-5850) for the names of qualified installers in your area.—Daniel Green, Portland, Ore.

Subwoofer Principles

Q Is the operation of a subwoofer based on air pressure or vibration? Is a bigger driver better than a smaller one? Is the structure of the cabinet important for quality sound? Is it true that placing fiberglass or foam in the cabinet will improve the subwoofer's sound quality?—Azlee Shah Basrudin, Milwaukee, Wisc.

A A subwoofer uses both vibration and air pressure to reproduce low-frequency sounds. The cone of the sub's driver vibrates back and forth quickly to produce higher frequencies (e.g., 100 times per second for a 100-Hz sound) and relatively slowly for low frequencies (e.g., 20 times per second for a 20-Hz tone). The alternate compression and rarefaction (expansion) of the air surrounding the speaker cone generates changes in air pressure that cause our eardrums to vibrate at the same rate as the woofer's cone. This information is sent to the brain, which interprets the signals from the eardrum as "sound." (More specifically, in the case of *Jurassic Park*, you'd hear the thumps of the dinosaur's feet as it lumbers towards the terrified passengers inside the Jeep.)

The larger the area of the subwoofer's cone, the more air that it can move for a given excursion. This means that a small-cone woofer must move farther forward and backward in order to displace as much air as a larger cone and thus produce the same output. There is a practical limit to how much excursion can be achieved without excessive distortion, however. But this can be overcome with multiple drivers; in fact, some designers have obtained excellent subwoofer performance by using two long-excursion small-cone woofers in a single enclosure.

Ideally, a subwoofer cabinet, like any speaker enclosure, should not vibrate at all;

only the woofer's cone should move. If the cabinet vibrates, it will tend to radiate sound the same way the cone does. It won't radiate a lot, but it may be enough to alter, or color, the tonal character of the subwoofer's sound, making it inaccurate. That's why high-quality speakers and subwoofers often have internal braces to minimize vibration of the cabinet walls.

Various linings or fillings—made of foam, fiberglass, or other absorptive materials—are often used in speaker cabinets to kill reflections within the cabinet that might reemerge through the cone and color the sound. Such fillings can also affect driver loading, however, so it is not a good idea to add such fillings to a speaker after the fact.

Adjusting Tape-Head Azimuth

Q I decided to readjust my tape deck's head azimuth. The record and play heads of this deck are on a single plate, so I have to tweak only one screw. I used a five-year-old tape, *The Simpsons Sing the Blues*, because I had no other that I knew to be in correct azimuth. I set the azimuth so the tape sounded right and then compared it to another copy. The newer copy sounded much brighter, and I could hear subtle details that were muffled on the old tape. Again I adjusted the azimuth until I got the new tape sounding as bright as possible. Then I played other tapes and had to readjust the azimuth again! What is going on? Which of my tapes has the correct azimuth?—Eric D. Wong, Fallston, Md.

A The tiny gap in an analog tape head must be exactly perpendicular to the tape for best high-frequency response. If the azimuth is off by a minute of arc either way, you'll get degraded sound. Moreover, the tape you play during azimuth adjustment has to have been recorded on a machine whose head azimuth was correctly set. In either case, if the gap of the playback head does not line up with the magnetization on the tape, high-frequency losses will result. If a tape has been recorded with an incorrect azimuth, it can be played back properly only by misadjusting the playback head to compensate for the azimuth error.

Your problem is to determine which of two copies of the same prerecorded tape has been recorded with the correct azimuth.

Worse, both may suffer from azimuth error—we just don't know. The quickest way to determine proper tape-head azimuth is to obtain a good test tape.

Because test tapes are often hard to obtain and expensive, I made an azimuth-alignment tape of my own. I started with what I hoped wasn't a dangerous assumption, that the azimuth of most commercially recorded tapes is dead accurate. I then checked enough tapes to determine if most of them agreed in azimuth. In other words, if the sound was similarly clean and unmuffled from all the tapes, then I could adjust the heads on my machine and most tapes would sound good with my guesstimate setting. Some tapes fell outside the range, so I eliminated them. However, I found that many tapes worked well for a given azimuth setting. I chose one as the reference tape and set it aside, playing it only for azimuth adjustment; I bought another copy of that tape for my music library.

If your preamp or receiver can be set to mono, do so and then play your tapes. When the azimuth for a given tape is right, switching from mono to stereo will result in virtually no change in high-frequency response. All you should hear is the soundstage widening as you switch to stereo. (Use the preamp's or receiver's volume control to compensate for level differences when you switch from mono to stereo; otherwise, the louder signal may sound subjectively brighter.) If your tapes all sound good in mono, then it is likely, by the law of averages, that they are all correct in terms of azimuth and that your cassette deck's play head is properly adjusted.

Tape decks that have separate play and record heads are more difficult to adjust because both heads must be correctly aligned. Adjust the play head as described above. Next, make a recording of high-frequency noise. You might want to use a pink-noise signal from a test CD or FM interstation noise (turn off the muting), and I recommend using a C-60 cassette (the base film is thicker and is less likely to stretch, which could skew the azimuth of the test tape). As you make this recording, adjust the record head's azimuth for best high-frequency response while you monitor the sound off the tape from the playback head. You should switch between mono and stereo to be sure that you have

Output Tube Glow

Q *I am 15 years old and am trying to learn about audio and how equipment works. I know that vacuum tubes are like light bulbs; over time, their filaments burn out. I also understand that if you leave a tube amplifier on all the time, the fidelity will improve. Naturally, I had to experiment. I left my amplifier on overnight to see if this made any difference in sound quality. I woke up the next morning, and to my surprise, the output tubes were a hazy, glowing purple. The audio sounded the same as if I had not left the amplifier on. What made the output tubes in my amplifier glow purple?—Cory Melvin, Sioux Falls, S.D.*

A I certainly can appreciate how a 15-year-old can be an audiophile and an experimenter. I was about that age when I cut my first disc recording, and I was hooked. A year or so later I designed my first sound system, complete with two turntables and a mixer. I sold it to a very happy client!

Now, back to your problem of glowing output tubes. I could tell you that the tubes glowed because they were angry over not getting enough rest. I know you wouldn't believe that, so I'd better get serious.

It would be wonderful if vacuum tubes could be completely evacuated of gases, but it is almost impossible to obtain a perfect vacuum. Some of the remaining gases are embedded in the cathode. Heat can force some of this gas to boil off the cathode's surface and enter the electron stream. The high voltage present between the plate/screen and cathode will ionize the gas, resulting in the glow that you described. (This is the same principle that underlies the operation of neon signs.)

Because of the higher filament current and greater power dissipation within the output tubes, they run hotter than voltage amplifier tubes. This is why output tubes are more likely to glow than other tube types.

Some tubes are poorly evacuated, and these will glow almost immediately after warm-up. If the tubes are old, gases will

have boiled from the cathode and they will glow more than newer tubes. Also, if the grid bias voltage is too low, the tubes' plates and screens will draw excessive current. This, in turn, will cause more heat to be developed, and hence more gases will form, helping to create the glow. Incidentally, the excessive current will ruin the tubes.

The matter of a tube-equipped amplifier sounding better when it is left on continuously rather than turned off after each use has been debated for a long time. I have not discovered any scientific reason why leaving a tube amplifier on should improve its sound. There might be some truth to the idea that tubes will last longer when they are left running, because the heating and cooling of their filaments contribute to their gradual deterioration.

Turntable Considerations

Q *I want to upgrade the sound from my turntable. I bought a new cartridge, but will I get improved sound by using better interconnects than those supplied with my turntable? The owner's manual for the turntable says that it should be cleaned and lubricated every two years. I've had it for 20 years without servicing it and have noticed no ill effects. Do you think I should get it serviced?—Lloyd Campbell, Bronx, N.Y.*

A It's amazing that you've had no problems with your turntable after 20 years of use. Even though it appears to be running well, you may be surprised at how much less rumble or wow and flutter you'll hear after lubricating it properly. The oil reduces friction, which results in smoother rotation of the various parts.

The owner's manual should tell you how to lubricate the turntable. You should be able to do it yourself; if you can't, take your turntable to a reliable service shop. Usually the platter's main bearing requires some oil every few years. The instructions may recommend a particular lubricant, but 10-weight oil or a fine machine oil will suffice. Don't use common household oil, because it leaves a waxy residue.

The capacitance of phono cables is the main characteristic that affects the sound of a moving-magnet cartridge (some are more susceptible to such loading effects than others). Cable capacitance is usually stated in picofarads per foot of cable; when its total capacitance is added to that of the preamp's or receiver's phono stage, it should equal the total capacitance called for by the cartridge maker. Check the cartridge specs and those of your preamp or receiver. Even if your old cables had the proper capacitance for your previous cartridge, that capacitance may not be appropriate for the new cartridge. You can easily adjust capacitance by trimming or lengthening the cables between the turntable and the preamp.

CD Player to Multiple Receivers

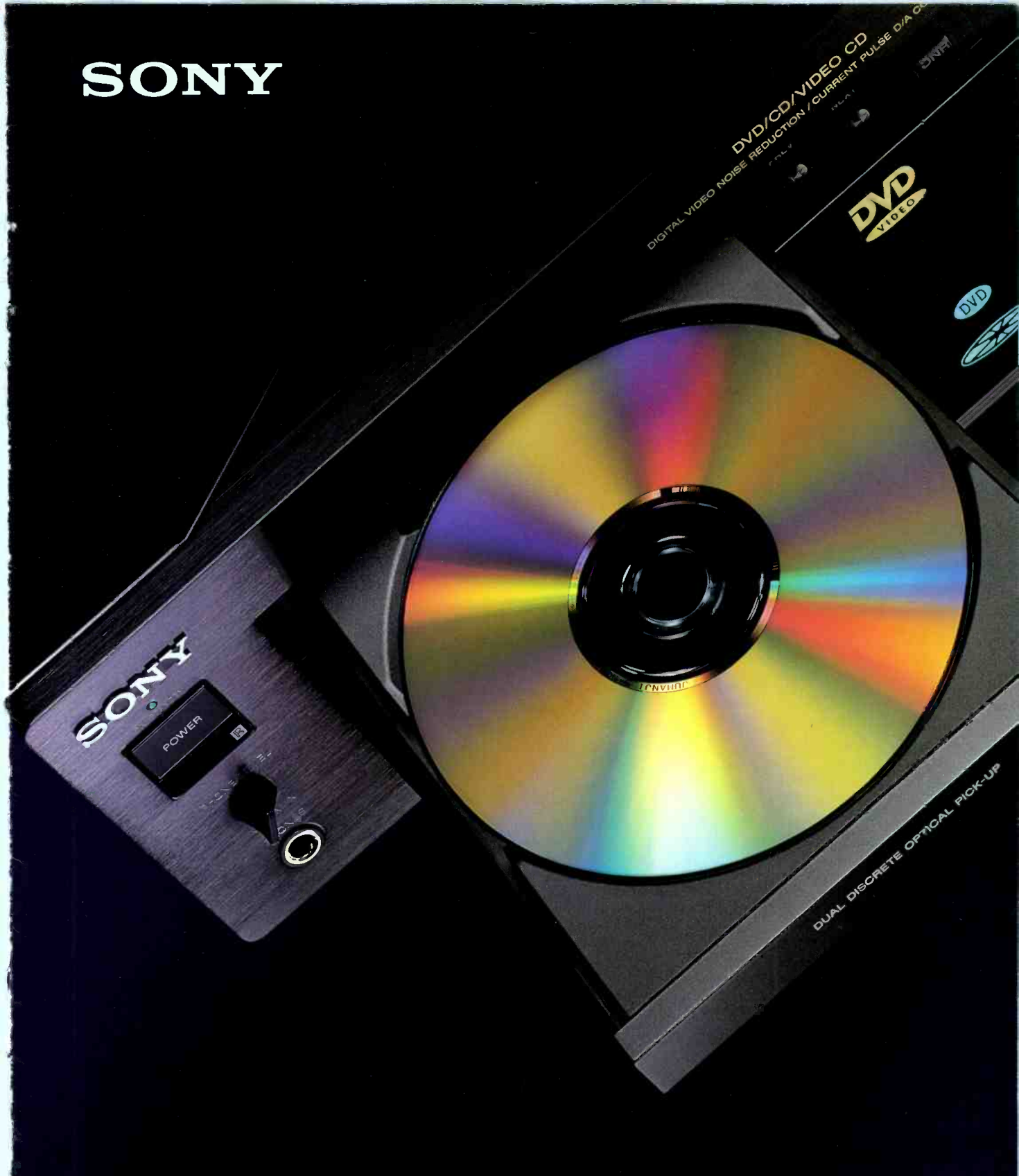
In the October 1996 issue, Kevin Duggins asked a question about connecting his CD player to three receivers. Although you answered the question well, I have some additional suggestions that may be helpful. As a custom installer, I have done this type of work many times. Two approaches have worked well for me.

To send only the CD signal to two receivers, the simplest approach is to use a standard Y adaptor (for each stereo channel) to two sets of shielded cables leading to the two receivers. You mentioned the problem of possibly shorting inputs on some receivers. By soldering a 1-kilohm resistor into the hot line leading to the receiver with the shorting inputs, the shorted contacts will no longer pose a problem to the other receiver or to the CD player.

However, a distribution amplifier is the best solution for a multiroom or multizone installation where many receivers are to be used. Such a device accepts one input, divides it electronically, and distributes it to multiple outputs. The outputs are buffered, and the signal is not degraded. Niles Audio (800/289-4434) makes a one-in, six-out stereo distribution amplifier (Model ADA-6) and a similar video amplifier (Model VDA-6) that sends a

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

SONY



THE DISC IS ONLY THE BEGINNING

By creating the Compact Disc standard—as well as virtually every innovation in home, car and portable player design—the history of CD has been virtually written by one company: Sony.



THE HISTORY OF CD IS THE FUTURE OF DVD

From the beginning, our Compact Disc strategy was based upon a fully integrated approach to CD technology. Now Sony is poised to lead the most significant advancement of all—the extension of CD into the new DVD format.

Identical to CD in shape and size, but with a much greater storage capacity—DVD has been specifically designed to serve as the foundation for an entirely new generation of products.

And as you would expect, Sony is committed to delivering nothing less than the ultimate DVD experience.

A New Type of Digital Media

As the original CD created a revolution in audio, DVD is destined to set new standards for both home video and multimedia.

- ▶ Nearly 133 minutes of full-motion video on a single-sided disc
- ▶ Picture quality that approaches the "D-1" (CCIR-601) studio production standard
- ▶ Over 500 lines of horizontal picture resolution
- ▶ Choice of PCM stereo sound or Dolby Digital (AC-3) multi-channel surround sound
- ▶ Supports letterbox, pan and scan or 16 x 9 formats
- ▶ Features up to 8 language soundtracks and 32 subtitles

DVD will also support other new creative applications in the future:

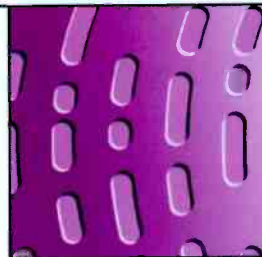
- ▶ The ability to view scenes shot at multiple camera angles
- ▶ Dual layer, single-sided discs that provide more than 12 times the capacity of current CDs
- ▶ Recordable, rewriteable and high definition media

Looks Can Be Deceiving

Nearly every aspect of CD has been redefined or reinvented to achieve DVD's remarkable increase in data capacity and density. These include smaller pit dimensions, a more closely-spaced track (finer "track pitch") and a shorter wavelength laser.

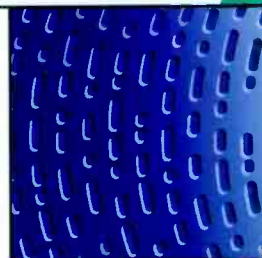
What's Familiar:

- ▶ Like CD, DVD is 120 mm (4.72 inches) in diameter and 1.2 mm thick
- ▶ Like CD, DVD offers instant random access that no tape format can match
- ▶ Like CD, DVD is highly durable and tolerant of dirt, dust and fingerprints



What's New:

- ▶ DVD can hold 4.7 gigabytes of data per layer (compared to 680 megabytes of data on a CD)
- ▶ For even greater storage capacity, DVD offers dual-layer and double-sided disc options
- ▶ Each DVD disc is composed of two 0.6 mm substrates that have been bonded together to improve rigidity



Clearly, DVD poses new challenges for optical disc technology. Yet one player has been specifically designed to deliver the maximum performance possible from both DVD and CD.

INTRODUCING THE SONY DVP-S7000 REFERENCE STANDARD CD/DVD PLAYER

VIDEO:

SONY MPEG-2 DECODER LSI assures accurate MPEG-2 decompression.

10-BIT VIDEO DIGITAL-TO-ANALOG CONVERTER minimizes digital artifacts for video that's closer to the original master.

SMOOTH SCAN™ PICTURE SEARCH with 32-bit RISC microprocessor, for superior picture quality in High Speed, Slow Motion and Frame-by-Frame mode.

DIGITAL VIDEO EQUALIZATION with custom memory settings.

DIGITAL VIDEO NOISE REDUCTION

COMPONENT VIDEO OUTPUT insures the highest image quality with compatible video monitors and projectors.



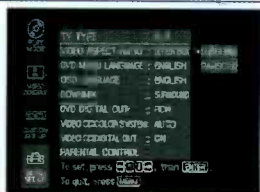
CONVENIENCE:

MULTIPLE PLAYBACK MODES include Freeze Frame, Frame Advance, Slow Motion (at 1/10 and 1/5 speeds) and Smooth Scan (at 2X, 10X and 30X speeds), in either direction.

ON-SCREEN DISPLAY MENUS simplify player operation.

A/V CALENDAR DISPLAY confirms DVD chapter and CD track selections.

BIT-RATE METER monitors average video bit-rate level.



THE SONY DVP-S7000 INCORPORATES EXCLUSIVE TECHNOLOGY AND FEATURES THAT PROVIDE DEFINITIVE DVD AND CD PERFORMANCE. BUT WHAT ELSE WOULD YOU EXPECT FROM THE COMPANY THAT DEMONSTRATED THE FIRST PROTOTYPE DVD PLAYER.

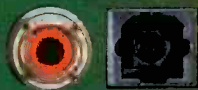
AUDIO:

CURRENT PULSE D/A CONVERSION low distortion current-source converter, for greater precision and immunity from voltage fluctuations.

FULL FEED FORWARD DIGITAL FILTER reduces requantization noise by using 3-stage 8x oversampling, 45-bit internal processing and 20-bit outputs.

DOLBY®DIGITAL (AC-3) COMPATIBILITY with Sony's SDP-EP9ES 24-Bit decoder (optional) that features exclusive digital cinema soundfields and bass redirection functions.

DYNAMIC RANGE CONTROL for adjusting audio dynamic range level.



COAXIAL OR OPTICAL DIGITAL AUDIO OUTPUTS for use with DSP components and outboard D/A converters.



CONSTRUCTION:



DUAL DISCRETE™ OPTICAL PICKUP with separate laser diodes assures compatibility with DVD, CD, Video CD and CD-R. Also eliminates lens switching and reduces laser wear.

ALUMINUM FRONT PANEL/ANTI-RESONANCE TOP PLATE resist air-borne vibration.

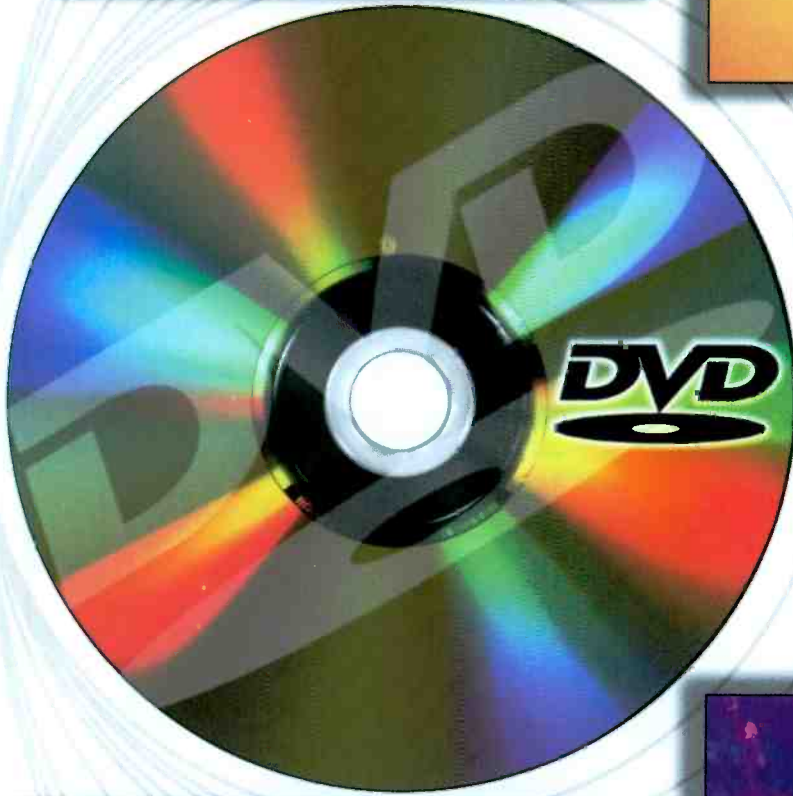
BULK MOLDING COMPOUND CHASSIS suppresses mechanical vibration.

LOW-RESONANCE HONEYCOMB CONSTRUCTION WITH OFF-CENTER ISOLATING FEET

IN THE LINE OF FIRE



FLY AWAY HOME



**A TOTAL
SYSTEM
APPROACH**



SESAME STREET'S 25TH BIRTHDAY



TONY BENNETT UNPLUGGED

At Sony, our approach to DVD extends beyond hardware, to include practically every division of our corporation.

During the coming year, Columbia TriStar Home Video will offer an extensive range of its best titles on DVD. These releases will include blockbusters such as "Jumanji," "In the Line of Fire" and "Legends of the Fall;" classics such as "Close Encounters of the Third Kind- The Special Edition" and "Taxi Driver;" as well as recent hits such as "Fly Away Home" and "Matilda."

Additionally, Columbia Home Video will release the full-length DVD version of the MTV performance "Tony Bennett Unplugged: The Video." And Sony Music Video will introduce titles like "Street Fighter II-The Animated Movie," "Odyssey Into the Mind's Eye" and "Beavis and Butt-Head's The Final Judgment." And Sony Wonder is offering "Sesame Street's 25th Birthday: A Musical Celebration!"

But that's not all. Sony has also established DVD authoring centers in Japan, as well as at Sony Picture's Culver City Studios.

The new Sony Pictures DVD Authoring Center is fully engineered to maximize production efficiency. It features individual stations for MPEG video compression—multiplexing—subtitling—and Dolby Digital encoding— as well as for quality control assurance and telecine film transfer.

And when it comes to mastering and replication, Sony Disc Manufacturing's reputation for quality and service is second to none. Since establishing the world's first CD mass production facility in 1982, the total output from our 11 CD plants worldwide has reached 4 billion discs!

Already, DVD manufacturing is underway in Japan and is scheduled to begin at our DADC facility in Terre Haute, Indiana. Both facilities provide fully integrated DVD production, utilizing the latest Sony Solo-Line Replicator.



THE SONY DVD COMMITMENT



ALTHOUGH THE DVD STANDARD IS SUPPORTED BY MANY COMPANIES, MUCH OF THE TECHNOLOGY WAS ORIGINALLY DEVELOPED BY SONY, INCLUDING THE FORMAT'S MODULATION, ERROR CORRECTION AND DISC BONDING TECHNIQUES. SONY IS ALSO RECOGNIZED AS ONE OF THE "EXPERTS" INVOLVED IN THE MOTION PICTURE EXPERTS GROUP THAT DEVELOPED DVD'S MPEG COMPRESSION.

IN DVD AS WITH CD, SONY'S COMMITMENT IS COMPLETE. IT UNDERSCORES WHY THE DVP-S7000 IS DESTINED TO BECOME THE BENCHMARK IN TOTAL CD/DVD PERFORMANCE. AND IT'S YET ANOTHER EXAMPLE OF HOW SONY IS DEFINING THE DIGITAL FUTURE™.

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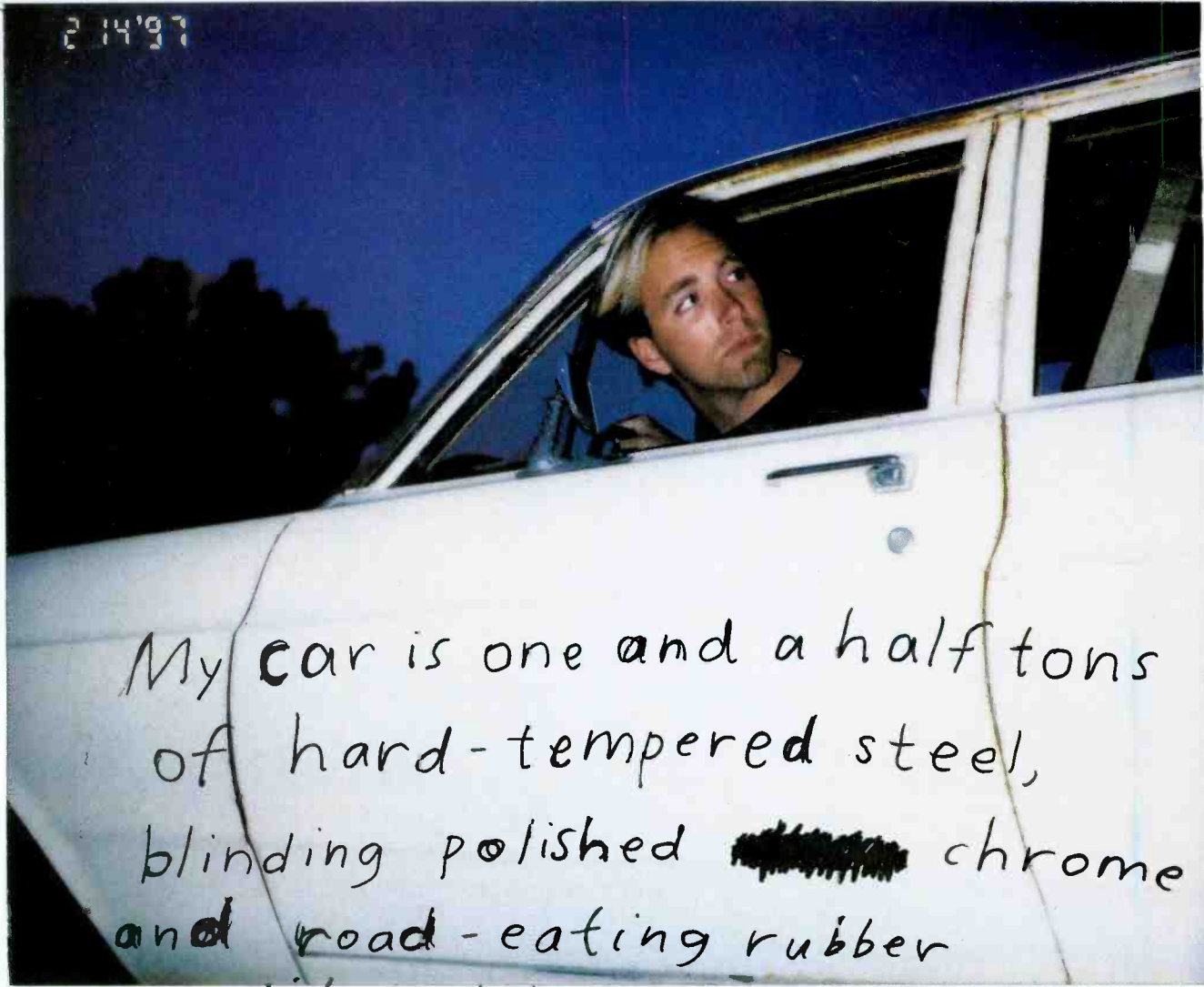
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April 28	Chicago	United Audio
April 29	San Jose	Fry's Electronics
April 30	San Diego	Dow Stereo
May 5	Seattle	Magnolia HiFi
May 6	Denver	Soundtrack
May 7	Minneapolis	Audio King
May 12	Boston	Tweeter etc.
May 13	Atlanta	HiFi Buys
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Speaker Cones vs. Discs

Q *Why are dynamic speaker drivers (woofers, subs, etc.) cone-shaped and not flat or circular discs? What are the disadvantages of each? I know that Precision Power makes flat-diaphragm speakers for car audio systems. What gives?—Stephen Curling, Mexico, N.Y.*

A The main reason for making a speaker diaphragm in the shape of a cone rather than a flat disc (circular or rectangular) is for purposes of stiffness and rigidity. It is easier to control irregular flexing of a cone than it is of a flat disc (bending or flexing of a diaphragm produces resonances that cause tonal colorations and distortions). If you imagine the physics of a speaker's motion, you'll understand why.

Consider the speaker's task: It must create sound by producing *pressure waves* from a vibrating source, the driver's diaphragm. To accomplish that, it has to alternately compress and rarefy air molecules—and do so rapidly (e.g., a woofer diaphragm must move back and forth 300 times per second to produce a 300-Hz sound). A dynamic speaker is really a reciprocating air pump driven by an electromagnetic motor (the voice coil/magnet assembly), attached to the apex of a cone.

However, let's assume for the moment that instead of a cone, we attach the voice coil and magnet to the center of a flat disc, held in place at its edges by a border of flexible rubber (the surround), the latter attached to a rigid frame. If you imagine the voice coil rapidly pumping back and forth, it will tend to displace the center of the flat disc before the larger area near its outer circumference—to bend rather than move uniformly, unless, of course, we make the disc of very stiff material. That's the trick. If we use a rigid metal or hard plastic, then the diaphragm may become too heavy, and the voice coil/magnet will require too much power to move the flat disc back and forth. On the other hand, if we attach the voice coil to the apex of a dense, stiff-but-light paper cone, and perhaps treat the cone with a thin lacquer spray or plastic coating to increase its rigidity, then the cone will follow

the vibrations of the voice coil with greater uniformity and less bending than a flat disc driven at its center.

Flat diaphragms are nothing new; electrostatic speakers are, of necessity, flat, as are planar magnetic drivers, and they can sound superb. In the '80s, Sony developed a flat, *square* aluminum-honeycomb-diaphragm woofer. To drive it uniformly, four voice coils were used. It worked fine but was costly to manufacture. And for a number of years, Phase Technology has made speakers that use flat diaphragms made of light but rigid expanded-foam plastic.

There also are sound reasons to alter the shape of a diaphragm, such as to control the dispersion and diffraction of high or low frequencies. For example, large flat diaphragms produce serious beaming of highs, which has prompted some designers of planar speakers to shape diaphragms in a gentle curve, to better disperse the highs and alleviate the beaming.

Insofar as applications in car sound, when you consider that space within a car is scarce, particularly in the doors and the dashboard, a flat diaphragm makes sense. A compromise must be struck between efficiency and practicality.

A Phono Cartridge Phono Inputs Can't Take

Q *I came across a three-speed turntable that can play my old 78-rpm records. However, its crystal cartridge produces terrible overload and distortion when I connect it to my amp's phono input. How can I adapt the crystal cartridge to the magnetic phono input of my amp?—David Licht, via e-mail*

A Crystal (and ceramic) cartridges do not require standard RIAA equalization and are relatively high-output devices (that's why your cartridge is overloading the magnetic phono input). You should therefore connect this cartridge to one of your amp's auxiliary inputs. However, you'll need to advance the volume control significantly because the output of the crystal cartridge won't match that of high-level sources, such as a tuner or a tape deck. I would have suggested replacing the crystal cartridge with a magnetic one, but the motors of most old turntables that used crystal or ceramic cartridges were not shielded well enough to permit hum-free operation. **A**

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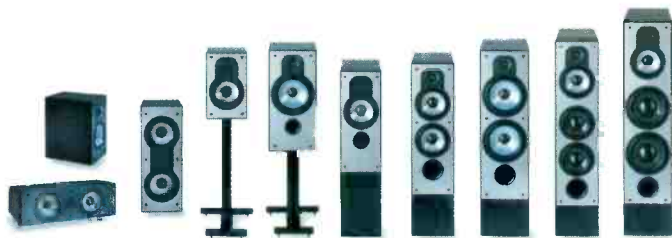
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DIGITAL DOCTOR



This deck digitally improves the sound of old analog cassettes.

With DAT mostly relegated to professional use, DCC dead, and Mini-Disc just hanging on (at least on this side of the Pacific), recording enthusiasts may have to be content with analog media for the time being. But that needn't mean much sonic sacrifice, thanks to advances in tape and hardware technology. Under the proper circumstances, you can make an analog cassette that is virtually indistinguishable from its CD equivalent.

Yet this isn't so easily accomplished. You must use the best possible tape (preferably metal), set the recorder to exactly match that tape each time you make a recording, and use the most advanced noise-reduction system as well as Dolby HX Pro. All this and you get a recording almost equal to what you'd get by just popping a tape into a digital deck and pushing the record button. And even these finicky procedures don't

apply to the problems of old tapes that were recorded under less than ideal conditions.

Now Pioneer has applied digital technology to analog tape reproduction. This technology, which Pioneer calls Digital Processing System (DPS), seemed impressive in the early public demonstrations of the company's CT-W606DR (\$285) and CT-W616DR (\$300) dual-well dubbing decks.

Recently I've had a chance to use one of the first production samples of Pioneer's CT-W616DR. Naturally, this model does the things that older models did, such as noise reduction and tape matching, but it does them in the digital domain. Matched 20-bit A/D and D/A converters take the deck's analog input, convert it for processing, reconvert it, and then feed it to the recording head. (Pioneer's literature suggests that it would be possible to feed a digital signal directly from a CD player to the processing circuits, but there's no provision for doing that on the CT-W616DR.)

PCM TURNS 50

When did you first read in *Audio* about pulse-code modulation (PCM)? Circa 1982, when the CD introduced it to consumer electronics? Or when we first covered it, in 1947?

You probably wouldn't have heard about it anywhere before that. The story in our October 1947 issue covered PCM's first public demonstration, earlier that month. For that demo, music and speech were transmitted from Bell Telephone Laboratories in Murray Hill, N.J., to a meeting of the Institute of Radio Engineers in New York City. The system used seven-bit coding and a sampling rate of about 8 kHz—hardly hi-fi but fine for its intended use, long-distance telephony.

As the demo was in 1947, tube A/D and D/A converters were used. Our story described the special tube used for A/D conversion: "All the 128 codes available in the seven-pulse code group are perforated in appropriate order in a special plate inside the tube. This plate is so placed that a beam of electronics can sweep across the seven elements of any one code group. Which one it actually sweeps across is determined by the position of the beam, and this in turn is determined by the amplitude of the signal at the time of sampling. If the beam goes through a hole in the perforated plate, the pulse is an on-pulse; if the beam is blocked because there is no perforation at that point, it is an off-pulse." *I.B.*

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CIRCLE NO. 14 ON READER SERVICE CARD

MINIDISC DRIVES ON

When the MiniDisc (MD) format was first announced, the obvious comparison was with DCC. They came out at virtually the same time, and both offered digital alternatives to the Compact Cassette. But DCC failed miserably, whereas MiniDisc is still with us.

Now the obvious comparison is with laserdisc. Laserdisc has survived for nearly 20 years, largely sustained by the faith and efforts of a single company (not Philips, which developed it, but Pi-

duced its first home MD recorder, and Sharp announced 11 MD products.

MiniDisc is hardly new to Denon, however; the company makes several MD machines for professional use. That may sound odd if you think of pro recorders only in terms of super-fidelity studio mastering or if you've failed to keep track of how far MiniDisc's sound has progressed. Its sound quality is now plenty good enough for radio, and radio studios love its ruggedness, easy editing,

and instant cueing. Reporters with MD portables can edit their discs with the aid of laptop computers, then send them via telephone or as E-mail attachments.

And MiniDisc is good for more than audio. Sony has long since formalized a 140-megabyte MD-ROM standard for compact computer storage (though I don't think anyone's espoused it). And one of Sharp's 11 new MD products this year is a digital camera that can store 2,000 VGA-quality still images, or 365 images accompanied by digital sound.

In theory, MiniDisc is as universal a system as cassette is. MiniDisc portable players and recorders, boomboxes, car stereo units, and home decks are available; when the format first appeared, you could even buy commercially recorded discs. MiniDisc' sound is rather good, its convenience is unparalleled, and prices are now affordable. What stands in the MiniDisc's way is that everyone already owns portables,

boomboxes, car stereos, and home decks that take cassettes, plus libraries of cassette software—and cassette recordings are still not difficult to find.

I don't think MiniDisc will ever make it big, at least outside of Japan. But despite initial skepticism, I'm beginning to think that it will make it. *I.B.*



Denon's new MiniDisc for the home...

oneer). MiniDisc's survival, too, is largely based on the efforts of a single company, Sony, and Sony has more muscle to put behind a format than Pioneer. MiniDisc is also sustained, as laserdisc has been, by popularity in Japan.

But Sony, though MiniDisc's originator, is not the format's only friend. Our most recent Annual Equipment Directory (October 1996) also listed MD recorders from JVC and Sharp. At the 1997 Consumer Electronics Show, Denon intro-



...and Sharp's MiniDisc for photography.

In recording, DPS handles the sophisticated tape-matching functions Pioneer calls Super Auto BLE XD (not available in the less expensive model), plus Dolby B and C noise reduction. (Curiously, Pioneer has omitted Dolby S, which was included in earlier models.) In my listening tests, these worked well and produced fine recordings. But Pioneer's analog predecessors worked excellently, too. Truthfully, I didn't hear much difference.

It's when *playing* tapes that the digital additions come into their own. In playback, DPS equalizes the spectral balance of old tapes (another feature missing from the

CT-W606DR). When tapes are copied from one well to the other, DPS also reduces hiss in the quiet passages between songs. But the spectral balancing and hiss reduction are both digital versions of existing functions. What's really new is that DPS removes noise from existing recordings.

Like most dual-well decks, the two new Pioneers can copy at regular or double speed, but they also include a Tape Duplication Noise Suppressor (TDNS). This circuit senses the end of a track and fades the signal until the next track begins, reducing noise between selections, where it's most noticeable because there's no signal to mask

it. The TDNS system seemed very effective in killing the noise, but I was sometimes aware that a tiny bit of the following selection's first note had been clipped. Most of the time, I switched TDNS off.

The 616 also includes Pioneer's Frequency Level Expander (FLEX). Despite its name, this is actually an automatic equalization circuit designed to detect when the overall balance of a musical signal varies from preprogrammed norms; it then makes whatever corrections are necessary. I found FLEX effective with very old tapes, which tended to be boomy and whose high frequencies may have been partially erased by

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



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 VA- Myer-Emco; Falls Church, Tyson's Corner, Fairfax- Audio Connection;
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 Windsor- Target Hi Fi; London- Treble Clief; Ottawa.
 Mexico- Contact Grupo Volumen; Mexico City.

magnetized transports over the years. While the system didn't totally flatten response, it did make a number of cassettes sound considerably better.

But the big news with DPS—and the feature that made me want to get my hands on the CT-W616DR and try it out—is its after-the-fact digital noise-reduction capability, which Pioneer claims can yield an S/N ratio of 90 dB. Details on this feature are still fairly sketchy, probably because Pioneer's patent is still pending. Essentially, the DPS circuitry divides the frequency spectrum into several narrow bands, analyzes whether there is signal or just noise in each, and attenuates the bands it decides contain only noise. The system seemed to consider anything below a certain level as noise; when I recorded music that peaked at about -20 dB on the level meters, the circuits eliminated everything but the peaks. Similarly, if the noise level was too high, the circuits read the noise as signal and left it in.

Except for these extreme situations, this digital noise reduction worked quite well with a broad range of recordings. I put it through its paces with a variety of tapes; most of these were prerecorded, but I included some old dubs as well. A couple of the tapes were nearly 30 years old, others only a year.

The newer tapes didn't benefit greatly from the process. The noise might have been lowered a bit, but these tapes were already so quiet that I didn't hear much improvement. On the other hand, the digital noise-reduction circuit didn't degrade the sound—which was fortunate, because unless you go through an unintuitive procedure to cancel it each time you power up the 616, the digital circuits are always on. With older tapes, however, the effect was startling. The digital noise reduction seemed to eliminate the noise on tapes recorded 10 to 15 years ago, which contained a noticeable amount of hiss even though they had been Dolby-encoded. And eliminating the noise did not affect the music. Occasionally, as I switched the circuit in and out, I noticed a slight sort of "phasiness" on the processed signal, although it was never obtrusive in normal, extended listening.

Removing the noise sometimes revealed other flaws, hitherto masked. Dolby mistacking, which causes high-frequency anomalies, was fairly common. However,

tapes that exhibited this problem often sounded better with the CT-W616DR's Dolby noise reduction switched off; the FLEX circuits were then quite effective in restoring spectral balance.

A couple of old tapes demonstrated the system's effectiveness most dramatically. First, my wife's old copy of Neil Young's *Harvest*, from 1968 or so, was made without noise reduction and had been tweaked in the bass, presumably to get some low-end output from the car systems of the day. The result was basically unlistenable until the DPS noise reduction virtually eliminated the hiss and FLEX toned down the bass (or maybe goosed the treble); only then was it possible to sit back and appreciate the music.

The second dramatic example was an atrocious copy of The Moody Blues' *Days of Future Passed*, duplicated in 1972. Without DPS, the start of the long cymbal crescendo that opens the album was lost in the murk, emerging only as it rose to full level. When the noise was eliminated, I heard what sounded like an intermittent connection in an audio cable and possibly the shuffling of feet in the studio. Not an improvement, perhaps, but interesting nonetheless.

I was also keen to find out whether DPS could eliminate vinyl surface noise from records dubbed to cassette. Here, DPS was less successful, but in fairness, it wasn't designed to do this. Tape noise included in a vinyl record—not such an uncommon phenomenon with non-audiophile recordings of the '70s—was handled pretty much like any other hiss, but most of the surface noise remained. My greatest success was with jazz pianist Ahmad Jamal's classic album *But Not for Me*. My copy of this LP had always contained large dollops of tape noise, but the years have not been kind to it and it has become crackly as well. The DPS circuits couldn't begin to handle the record's surface noise, and it was difficult even to hear the hiss under it. But when I tamed the physical noises by playing the record with its grooves wetted by distilled water, the hiss emerged and was easily dealt with by the CT-W616DR.

Pioneer's new technology is not for all occasions, so it's fortunate that it's been incorporated into an otherwise fine cassette deck. But when you encounter the kind of noise it was meant to combat, DPS works like a charm.

Ian G. Masters

Julian Hirsch Says, "...I Would Choose These Speakers for Myself."

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—Julian Hirsch, *Stereo Review*

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NO RESPECT



Maybe we really *do* get what we deserve: to be dissed wherever and whenever. It's as if the hi-fi community, any and all of us—enthusiast, manufacturer, retailer—revels in being regarded as, well, weird. In case you thought that “geek” and “nerd” were terms restricted to describing computer addicts and owners of Sta-Prest slacks, the world outside of our little encounter group thinks that we're actually less admirable/cool than even the most pizza-breathed Net-surfer you could imagine. And we *ask* for it.

My colleague Steve Harris nailed it on the head with the delicious truism, “The trouble with ‘popular science’ is that the more popular, the less scientific.” Okay, so you'd expect

newspapers, mainstream magazines, and television programs to have a real problem conveying the intricacies of new technologies; they're forced to avoid technical details. So we face dilemmas. How do you explain to a computer/hi-fi-illiterate audience what advantages DVD offers over existing formats, when that audience is still wrapping its minds around the concept of 8-track tapes? How do you communicate to a herd of knuckle-dragging, RV-driving, beer-swilling Al Bundys (or their opposites—a bunch of BMW-

**WHY WOULD
A MUSIC MAGAZINE
RUN AN ARTICLE ON HI-FI
THAT PLAYS IT
FOR LAUGHS?**

driving, Chardonnay-sipping, post-'80s yuppies) why flat speakers are revolutionary or why a handcrafted Class-A power amplifier sounds better than a boombox?

I'm beginning to think that you don't explain. Or can't. Perhaps it's time we give up proselytizing. Maybe we should suspend any missionary tendencies to convert the Great \$99-

Speaker-Owning Unwashed into

music lovers who would appreciate more refined sound.

Why? Because the only magazines that treat the subject with a modicum of intelligence and respect—i.e., hi-fi magazines—preach to the converted, and nonenthusiasts will never pick up such publications. Therefore, the only dependable sources will never reach these lost souls.

Which leaves the mainstream press. And it is convinced that we're nerds, geeks, and social misfits with personality bypasses and the sexual histories of monks—well, some monks. And that hi-fi is the biggest snooze going.

Think about it: If a mainstream publication or TV show feels compelled to run a feature on a specialized subject—be it Italian supercars, gambling, French wines, upscale kitchen appliances, cigars, digital cameras, hunting equipment, or anything else even remotely topical or interesting—then it will try to present that subject in a digestible,

comprehensible manner. The exceptions would be intrinsically odd topics, such as crop circles, UFO spotting, or the Pinky Lee Fan Club.

For the most part, though, it's a safe bet that responsible media would not, for example, portray skiers as a bunch of sick obsessives or suggest that cigar lovers need to employ the services of computer-dating agen-

cies. Said media will hire writers or reporters au fait with the subjects. Why? Because the editors assume that what those authors have to say will interest their readers. And they will want to use experts who have no antipathy toward the topic if they're to convey its worth to neophytes. In other words, neither *Reader's Digest*, nor *Playboy*, nor *Time* would hire a bag lady to write about the latest fashions on the Parisian runways or a nonagenarian Nazi domiciled in Bolivia to write about Israeli cuisine.

So why would a music magazine, read by millions of potential hi-fi connoisseurs, run an article about cutting-edge hi-fi that plays it for laughs? Yes, a *music* magazine with exactly the sort of audience that *deserves* to learn about a better method of enjoying its *raison d'être*. And yet *Rolling Stone* hired a computer journalist ('nuff said) to report on the current state of the art and the people circulating in the loftiest audiophile strata.

Now, I've never met Rogier van Bakel, who's probably a nice guy who likes dogs and children, but I have tried to read *Wired*, a magazine for which he is a contributing editor. His article on audio in the November 28, 1996, issue of *Rolling Stone* is subtitled "Strange But True Tales of Stereo Obsessives," which tells you immediately that this article was intended to generate chuckles. (The biggest surprise is that the byline wasn't Hunter S. Thompson or P. J. O'Rourke.) Its headline? "Geek Love." But, as I said, I have sampled *Wired*. In which case, we are the "kettle" and van Bakel is the "pot."

Oh, does this break my heart! After penning the March "Mondo Audio" and finding myself in a gloomy funk over the parlous state of the high-end audio market, it nearly killed me to see not only that a major music publication would perform a hatchet job on hi-fi, but that the little axes would be none other than the very audiophile celebrities who should know better. Maybe they didn't realize that they were being set up, portrayed as clowns or freaks or social misfits, like those guys you read about who collect pocket lint or make masks from human flesh. Or maybe, because they rarely venture outside of hi-fi circles, they didn't realize that you can't talk to civilians about expensive cables, tubes, and Mpingo discs and expect them to comprehend such high-end mysteries. You even have to be careful when discussing high-end pool cues, fish-

ing rods, or camera tripods, because civilians just won't understand. Worse—it'll scare them away.

Maybe van Bakel is really a hi-fi junkie himself and simply wasn't aware of the article's negativism, because he also wrote that one of the systems he heard "... sounds simply magical" and it was "hard to imagine ever getting tired of listening to great records on gear this good." And yet, in the opening paragraph, he quotes one reviewer as saying that a listening session is "... a way of being in touch with myself, to know myself, of being able to touch greatness." (The words "pretentious" and "moi" spring to mind, as do "hoist" and "petard," so much so that "gag order" takes on a new meaning.) But this sets the tone for the article. The



THE MAINSTREAM PRESS
THINKS THAT
WE'RE NERDS, GEEKS,
AND SOCIAL MISFITS.

number of words about the crackpot element equals the number of column inches that try to convey what high-end audio equipment is really all about: better sound.

Perhaps most unfortunate is the article's use of an apocryphal, tragic tale to illustrate the lunacy of audiophiles. It is well known that those Decca cartridge mavens, Australia's Garrott brothers (and their wives), committed suicide en masse in 1990. It is also known to those who bothered to find out that one of the brothers had a terminal illness and that the families were in dire financial straits. The article carries the quote that "These guys committed suicide because of the CD." No wonder three or four million *Rolling Stone* readers now think that audiophiles are, well, crazy.

Sloppy reporting about hi-fi is just as bad on TV, here in the United Kingdom and in many other countries. Take that most banal of science popularizers, the TV show *Tomorrow's World*. Given that it's a long-running staple of the BBC, you can safely assume that its audience is never smaller than two million—impressive stuff for a so-called "science" program in a country with a population of 53 million. But, alas, this is

the same show that, in 1983, described the CD as indestructible; there are still civilians out there who raise hell in record stores when their scratched-beyond-redemption discs will no longer play, quoting *Tomorrow's World* as their main defense. The program's latest bit of half-baked reporting involved the new flat loudspeakers (see "Mondo Audio," February), which—inevitably—the BBC got wrong. Amusingly, part of the confusion was because the BBC is state run and loath to mention brand names, even when reporting on new technology. This reticence meant that viewers didn't know if the flat speakers in the show were made by NXT or NCT—to the embarrassment of the former, as the show discussed those made by the latter. Here's why: In typical mainstream manner, *Tomorrow's World* wheeled in a handful of man-and-woman-on-the-street types, all of whom were unable to distinguish between a flat-panel prototype speaker and one of the most highly regarded, fully developed electrostatics on the market today. "Gee, I couldn't hear the difference!" is the moronic war cry that drives hi-fi salespeople to drink. Worse, the electrostatic happened to be easily recognizable to anyone who ever looked at a hi-fi magazine. And you can be damned certain that plenty of audiophiles watch *Tomorrow's World* simply because there's nothing else on TV in the U.K. that might even touch on their favorite subject. So a BBC program is now responsible for telling the British public that there's no difference between a Martin-Logan and a speaker that exists only as a prototype and rolls off at around 200 Hz.

A week after the broadcast, I met the editor of *Tomorrow's World* at, amusingly, a press conference for NXT held by the Verity Group. As expected, he adopted the usual lofty BBC attitude and hid behind generalities concerning the difference between reporting in the specialist press and communicating with a mass audience via television. He pretty much refused to accept that the show was in error, irresponsible, or an insult to one's intelligence. And for the first time in my life, I wished I were a lawyer. Martin-Logan's lawyer.

The next time you hear about the "dumbing" of America, you might find solace in knowing that the rest of the planet is undergoing a lobotomy, too. A

MELANCHOLY AND THE INFINITE LOOP



I have a record from the '50s by the Southern gospel duo The Louvin Brothers, and on it they sing "The Drunkard's Plea," a plaintive ditty about a self-hating souse who finally reaches the end of his rope and, on bended knee, begs for salvation from the good Lord above. The Louvin Brothers took this stuff deadly seriously, and so do I. For I was that drunkard. Oh, 'twasn't liquor that drove me to near ruin, Dear Reader. It was high-end audio. But I didn't let that devil beat me; no, sir, I did not! It's been a

little more than three years now that I was loitering around the magazine rack at Tower Records thinking that it was, in fact, the public library, when I was saved from eternal hi-fi hellfire by none other than the 8-track tape.

By the time I'd dropped to my own bended knee, I'd already been writing about hi-fi professionally for several years. I was fast becoming just another self-obsessed high-end reviewer wasting what could've been useful and interesting ink on such things as a \$500 platter upgrade, relevant only to an obscure turntable whose ownership numbered in the few hundreds, and comparisons between the triode and pentode modes of a tube amp owned by even fewer. Why I wrote about these things, I have no clear explanation, except that I was so caught up in the audiocreep rat race that I jumped the tracks and was too far gone then to know it.

What got my head straight again was a small, crudely produced magazine, *8-Track Mind*, which I will never forget flipping through at the Tower mag rack in bug-eyed surprise. This wondrous little 'zine focused on that most maligned and ridicu-

lous of all audio formats, the 8-track tape. Not in a post-modern-ironic or kitsch-choked haw-haw mode, but in a clear, righteous tenor. Russ Forster and his small band of contributors didn't just write about the 8-track, they left out the "the" and simply wrote about *8-track*, as a culture and as a political statement defying the corporate interests that stole their childhoods by coldly abandoning formats like 8-track and the LP, and at whose toughened red teat professional swine such as I suckle.

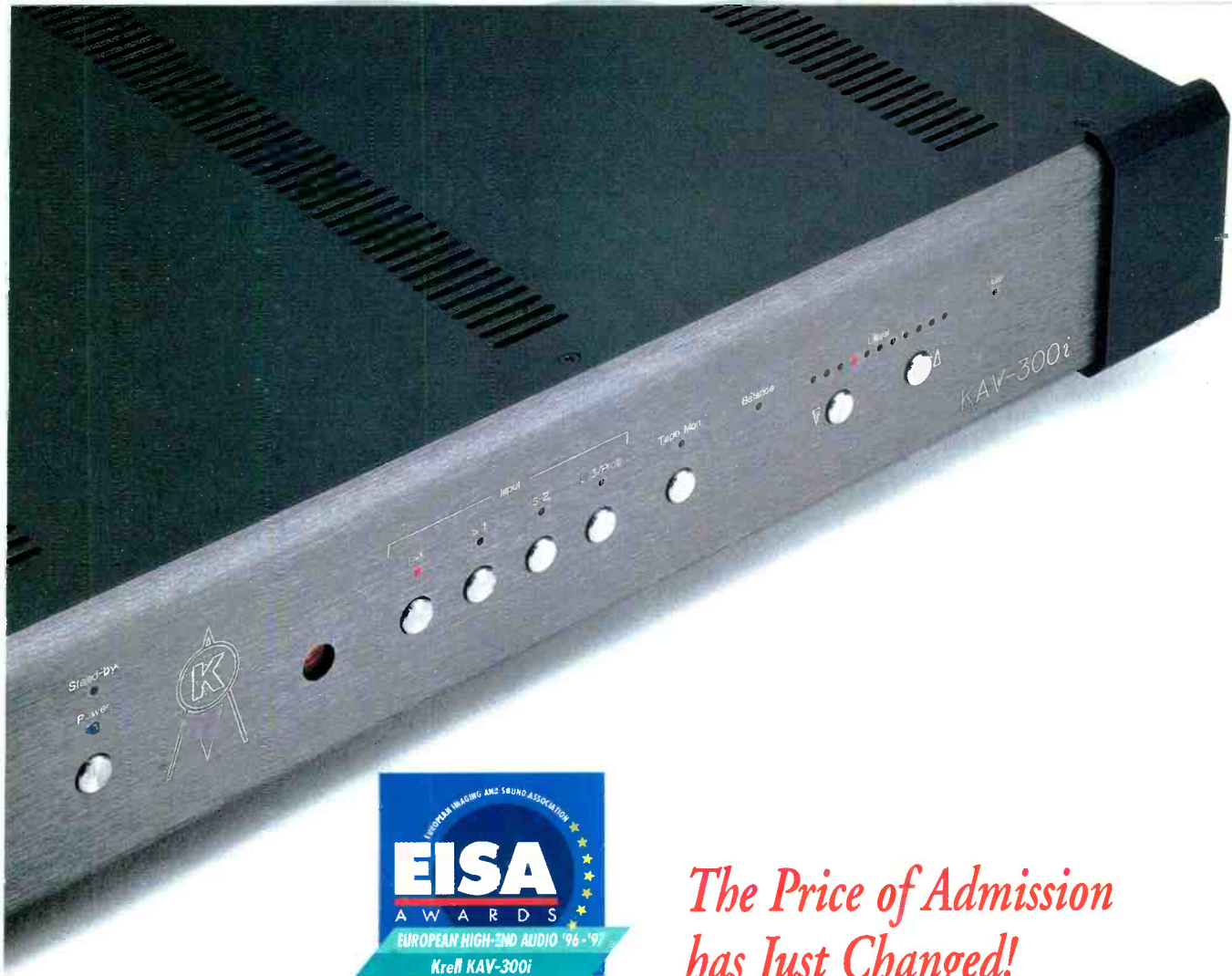
As a teen back in the '70s, I'd had a cheap 8-track deck and plenty of Robin Trower tapes, but it wasn't long before I junked that lowly kid-stuff and moved on to better things, such as the LP and then the CD. But reading *8-Track Mind*, I suddenly realized what I'd been missing all these years: fun! Stupid fun, especially. The kind where you listen to music on its own terms—even really, really dumb music like Don Ho and Blondie—without even a DNA's twitch of consideration given to sound quality. That's how I used to listen to music as a kid, before I got into hi-fi as a hobby. I think I've spent all these years as an audiophile chasing better sound quality as a road back to that state of baggage-free enjoyment of music, no matter how lousy the reproduction.

I remember taping all my Led Zeppelin records, before I left for summer camp in Freesoil, Michigan, by cramming my cheap jambox up against one of my crummy system's

foam-rotted Lafayette speakers and recording acoustically. I also remember, weeks later, lying on the top bunk at camp with my

big sweaty Koss headphones on, utterly and completely lost in the magic burned onto those cheap Certron tapes, sinking deeply into Frank

**I WAS SAVED
FROM ETERNAL
HI-FI HELLFIRE
BY NONE OTHER THAN
THE 8-TRACK TAPE.**



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The Krell KAV-300i

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Frazetta fantasies of huge-breasted Rumpelintze girls wearing scanty medieval armor with the “Zoso” emblem on their shields.

Now fast-forward 15 years, to my dedicated listening room with its precisely tuned rack of kilobuck audiophile gear and perfectly positioned speakers, and the fun just wasn’t the same. Audiophiles don’t give a damn about huge-breasted Rumpelintze girls unless they come bearing pipe cleaners and a bottle of Tweek. Even then, they just close their eyes in a waxy squint and wait to hear if there’s an improvement in upper-midrange transparency, tittering like old ladies watching *Full House* when they think there is.

Audiophiles are losers. I was a loser. A serious loser. Once, while preparing a comparison review of half a dozen phono cartridges, I actually sat for three whole days and broke in every cartridge by playing 20 sides’ worth of a crappy record—*Belafonte at Carnegie Hall*, I think it was—with each one in turn. Even The Louvin Brothers, in all their empathy, would’ve pulled the shades and beaten me to within an inch of my wretched life.

It was 8-track that saved me. After getting stoked by *8-Track Mind*, I went straight to the local Salvation Army and got back on track. I found a working Wollensak deck for \$15, and another five bucks got me a pile of tapes some toothless wino probably traded in 10 years ago for a pair of soiled Sansabelts. I took everything home in a greasy brown grocery bag the Salvation Army threw in at no extra charge, and then I plugged the Wollensak into my He-Man reference rig and shoved in a Devo tape.

The first thing that hit me was how surprisingly good it sounded. Far from 8-track’s deserved rep for lousy sonics, the Devo tape sounded really good. Actually, it didn’t. It sounded like crap, to be honest. But it *felt* really, really good. There was a bass-heavy, thudding, throbbing thing happening that I hadn’t heard since I played 8-tracks as a kid. Forget stereo imaging; the tape head alignment was so far off that the left channel had no highs at all, and the right channel sizzled like bacon in a skillet. Even with fast-tempo rock, I could hear the pitch go “WwowW WwowW WwowW” as the pinch roller’s flat spot came around and the cheap motor strained to keep up the

tape tension. But the midrange was real shouty and loud, just like rock sounded back when I was growing up and how it almost never sounded on my audiophile reference system. The whole mess sounded so inept and cutting and crude that after grinning for a while at just how loopy it was, I found myself thoroughly enjoying the Devo



**READING 8-TRACK MIND,
I SUDDENLY REALIZED
WHAT I'D BEEN MISSING
ALL THESE YEARS: FUN!**

record, the LP of which I’d had in my collection for years but had never played on my high-end rig because, well, I was too busy listening to well-recorded stuff in pursuit of great sound. Stuff like Dire Straits. You know the drill. What I call “kinda-rock.” (Look, I saw these middle-aged guys in concert when they were peaking with *Brothers in Arms*, and they played kinda-rock back then, too. Hell of a recording job they did on *Love over Gold*, though. Too bad I never really enjoyed even a picosecond of the time I spent listening to it, just because some losers in the hi-fi press pegged it as a sonic spectacular. I want those hours back, losers! Give them back so I can trade them for hours spent listening to wobbly 8-tracks. This is my Drunkard’s Plea.)

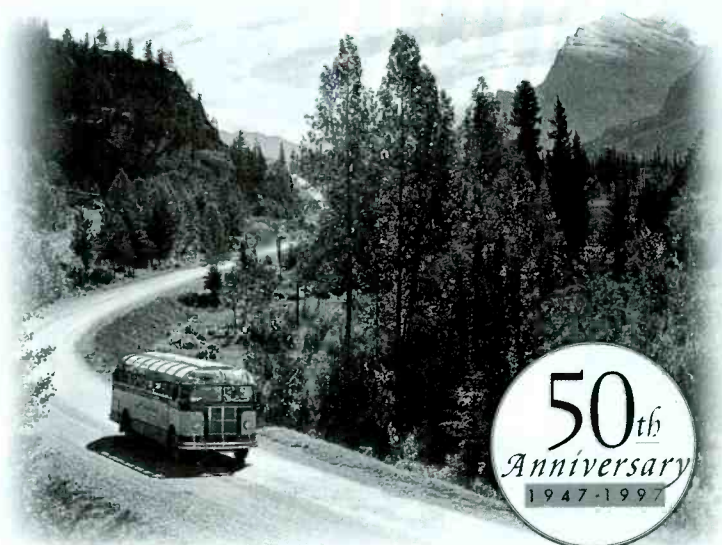
Getting back into 8-track collecting allowed me to take a time-out from the audiocreep rat race, reassess my music/sound values, and put this whole hobby of hi-fi into better perspective. Yes, sound quality matters. And, yes, I still do all kinds of little things to improve the sound of my system, to push it closer to my goal of the perfectly neutral, 100% accurate playback system. But I also play the world’s worst music on my floor-standing Japanese Victor 8-track karaoke machine from the ’70s that the kind folks at JVC sent me last year after they found it in one of their warehouses. This is usually the first hi-fi thing I show off to friends who visit. It’s got a built-in amp and speakers, disco lights on the front that flash in time with the music, a microphone with added echo effect for sing-along fun the karaoke way, and a manual pitch control I can turn back and forth to make the music go “WwowW WwowW WwowW” if a particularly well-recorded 8-track tape has a plastic case that isn’t warped enough to “WwowW” on its own. If my house were to go up in flames, I would throw my entire audiophile reference system out the window and make my way to safety with my indispensable 8-track karaoke machine cradled safely in my arms.

The Louvin Brothers’ record that has “The Drunkard’s Plea” on it is *Satan Is Real*; on the cover is a photo of the brothers standing in the darkness with piles of red-hot coals at their feet, cowering before an almost comically bad 10-foot-tall dummy of Satan (which the liner notes say the brothers built out of scrap materials). According to the notes, The Louvin Brothers took the photo shoot so seriously that they almost burned themselves trying to make their take on hell look realistic.

That’s why I love 8-track. It reminds me of how I’d rather be looking for *Sounds of Hawaiian Gold* tapes at five for a dollar at a flea market than fiddling with my tonearm’s tracking angle or engaging in some other audiocreep ritual of self-loathing. And it reminds me of how much fun listening to music and playing with gear can be when you stop taking it all so very seriously. On this, *Audio*’s 50th anniversary, pause for a moment to remember that Satan *is* real, friend. That’s why I play an 8-track every day, to remind me of just how close I came to serving him forever. A

Jump on the Tour!!!

Come join *Audio's* Corey Greenberg on *Audio's* 50th Anniversary Tour for an insider's view of what's happening in the world of high performance audio and video. From 2-channel, to multi-channel, DTS, to DVD, Corey will offer his perspective and answer your questions. Attendance is limited, so be sure to RSVP now! First 50 guests at each event will receive *Audio's* 50th Anniversary commemorative Gold CD, produced in conjunction with Mobile Fidelity!



Archive Photos

AUDIO 50th ANNIVERSARY/COREY TOUR LOCATIONS

DATE	DEALER	DATE	DEALER	DATE	DEALER
Thursday, April 17, 1997 7:00pm	Genesis Audio 23684 El Toro Road El Toro, CA 92630 (714)830-5000	Saturday, May 3, 1997 2:00pm	Sound Advice 351 N.E. 51st Street, Yamato Rd. Boca Raton, FL 33431 (561)994-4434	Saturday, June 7, 1997 1:00pm	Home Entertainment 5310 Kirby Drive Houston, TX 77005 (713)526-4317
Friday, April 18, 1997 7:00pm	GNP Audio Video 1254 E. Colorado Blvd. Pasadena, CA 91106 (818)577-7767	Saturday, May 10, 1997 1:00 pm	Audio One 3200 Steeles Avenue West Toronto, Ontario L4K3B8, Canada (416)665-0749	Sunday, June 8, 1997 1:00pm	Sounds Like Music 2734 Westbell Road, Suite 1306 Phoenix, AZ 85023 (602)993-3351
Saturday, April 19, 1997 2:00pm	Audio FX 1415 Howe Avenue Sacramento, CA 95825 (916)929-2100	Thursday, May 15, 1997 7:00pm	United Audio Oaks of Oak Brook 1600 W. 16th Street Oak Brook, IL 60521 (847)205-1950, ext. 168	Friday, June 20, 1997 7:00pm	Woodbridge Stereo 751 Amboy Avenue Woodbridge, NJ 07095 (908)636-7777
Sunday, April 20, 1997 1:00pm	Performance Audio 2847 California Street San Francisco, CA 94115 (415)441-6220	Friday, May 16, 1997 7:00pm	Paulson's Audio & Video 37670 West 12 Mile Road Farmington Hills, MI 48331 (810)553-4100	Saturday, June 21, 1997 1:00pm	Sound by Singer 18 E. 16th Street New York, NY 10003 (212)924-8600
Thursday, May 1, 1997 7:00 pm	American Audio 101 Verdae Blvd., Suite 800 Greenville, SC 29607 (864)288-4293	Friday, June 6, 1997 7:00pm	Bjorn's 530 N.E. Loop 410 San Antonio, TX 78216 (210)828-3237	Sunday, June 22, 1997 1:00pm	Lyric Hi Fi 146 East Post Road White Plains, NY 10601 (914)949-7500
Friday, May 2, 1997 7:00pm	Hi Fi Buys 3135 Peachtree Road N.E. Atlanta, GA 30305 (404)261-4434				

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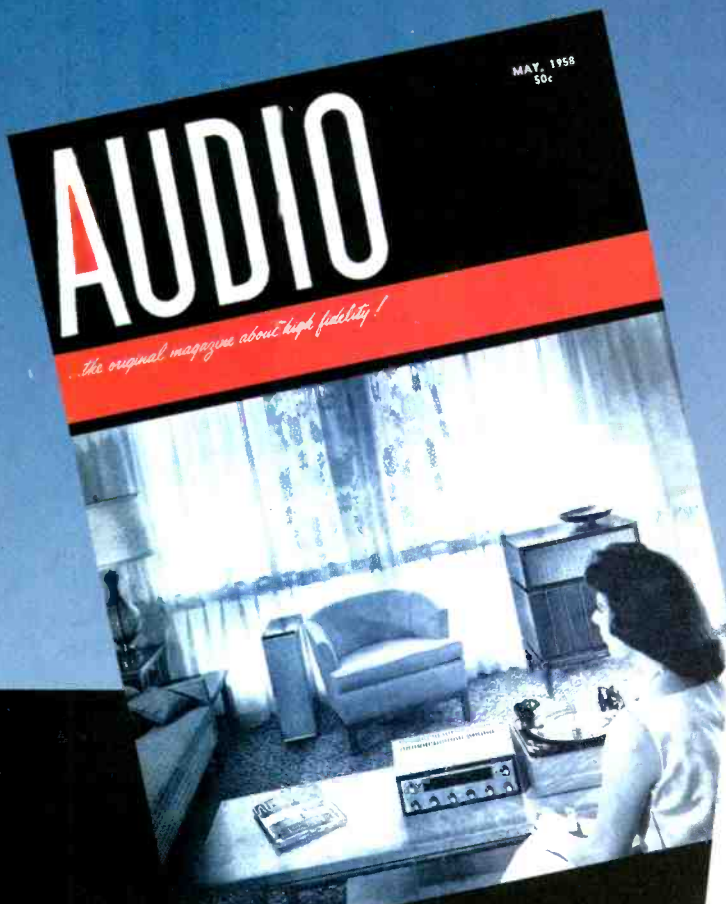
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AUDIO SYSTEMS

Equipment Review

KLH Research and Development Corporation loudspeaker line—H. H. Scott Model 135 Stereo-Daptor control unit

WHEN I first reviewed the Model 135 Stereo-Daptor control unit, I was struck by the way it seemed to have been designed for the purpose of providing the best possible sound reproduction. The design was not just a few inches of metal and wood, but a carefully thought-out piece of engineering. The unit is a very solid piece of equipment, and it is a pleasure to use it. The design is a very solid piece of engineering, and it is a pleasure to use it. The design is a very solid piece of engineering, and it is a pleasure to use it.

The Model 135 Stereo-Daptor control unit is a very solid piece of engineering, and it is a pleasure to use it. The design is a very solid piece of engineering, and it is a pleasure to use it. The design is a very solid piece of engineering, and it is a pleasure to use it.



Fig. 1. KLH Model 135 Stereo-Daptor control unit.



Fig. 2. The new Model 135 Stereo-Daptor control unit.

KLH AUDIO SYSTEMS SPEAKER LINE

MAY 1958

"Loudspeaker that does not sound like a loudspeaker" and "one feels that he is hearing a direct performance" were part of a May 1958 review of the new KLH speaker line. Today, celebrating their 40th anniversary, KLH continues to produce loudspeakers of superior quality and value, firmly believing that "Some people have an ear for music, some people have the speakers to prove it!"



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by David Lander

Glorious Beginnings

A Golden Anniversary Celebration of Audio's Earliest Years



The demure woman on the cover of the May 1951 issue seems unruffled by the monster multihorn speaker in her living room.

Just a few months before the first issue of this magazine rolled off the presses (dated May 1947 and then called *Audio Engineering*), the trendspotters at *Fortune*

homed in on a little-understood hobbyist preoccupation. High fidelity wouldn't become a household term for several years, but *Fortune's* extensive coverage of the phenomenon—the text, photos, illustrations, and charts took up 11 pages in its October 1946 issue—was a shot heard round the world. “That article was the watershed for our company internationally,” remarked Avery Fisher, whose Fisher radio-phonographs won first-place rankings. Some four decades later, this founding father recalled the torrent of orders that flowed in from people who “literally [constituted] a Who’s Who of American industry, education, and government.”

High fidelity was a post-World War II hybrid, in large part propagated by Americans, and the sonic shoots that sprouted from new ground had deep roots. These reached back in several directions to broadcasting,

recording, motion pictures, telecommunications, and even submarine detection. Fisher himself had become an electronics manufacturer shortly before American factories turned their efforts to military work. Headquartered in a 750-square-foot office and manufacturing space, part of a shared loft on Manhattan’s West 21st Street, he was then assembling tuned radio-frequency receivers under the Philharmonic brand name. “The object was to get the best possible reproduction of local stations and the best possible reproduction of recordings,” he later explained.

Fisher, in his own words, was a “meticulous hobbyist who wanted to get the best results,” and there were others like him. In its far-reaching 1946 report on hi-fi, *Fortune* profiled one such man, New York radio engineer Thomas R. Kennedy, Jr., “whose avocation is fine music well performed. A ‘golden ear’ of the richest sheen, he is one of that small band who have dedicated a good part of their lives to extending the range of reproduced sounds to the limits of human hearing,” the writer explained. “Merely reproducing the highs and lows to which most prewar instruments are

1947 - 1997

Avery Fisher tested each of his components, like this early stereo Model 400 Master Audio Control tube preamp, at home.



deaf will not satisfy Tom Kennedy or any other golden ear. A purist, he insists that the tones be noise-free and undistorted, sharp, clear, and full from treble to bass. The only damper his enthusiasm seems to know—so far not very effective—is the fact that when fidelity even approaches the degree achieved in his laboratory, the cost graph rises like a helicopter.”

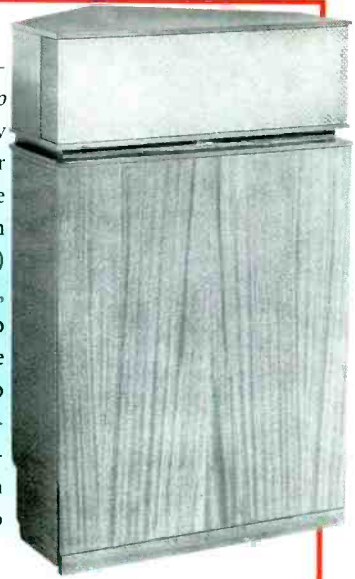
The *Fortune* story went on to document the “fantastic lengths” to which Kennedy had gone in assembling his system, which, “of course, [had] an FM circuit” as well as an amplifier “built at the Bell Telephone Laboratories.” The speaker comprised “three units”; the record player, “to forestall phonograph vibration,” employed a separate motor connected with “a dental-machine belt” to a turntable embedded in 600 pounds of sand. “The pickup arm sports a feather-light sapphire needle kept at even temperature and humidity in an airtight container until just before it is used,” the *Fortune* writer continued. Not surprisingly, Kennedy was sometimes accused of “making a fetish” of his hobby, but

HORN SECTION

When, in the mid-1980s, numerous hi-fi makers began calling their products “digital-ready,” one *Audio* reviewer commented that the only really digital-ready speaker was one Paul Klipsch had devised some four decades earlier in Hope, Arkansas. (Prior to that, the area’s best-known invention had been the Bowie knife.) To scale the cabinet down, Klipsch folded a horn into segments connected by acute angles and split it into two lengthwise sections that re-joined at the mouth. The result was the Klipschorn, which remains in the Klipsch line to this day.



Paul Klipsch's folded-horn speaker, the Klipschorn, could produce deafening sound levels from low-powered '50s amplifiers.



he challenged detractors to compare “music from my equipment with what the average combination gives. You’ll go home and throw rocks at your set,” he boasted.

Funeral March

There was, however, a tarnished side to this glittering coin, and *Fortune*, which had

begun its hi-fi story by noting that the American public “is getting a poor deal today in the line of musical reproduction,” was not shy about laying blame. The report fingered major manufacturers with “standards of fidelity. . . years behind practicable levels.” Given “heavy investments in plants, patents, and franchises,” these companies were said to find high fidelity a threat.

“Cagily,” the publication observed, “they have moved out of the defensive position with an attack,” contending that “the public neither wants nor likes wide-range reception or wide-range instruments.”

The big corporations had evidence of this. *Fortune* cited a test by two Columbia Broadcasting System staffers that found “audiences chose standard broadcasts (up to 5,000 cycles) over wide-range programs (up to 10,000 [cycles]) by more than two to one.” Moreover, FM radio owners, “presumably with highly developed tastes,” voted more than four to one for limited bandwidth while professional musicians came down “against wide ranges and thus, apparently, against high fidelity” by a margin of 15 to one. While there are many possible reasons for this, a

FM and the LP

Edwin Howard Armstrong’s idea of modulating the frequency of radio waves (FM), rather than their amplitude (AM), had numerous advantages, including substantially lower noise. RCA chief David Sarnoff had been an early supporter, but he soon turned his back on the inventor, so Armstrong resolved to finance FM radio from the substantial funds his earlier inventions—the regenerative, superheterodyne,



Peter Goldmark's development of the LP record, at CBS Labs in 1947, was a catalyst to the fledgling audio industry.

and superregenerative radio circuits—had earned. On July 18, 1939, he began broadcasting from his own station, W2XMN, in Alpine, New Jersey. Although FM provided program material that helped hi-fi succeed, it became Armstrong’s nemesis. Entangled in a web of patent lawsuits, on January 31, 1954, he hurled himself from a 10th-floor window. His widow, Marion MacInnis Armstrong, whom he had met when she was working as Sarnoff’s secretary, pursued the litigation that continued for another 13 years and ultimately won.

The long-playing record was an even more significant program source for hi-fi listeners. Developed by Peter Goldmark and colleagues toiling in the electronic vineyard at CBS Laboratories, the LP combined vinyl for quieter surfaces with a narrowed groove and a reduced playing speed. Officially introduced by Columbia in 1947, it remained the reference standard for nearly 40 years.

marantz®

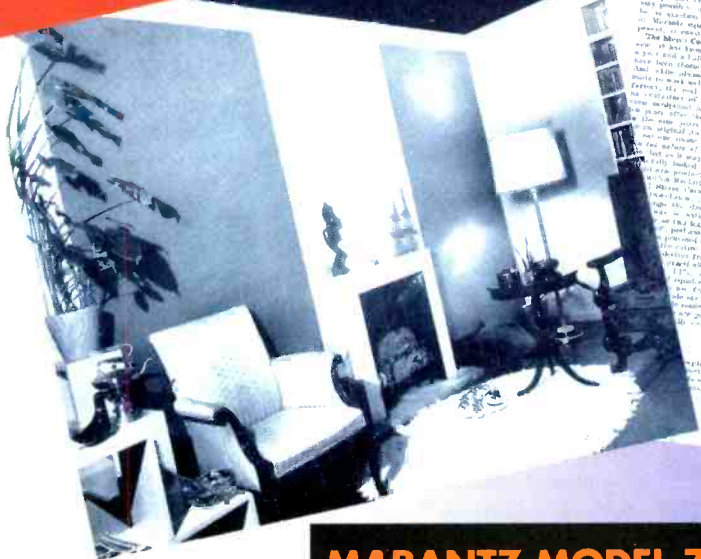
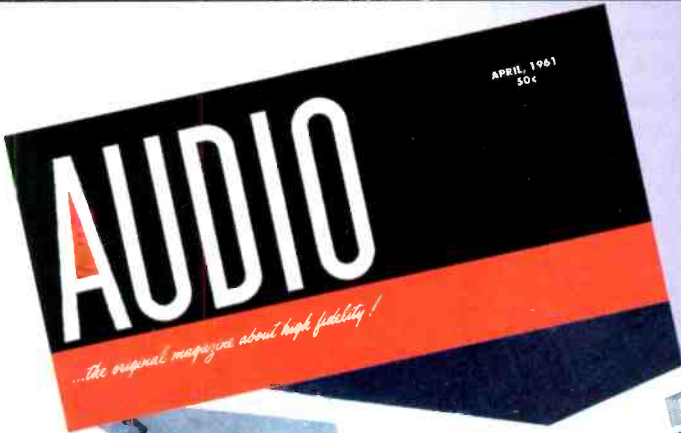


Fig. 1. The Marantz Model 7 Stereo Console.

MARANTZ MODEL 7 STEREO CONSOLE

When in the course of events a new product comes out of the Marantz shop, all audio fans, including ourselves, become excited. These words were chosen not only to describe the Marantz Model 7, reviewed in April 1961, but all Marantz products. That excitement has continued throughout the years and is witnessed today, as Marantz re-introduces the Model 7 as part of the "Marantz Classics" line.

The Marantz Model 7 Stereo Console is a high fidelity stereo system which offers the best of both worlds. It is a complete system, including the Marantz Model 7 Stereo Console, the Marantz Model 7 Tuning Indicator, the Marantz Model 7 Loudspeaker, and the Marantz Model 7 Turntable. The Marantz Model 7 Stereo Console is a high fidelity stereo system which offers the best of both worlds. It is a complete system, including the Marantz Model 7 Stereo Console, the Marantz Model 7 Tuning Indicator, the Marantz Model 7 Loudspeaker, and the Marantz Model 7 Turntable.

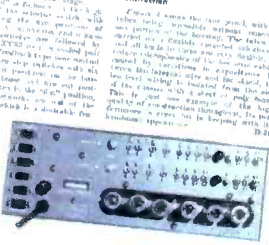


Fig. 2. Rear panel of the Model 7.

AUDIO • APRIL 1961

MARANTZ MODEL 7 STEREO CONSOLE

APRIL 1961

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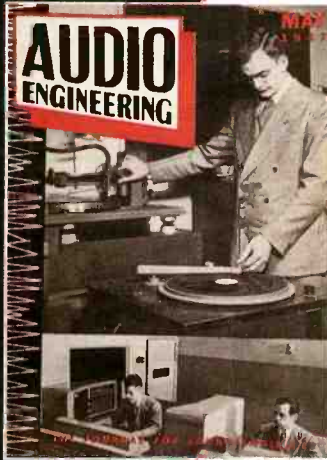
comment by Rudy Bozak, one of hi-fi's first major speaker designers, may explain it best.

"The ear is a very queer thing," Bozak observed. "Our reaction to what we hear is subject to a number of things, not the least of which is our disposition of the moment. You know, I built my first radio set in 1922,

lived in fear of the manufacturing giants, even as the big companies continued to pursue resolutely no-fi marketing strategies. Had they reversed their course and marched upmarket, they may well have crushed the newcomers under their boot heels, but corporate commanders kept their division-strength columns moving straight ahead.

Picking Up

Prior to working with CBS colleague Peter Goldmark on the LP, William Bachman had been an employee of General Electric, where he and his wartime compatriots worked after hours to develop products that the company could sell in peacetime. Bachman's chief contribution was the variable-reluctance cartridge, which dramatically reduced tracking force from 30 grams to a then remarkable 5. This and other innovative pickups—Norman Pickering was pictured demonstrating one of his own on *Audio's* very first cover—were crucial in helping a fledgling industry fly.



In May 1947, the cover of this magazine's first issue showed Norman Pickering testing his innovative new phono cartridge.

Perpetuum Mobile

With a bewildering array of products crowding store shelves, it's hard today for Americans to envision a nation as starved for consumer goods as this one was in the mid-1940s. Jack Fields, for years a New York-area sales representative wholesaling various hi-fi brands, was able to shed light on that era. Shortly before the War ended, Fields related to a group of industry colleagues some time ago, "Webcor got a contract from the Navy to build 400 record changers for recreational purposes." The government had paid for the tooling, he explained, and when the War ended, the company was "prepared to produce, literally, thousands of changers." Fields went down to lower Manhattan's Cortlandt Street, which was lined with a row of radio parts stores. (Along with their counterparts on Melrose Avenue in Los Angeles and in other American cities, they were to become the first outlets for early audio component manufacturers.) Fields had thought he'd sell "maybe 100 record changers," but by the end of the day he had written orders for 6,000.

The sales rep then learned, much to his dismay, that Webcor had reserved all but a few hundred units a month for console manufacturers. These companies found themselves unable to procure enough cabinets to house their allocation, however, so Webcor shipped to the Cortlandt Street dealers, and Fields was on hand the day the first cartons arrived. "I'll never forget it," he

The Upper Register

Frank McIntosh introduced his company's first product, the Model 50W1 amplifier, in 1949. The 50-watt design was the first to keep distortion under 1% from 20 Hz to 20 kHz. It was developed from McIntosh's concept by Gordon Gow (who relinquished the patent rights to McIntosh and was made a vice president of the company, which he later took over and ran for many years). The 50W1 was used primarily for studio and sound reinforcement applications, but a significant number of hi-fi cognoscenti were willing to pay \$249.50 for it. The company made even deeper inroads into the consumer market in the mid-1950s,



When McIntosh abandoned industrial gray paint for chrome chassis and enclosed, black enamel transformer cans, sales of its power amps took off.

when it substituted chrome chassis and enclosed, black enamel transformer cans for the industrial gray paint that previous products had worn. McIntosh's primary marketing tool, however, was its engineering philosophy: Build the best products possible, and build them to last. A traveling clinic program won countless friends as well. McIntosh tested any amp carried into its dealers' showrooms on specified days and compared the specs to those of its own units. The program began in 1962, and, by the time it was discontinued 29 years later, more than 300,000 amplifiers had been tested.

and my loudspeaker system was a soup plate with a pair of earphones put in it. We were tremendously impressed about how great the thing was because, in that particular instance, the novelty matched everything else. It's only after continued hearing or association that people begin to be critical. . . . The ear educates itself in time."

For many years, the small firms that constituted the fledgling high-fidelity industry

RCA

times, the output source should be continuously (and easily) variable throughout its frequency range. Those of us who have used this kind of oscillator in sweep ranges which display the output on a scope know how quickly difficulties can be overcome. Another useful attribute for transistor circuits is the ability to provide a balanced output.

The 11 & W Model 210 is an RCA oscillator which provides all the features mentioned above plus a few more. From the photograph we can see the just-mentioned, calibrated dial which makes it a snap to read frequency accurately. In addition, it can be frequency locked per the dial center. The 210 provides outputs from 10 cps to 100,000 cps in four ranges. It also provides a variable output up to 10 volts, or 50 milliwatts into 8-ohm load.

The oscillator of the Model 210 is a two-stage RCALC and half a 6C17T resistance-coupled amplifier with positive feedback to cause oscillation. Negative feedback is used to reduce distortion and to stabilize the output. Tuning is simplified by means of a variable capacitor and the range is extended by switching resistors, both on the positive feedback loop. An interlocked loop (feedback increases with output) is used to minimize distortion and reduce the output impedance so that the negative feedback is automatically increased, thus tending to

stabilize the oscillator output.

The output of the oscillator goes to the driver, the other half of the 6C17T, which drives a 60/18 period. This provides then an output one of the two outputs in the range from 10 cps to 100,000 cps and the other from 10,000 cps up to 100,000 cps. Negative feedback is provided from the output transformer to

the output of the driver. Frequency response of the 11 & W 210 is with a 0.70 db over the entire range into 8-ohm load. At a 10 volt output the distortion was 0.25 per cent from 50 cps to 20,000 cps, 11%, at a 10 volt output in the range from 10 cps to 50 cps and from 20,000 cps to 100,000 cps, the maximum distortion was 0.11 per cent. The load regulation at 10 volts was less than 0.5%.

Altogether, this is a very fine device used in the 100,000 to 200,000 extreme and well worth the attention of the serious audio worker or lab.

RCA RIBBON MICROPHONE, MODEL SK-46

RCA has been making ribbon microphones for many, many years now. In fact, most of its products were an early sound transmitted by RCA ribbon microphones. We don't even go back to that first ribbon microphone model "44"



Fig. 3. RCA ribbon microphone, Model SK-46.

sound, but rather that RCA is a very experienced maker of this type of microphone.

The SK-46 was designed for use in reinforcement and broadcasting applications. Over the years, ribbon microphones have proved very effective in this type of application, because of their "figure-eight" pickup pattern. This characteristic eliminates or severely reduces pickup of unwanted sounds from the sides of the microphones.

The RCA SK-46 comes in a handsome, (Continued on page 47)

FR

many about the drive servo spot the motor 7 and 15. (check these out) Watch the pump adjust maintain this 0 response should not let signal for a prop. note, view if been well used. me. pl. at. be.

AUDIO

...the original magazine about high fidelity!

JULY, 1964
60p

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RCA SK-46 RIBBON MICROPHONE

JULY 1964

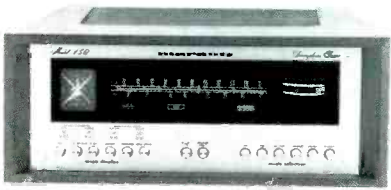
Those in the know who read *Audio*, will recognize RCA's long-standing commitment to high fidelity reproduction. The ribbon microphone, model SK-46, reviewed in *Audio's* July 1964 issue, is testimony to RCA's heritage. Today RCA has turned this heritage into a leadership position in the world of digital technology.

1947 - 1997

marveled, "because I never knew what 500 record changers looked like. The entire sidewalk was blocked off about 10 feet high. Everybody was loading them in, and they were selling them as fast as they could get them."

Avery Fisher held a dim opinion of Cortlandt Street, which he called Swindle Street. An early experience there preceded his in-

The appearance of bookshelf speakers (top shelf), record changers, and integrated electronics helped popularize audio in the mid-'60s. Visible in the lower foreground are a marble-topped Empire Grenadier speaker and Bose's first speaker, the multidriver 2201.



Many audiophiles coveted this high-end Marantz Model 150 stereo tuner with its built-in oscilloscope display.



Classic '50s high end: The Marantz Model 9 tube power amplifier had adjustable bias, DC balance, and AC balance.

terest in the kind of sound that would become known as high fidelity. He had gone downtown, he recounted, to buy a radio as a gift for his parents, whose East 94th Street

apartment then had DC current. His choice came down to two models, one with six tubes and one with eight. Because "Fisher always went for quality," he opted for the eight-tube set. Some years later, when he took the radio in for service, he found that the two additional tubes "were not even in a circuit; all they did was light up." Nor did the hi-fi pioneer ever forget the Cortlandt Street merchant who specialized in used tubes and displayed a sign that stated, "Our tubes are guaranteed for life." That meant the life of the tube and, Fisher suggested ruefully, was not meant to be humorous.

Saul Marantz was just one of the young men who, after the War ended, went to electronics stores seeking parts and information. Recently discharged from the Merchant Marines, he had tried to install a car radio in his living room. "It didn't work," he noted many years afterward. "I found I had to have a 6-volt power supply. And I had to get rid of my loudspeaker because it had an electromagnetic field coil. I went down to Harvey Radio [in New York City] and asked some questions. I didn't know

much about it in those days." He seems to have learned quickly. The company he later founded produced such legendary components as the Model 7 preamp, the 8B and 9 amplifiers, and the 10B tuner; today, these are valuable collector's items.

Virtuoso Duet

Consumer hi-fi exhibitions were ideal showcases for products in a relatively obscure field. The first, the 1949 New York Audio Fair, was officially sponsored by the Audio Engineering Society but planned by this magazine and produced by its sales manager, Harry Reizes. The then-annual event at the Hotel New Yorker engendered shows in Chicago in 1952 and in Los Angeles the following year. In 1954, Japan imported the concept; the reported attendance figure, 55,000, was an early indication of what would become a nearly insatiable national appetite for high-fidelity components.

Build It Yourself

Low-cost, easy-to-build hi-fi kits, like this Heathkit EA-2 14-watt mono tube integrated amp, were popular in the late '50s.



David Hafler's Dynakit Mark III amplifier could be assembled in two hours. The 60-watt amp cost \$79.95 in 1957.

No one will ever know just how many hi-fi aficionados cut their teeth on kits. Eico and Heath were two popular early names, but, thanks to David Hafler, Dynaco's dynamo, that name stands out. For one thing, by relegating much of the critical wiring to the factory, Hafler made sure that buyers could assemble Dynakit quickly, often in a small fraction of the time it took to put together competing products. While Hafler insisted on good sound, he also made sure his engineering staff adhered to simple design principles. This resulted in true value for every dollar that listeners allotted to Dynakit components, and later to the company's wired gear.



AR

ACOUSTIC RESEARCH AR-3A

OCTOBER 1968

In 1954, Acoustic Research introduced the benefits of its original acoustic suspension design in the legendary AR-1. Eight years later, the popular AR-3 was developed. October of 1968 found its successor, the AR-3A, enjoying a review in *Audio* that concluded, "AR has done it, creating a new high standard of performance at what must be considered to be a bargain price." This combination of performance and price continues today as AR introduces the new AR High Output Series Speakers.

the grille cloth is different. The AR-3A model is also identical with that used on the AR-3 except that it only goes up to 575 Hz rather than at the 1000 Hz crossover point of the AR-3. Acoustic Research eliminated roughness at the top end of the woofer, makes the woofer essentially unidirectional and (because of these electrical and physical parameters) maintains consistency.

A hemispherical direct radiator speaker takes over at 575 Hz and a frequency upwards from 1 kHz. In contrast, the earlier model AR-3 crossover frequencies are 1000 Hz and 7.5 kHz. Voice-coil diameters of the new AR-3A and range and tweeter diameters compared with the AR-3's diameters of 2 and 1 1/2 inches, respectively. AR-3A's smaller dome diameter makes it possible to obtain superior dispersion and high-frequency power radiation. At the same time, AR has been able to lower the crossover frequencies, obtain still greater power-handling capacity, even lower distortion, and greater smoothness by design changes in the dome. The new dome uses different diaphragm materials and aluminum wire in the voice coils.

Concerning power-handling ability, always a controversial subject, Acoustic Research's among very few speaker manufacturers who, along with frequency response and related technical data, specify the actual rms power dissipation in a sustained input of 11 watts rms or any frequency for at least 30 seconds, and overload of 400 watts for 1/2 minute (with a 1000 Hz sine wave FM burst). When we connect this input power to acoustic power we observe that the speaker can produce acoustic conversion efficiency of just under 1% for the AR-3A and no more for other peak loading effects in acoustic watts, 0.2 acoustic watts for 30 seconds period. So the AR-3A offers one a respectable sound pressure level capability which should be sufficient for any home and many professional applications. In fact, during our listening tests of the AR-3A, the louder we played it the better it sounded. Due to its low conversion efficiency, however, use of electrical power is required from the power amplifier. This is a

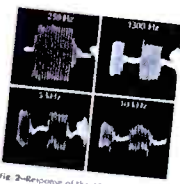


Fig. 2—Response of the AR-3 speaker system to sine wave input frequencies of 200 Hz, 1000 Hz, 5 kHz, and 10 kHz. Excellent transient response is evident at all frequencies.

more clearly put in view of the low quality. To really do justice to the speaker system, and have complete reverse for peaks when listening to it, please that has an available power of 6000 watts (not per channel) at about 50 watts of 0.6 rms.

Performance

In measuring the frequency response of the AR-3A, we found it to be especially wide and smooth. Our null noise yielded an improvement to 17,000 Hz ±0.5 dB after normally setting the tweeter and mid-range level controls and compensating for room acoustics. The bass started to roll off at 30 Hz. The mid range and treble had the two levels of distortion which the significant variations were evident throughout the audio range.

The harmonic distortion performance at bass frequencies was outstandingly low. We measured 5% and 10% at 30 and 50 Hz, respectively, using a 10-watt input level. These are very

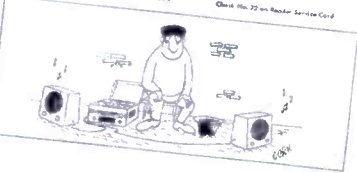
low distortion figures for speakers at these frequencies, with such a high input and volume clearly in the manufacturer's data.

During listening tests of the AR-3A, we could not compare the model after all. In a good speaker, the AR-3, which sounded distinctly better on most program material. No amount of fiddling with the mid-range and tweeter controls in back of the AR-3 could make it sound as good as the AR-3A, which has measurably wider dispersion and dispersion. In fact, in the widest of any speaker we have tested thus far.

The AR-3A's most important asset, lack of peaks when listening to it in a typical listening room. This may very well be the result of its wide dispersion sound field and play with the mid-range and treble controls in back of the speaker. We liked them turned up to maximum here between their average and mid-range positions most of the time. But the best setting really depends on the listening room itself and on how often, the high end of the source material really is.

One of the things that we feel needed extra in the AR-3 is the presence of a selector switch control, though not infinitely because of its remote design. (The manufacturer advises that they use the AR-3A in a competitive speaker market for over eight years. Its basic design and performance would have been perfect if it had been improved with it. AR has done it, creating a what must be considered to be a bargain price.

a amount little in relation. Its signal strength, the minor, went to full scale with a maximum of 30 mV. The increase in power was enough to make the speaker's output of about 100 dB. The speaker's output of about 100 dB was not a surprise. The speaker's output of about 100 dB was not a surprise. The speaker's output of about 100 dB was not a surprise.



Over the 70-watt speaker system.

Acoustic Research Model AR-3A Speaker System

MANUFACTURER'S SPECIFICATIONS:
Impedance: 16 Ohm, Crossover Point: 575 Hz and 3 kHz, Size: 14" x 12" x 11 1/2", Weight: 33 lb., Price: Close to \$115 (Market), Parts: None, and \$200 (Retail). For more information, contact Acoustic Research, 9424 Eton Avenue, Chatsworth, CA 91311.

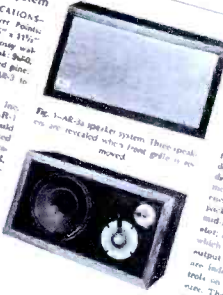


Fig. 3—AR-3A speaker system. This speaker system is revealed in front grille in a moved.

which compromised their excellent and popular speaker systems. A few however, but from a slight roughness in the mid range. It is this part of the spectrum in which AR appears to have focused its attention in design.

The AR-3A, then, in the usual respect of a series of speaker systems designed down into the mid-range, is a speaker system that is not in the AR-3A. This speaker system is in fact, a 12-inch direct radiator, a hemispherical direct radiator, and a 2 1/2-inch hemispherical direct radiator. The speaker system is not independently adjustable by one or more of the controls of the system. The AR-3A's cabinet is designed in use to the AR-3A, externally, only.

CIRCLE NO. 60 ON READER SERVICE CARD



1947 - 1997



The Bozak Symphony No. 1 B-4000A was a big, floor-standing speaker with eight tweeters, a midrange driver, and two woofers.

At just about the time Reizes was writing the libretto for the 1949 Audio Fair, Rudy Bozak was on the road peddling his first loudspeaker. Previously employed by Milwaukee's Allen-Bradley Company, Cincinnati's C. G. Conn and Wurlitzer, Bozak was about to turn 40 and was finally in business for him-

self. But even though he "made a tour from Buffalo to Boston, down the coast to New York and Philadelphia," the trip resulted in only a single sale.

Then an opportunity arose for Bozak to put his speaker in an appropriate setting for a component that was housed in a kettle drum. "I didn't buy any space at the [1949] show from Harry, but they had a loudspeaker comparison on stage in the ballroom, and we were invited to participate," he recalled in the last interview before his death in 1982 (*Audio*, May 1982). "We put our 201 there, and it stood up with the best in the business at that time. There was Klipsch, Altec's 604, JBL, the names that prevailed at that time, and we made a definite impression.

"The thing that really made Bozak," the speaker designer emphasized, was his friendship with the

record producer Emory Cook, "an idealist in recording. The fact that I was an idealist in loudspeakers made for a mutual meshing of feeling," Bozak remarked. "Emory liked to dramatize things, very much so.

He came [up] to me and said, 'Rudy, we want to steal the show at the 1951 Audio Fair. I'll make some recordings and you give me a loudspeaker with good bass and good highs, and we'll put this show on.'" Cook had just the record to do it, *Rail Dynamics*, a recording of trains that he had made, mainly at night, in yards at Harmon and Peekskill, north of New York City. (Cook subsequently noted that "Peekskill is a mountainous area, very nice for acoustics"; the sound, he said, would bounce across the Hudson River and then

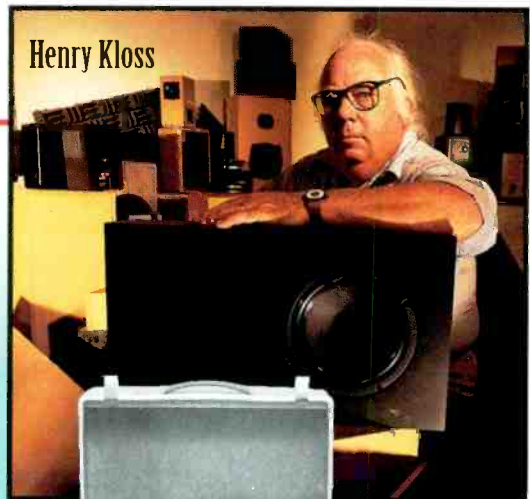


In the early '60s, the AR turntable popularized the use of a floppy platter/tonearm sub-suspension, which greatly reduced rumble and acoustic feedback.

Riding on Air

Edgar Villchur's acoustic-suspension speaker substituted the air in a relatively small, sealed box for the mechanical suspensions that previously helped control driver motion. Though he had to form a company, Acoustic Research, to get the design into production, the AR-1 went on to revolutionize the loudspeaker industry after its 1954 debut. Henry Kloss, an AR co-founder, endowed the venture with a small Cambridge, Massachusetts, manufacturing facility in which he had been building cabinets for the Baruch-Lang loudspeaker, one of hi-fi's earliest models. Kloss also brought along two friends, Malcolm Low and J. Anton Hofmann (son of the legendary piano virtuoso Josef Hofmann). After about three years, Kloss, Low, and Hofmann sold their interest in AR to Villchur and founded KLH. Kloss subsequently went on to other startups, including Advent, Kloss Video, and Cambridge SoundWorks.

The bookshelf-sized AR-1 speaker produced usable response to below 30 Hz.



Henry Kloss

Photo: Robert Lewis



The KLH Model Eleven, designed by Henry Kloss, was audio's first portable stereo hi-fi: The acoustic-suspension speakers folded into the ends of a suitcase housing a record changer and a solid-state amp.

BOSE®



BEHIND THE SCENES

BERT WHYTE

the more intricate... the "big speaker" ... lashed by waves and loved by men.

All the moment, this usually is a most uncomfortable spot. You see, speakers that are reproducing music something in the small speakers have any known as the Bose 901... and thereby lumps a tale.

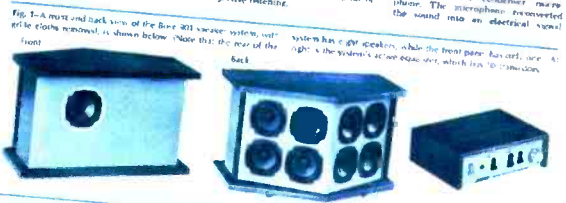
The 12-Year Quest

The speaker was designed by Dr. Amar G. Bose, a Professor of Electrical Engineering at the Massachusetts Institute of Technology. Among other things, Dr. Bose teaches acoustics, and for many years has been an avid music-lover and hi-fi enthusiast. About 12 years ago, he began a research program to investigate loudspeakers, realizing the truth of the old axiom that the chain of music reproduction, from the violin in his younger days and Boston Symphony Orchestra to mostly repeat what he heard in the concert through commercially available loudspeakers. This was especially true with reproduced art, which the speakers replicate sound. "Paraphrasing" words of the loudspeaker designer derived from the inadequacy of standard speaker measurement techniques, which tend to free field testing, and a lot of subjective listening.

Speaker design over the past thirty years has been just one-way, with an infinite and endless, and just one, "individual tuning," and still more will be little argument that equipment designers. There would seem to be a significant role in speaker design. It is also obvious that we don't listen to music in a vacuum; thus, the questions have been raised regarding the relevancy of chamber room.

The task Dr. Bose set for himself was to determine what kind of sound an ideally "perfect" speaker (theoretically) producing could be made, and to develop the techniques of measuring this sound, all within the context of the home listening experience.

With the vast technical resources of MIT at hand, Dr. Bose's Encyclopaedia would simulate the ideal and pressure waves in all directions, it is essential to note that the producing in the same fashion as a normal listening speaker. Thus the normal modes standing waves, etc., would be included in the measurement. The high voltage sphere turned out to be a charged into a typical home-type room. The sound of the speaker also was picked up by a calibrated Wente microphone. The microphone converted the sound into an electrical signal.



BOSE 901 SPEAKERS BEHIND THE SCENES

DECEMBER 1968

Bert Whyte called it a "breakthrough" product, stating "the overwhelming superiority of the Bose 901 system in terms of spatial presentation and stereo effect was immediately apparent. There is no question in my mind about the desirability of the direct/reflecting principle for home listening." Today, almost 30 years later, we know that the 901 Speakers have exceeded even the highest expectations, paving the way for many other successful Bose products.



CIRCLE NO. 69 ON READER SERVICE CARD

BOSE CORP. FRAMINGHAM, MA 01701 PHONE (508) 879-1916 FAX (508) 620-5523

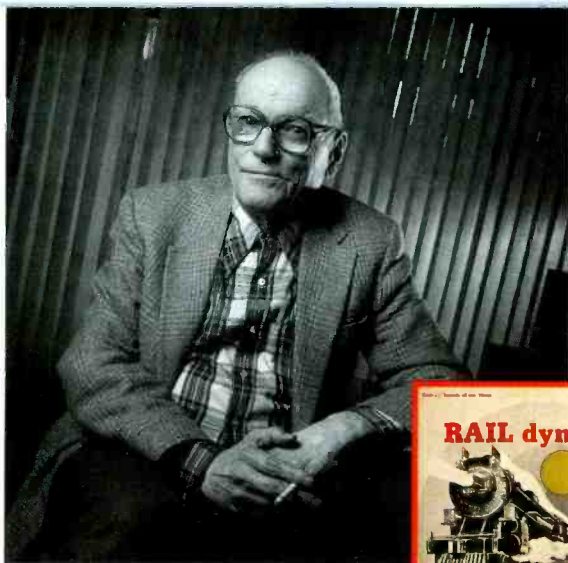


Photo: Robert Lewis



Emory Cook's demo LP recording of steam locomotives, *Rail Dynamics*, wowed attendees at the 1951 Audio Fair in New York.



In the 1950s, Emory Cook made the first stereo field recordings of trains and pipe organs, which audiophiles used to show off their hi-fi systems.

back again.) "We just stole the show," Bozak smiled. "The comments! Down the corridors, from around the corners, people would say, 'Where are those railroad trains?'"

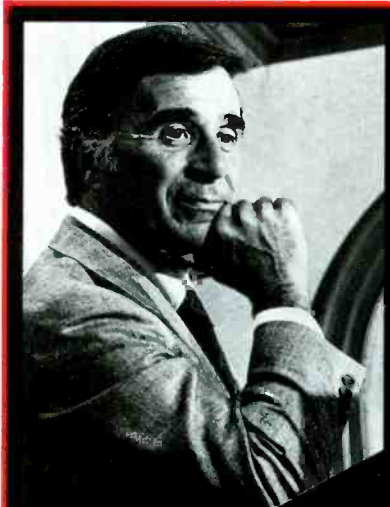
It would have been difficult for some to follow that act, but not for Bozak and Cook. At the 1952 Audio Fair, Emory Cook turned up with a *stereo* record. His system, which he called binaural, divided the disc into two separate bands of grooves, one with left-channel and the other with right-channel information. To play his records, he took along a bifurcated tonearm with twin pickups.

For their next attraction, this dynamic duo provided Audio Fair attendees with truly amazing bass. In 1952, Cook began

during the War. At a session in Boston's Symphony Hall, the producer told Foort that he was going to record him playing at 16 cycles. Recording a tone that low was unprecedented, and the organist said it could not be done. "I said, 'Do it anyway,' so he did," Cook recalled nearly 40 years afterward (*Audio*, September 1989). "He was cooperative enough to do that."

making recordings of organist Reginald Foort, who had been a popular figure in England

To reproduce organ tones down to 16 Hz, Bozak built a special pair of speakers, each of which had two cabinets. The lower housing contained eight 12-inch woofers and measured 4 feet wide, 5 feet high, and 21 inches deep. (A larger woofer complement would have required a box so large that it wouldn't fit through a hotel-room door.) The second enclosure held two 6-inch midrange drivers and a tweeter cluster. A visitor who had heard these speakers at the Hotel New Yorker later remembered feeling his trouser legs flap. Cook himself recalled that, when he played his organ



Sidney Harman, co-founder of Harman Kardon, brought his marketing genius to the audio industry. Harman International now owns JBL, Infinity, Madrigal, Harman Kardon, Lexicon, AKG, Studer, and others.

The Maestro

One of the men who helped get hi-fi out of the back corners of radio parts stores is operating at higher volume than ever. Not long after Sidney Harman founded Harman Kardon in 1952, the company introduced the Festival D1000, the first commercially available hi-fi receiver. Harman went on to earn a doctorate in organizational and social psychology, later both espousing and creating innovative programs to enhance quality of life in the workplace. He served for three years as president of Friends World College, a worldwide experimental Quaker institution, and has

been a Deputy Secretary in the U.S. Department of Commerce. Today, as chairman and CEO of Harman International, the hi-fi pioneer presides over an audio empire that includes JBL, Infinity, Harman Kardon, Madrigal (which produces Mark Levinson and Proceed components), AKG, Lexicon, Revel, Studer, dbx, and other companies. Sales for fiscal 1996 were \$1.36 billion.



Among the earliest stereo receivers, this Harman Kardon Festival model had duplicate controls for each channel and separate dials for FM and AM tuning.

a/d/s/

a/d/s/ MODEL 10 DIGITAL TIME DELAY SYSTEM

JUNE 1979

In June of 1979 president Jimmy Carter signed into law the SALT-2 nuclear arms treaty ending the cold war and removing the threat of global extinction . . .

In the same month, *Audio* magazine's Len Feldman examined the a/d/s/ model 10 surround-sound processor, remarking " . . . once achieved, the effect is really quite wonderful."

Today a/d/s/ uses it's ingenuity to produce products like the MV series loudspeakers, whose wide horizontal and controlled vertical directivity make the most of any system, audio or video.

To hear for yourself what 23 years of experience can do, visit your a/d/s/ dealer today.



ADS Model 10 Digital Time Delay System

MANUFACTURER'S SPECIFICATIONS

Operating Specifications:

Method of Delay: Digital pulse storage
Number of Initial Delays: Five
Length of First Delay: 10 to 40 ms
Length of Longest Initial Delay: Up to 100 ms before recycling
Reverberation Delay: 11
Echo Density: Controllable
Digital Memory Capacity
Memory Cycle Time:

Audio Specification
Impedance (output)
Input Impedance (input)
Input Sensitivity (16 dB)
Maximum Input Level (16 dB)
Output Impedance (16 dB)

ADS calls itself "the complete solution for the serious audiophile." It's no joke either. We certainly appreciate your interest in our products.

Maximum Output Level: 3 V at 0 dB
Front Level: 6 V at +15 dB, 0.5 V at -15 dB/3 V
Dynamic Range: 90 dB/80 dB
Frequency Response: 20 Hz to 20 kHz
30:1 S/N, 30:1:1 to 13 kHz, 4:1, 1:1 dB
THD Plus Noise: 0.005 percent at 2 V
-0.4 dB peak level line

General Specifications
Power Requirements: 120 V 50/60 Hz
3 amperes maximum
Dimensions: 11.75-in. (40 cm) W (with optional rack mount brackets) x 3.5-in. (8.5 cm) H x 12-in. (30.5 cm) D
Weight: 23.5 lbs. (10.7 kg)

See also specifications on page 104

104

Compliance with the new IEC Standards, dependent upon the setting of the two gain controls. Since 3/4 must be measured with 0.5-watt input and 1-watt output as reference levels, it is possible to achieve this output by an almost infinite combination of settings of the input and output level controls. Worst case was obtained with the output level control at maximum, where 3/4 (i.e. 1 watt output for 0.5-watt input) measured at 0 dB. "A" weighted filter results were obtained with the input level control at maximum and the output controls adjusted for the 1-watt output reference (all with 0.5 "A" weighted).

Time Delay Measurements
Our own experiences with audio time delay units have taught us the very low meaningful state measurements can be made concerning the performance of such units. Just:

Fig. 4 - Frequency sweep from 20 Hz to 20 kHz through delayed channel illustrates the comb-filter effect and bandwidth range.



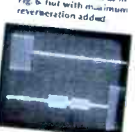
Fig. 5 - Output of delayed channels (lower trace) with (upper trace) and controls set for minimum stage distance and null size.



Fig. 6 - With same input signal as in Fig. 5, but controls now set at maximum stage distance and null size.



Fig. 7 - Conditions as in Fig. 6 but with maximum reverberation added.

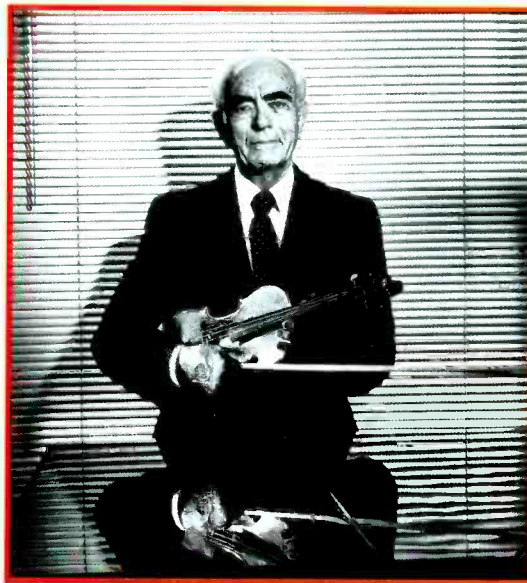


AUDIO + June '79



recording, "The pedal frequencies were heard in the lobby sometimes—felt was more like it. It's not something you could resolve and say, 'Oh, that's an organ' or whatever, but it's strange how [the sound] would travel around the hotel and up and down the elevator shafts then come out in the lobby. A feeling—not music, a feeling. . . . And it wasn't loud in the room. [The speakers] were played only somewhat louder than you would play them in your own living room."

Some of hi-fi's groundbreaking manufacturers, Rudy Bozak and Emory Cook included, held engineer's credentials, but others, like Saul Marantz and Avery Fisher, substituted hobbyist zeal for formal technical training. Fisher had two brothers who were engineers, but his own background was artistic; he had been a prize-winning book designer at Dodd, Mead and Company and was an ardent amateur violinist. Joseph Tushinsky, who did much to establish Sony on these shores, was also a musician and, while still in high school, worked as a professional trumpeter. In 1942, when lack of air conditioning led officials at New York's Carnegie Hall to lease the facility in summer, Tushinsky produced a light opera festival there and conducted every performance.



Avery Fisher, an ardent amateur violinist, donated \$12 million to New York's Lincoln Center for the Performing Arts when he sold his company.

rather poorly when Irving devised a dual-prism widescreen process that seemed promising. The Tushinskys, who were working at the RKO studios at the time, formed a company to produce the lens and, at the suggestion of Howard Hughes, named it Superscope.

In 1957, Far East Film Laboratories invited the Tushinskys to Japan to install their system. *Fantasia* had just been rereleased in their process, and "the name Superscope was blazoned all over Tokyo," the elder

brother recalled. This put the men in a favorable light when they visited Sony headquarters, where they spotted seven

tape recorders that they learned were the world's first stereo models to have inboard amplification. In true Hollywood fashion, Joe Tushinsky pulled a sheaf of yen from his pocket (he had received a plane-fare reimbursement in Japanese currency, but government regulations required that he spend most of it before leaving the country) and brashly offered to buy all seven machines. He told his hosts he'd show them in America, where they might prove salable. (He later confessed that he wanted to get them out of

sight until he concluded a deal to become the U.S. importer.) Tushinsky got six of the tape recorders, and he closed the deal. A few years later, in the early '60s, Superscope acquired Marantz from its founder and began producing equipment under that venerable name.

Coda

A. Whitney Griswold, a former English professor and Yale University president who died in the early 1960s, once rhetorically asked if *Hamlet* could have been written by a committee. He could have been making a point about the high-fidelity industry. Almost without exception, individuals—not corporations—created hi-fi, and they were highly passionate about their products.

Photo: Kevin Knight

In an interview (*Audio*, September 1990) conducted in the Park Avenue apartment where he lived for many years, I asked Avery Fisher if he had ever considered lowering the quality of his equipment in order to appeal to a larger market. "It never entered my mind," he replied, "because I had no personal interest in it. No model we ever turned out was brought anywhere near production before prototypes were brought into this home, this room as a matter of fact, and lived with for a while."

In 1973, Fisher donated \$12 million (more than a third of the \$31 million he had received when he sold his company a few years earlier) to New York's Lincoln Center for the Performing Arts. As a result, one of the city's two principal concert halls now carries his name. Other first- and second-generation hi-fi names continue to grace today's equipment; they pay homage to the talents of men named Bose, Bozak, Grado, Harman, Kardon, Klipsch, Koss, Marantz, McIntosh, and Shure. Still other names associated with the nascent hi-fi industry—some little known, some as recognizable as that of H. H. Scott—have faded into silence. But even after most or all disappear into anonymity, music lovers will owe a debt to those who cultivated the high-fidelity garden in its earliest years. At times, the soil must have seemed less than fertile. A



When Joe Tushinsky got a deal in 1957 to distribute Sony open-reel stereo recorders in America, he used the name Superscope, which he had used for a 3-D movie process.



The following year, with his younger brother Irving, Tushinsky migrated to Southern California to work in the film industry. When 3-D movies became a fad in the early '50s, the pair began searching for a process that would eliminate the cumbersome glasses the medium required. As Joe Tushinsky later recounted, they were faring

CERWIN-VEGA!®

Behind the scenes

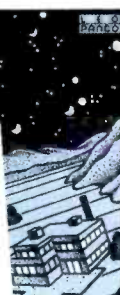
Bert White

In recent months I've been discussing various aspects of recordings with wide dynamic range. I have pointed out the difficulties of coping with the 64-dB dynamic range that appear to be the maximum on recent analog recordings, let alone the problems that will arise with the potential 90-dB range of true digital recordings.

It is quite unfortunate that the proponents of the laser/optical and capacitance types of digital discs are still battling each other to establish their supremacy. The various systems are incompatible with each other, and agreement on standardization still seems to be a long way off. Industry pundits are prophesying that digital discs are at least 5 to 10

the homes of myriads of music lovers, and its ability to handle the dynamics of digital recordings. Usually there is a receiver with low to medium amplifier output coupled with a pair of low-efficiency loudspeakers. To put it bluntly, such a combination simply cannot reproduce the 90-dB dynamic range of digital recordings. In a typical situation, allowing for a fairly quiet room with an ambient noise level of about

quantities of bass drums and tympani. I should also point out that I am not singing out "cheaper, low-power, low-efficiency systems for their inability to handle wide dynamic range," since many very expensive combinations of exotic amplifiers and speakers are similarly plagued by inadequate dynamic headroom. The hard fact of the matter is that very few amplifier/speaker combinations presently available will be able to reproduce the full dynamic range of the digital disc without distress. It is obvious that whatever the sonic attractions of low-efficiency, loudspeaker design, except for a few special cases, manufacturers will have to develop new high-efficiency designs for the proper playback of digital recordings.



... of loudspeakers at Cerwin-Vega's plant in Arleta, Calif.

wide SPL or full dynamic ex-

speaker clusters for rock concerts of more than a hundred thousand people. In 1972 he began to concentrate on the audio consumer market with an extensive line of high-efficiency loudspeakers. These were bread-and-butter designs, but they found a ready market with rock musicians with their seemingly insatiable thirst for high playback levels. Gene didn't neglect his research into innovative ideas for high-quality loudspeakers, however, always the underling. He developed an 8-inch high efficiency, 1000-watt, and one of his stunts: at hi-fi shows he would plug his brute into an ac outlet with obviously an amply 60-Hz signal. One of his company's most interesting designs was the Magnastat. This had a thin-film diaphragm, approximately 65 inches, which was inserted into an exponential horn, and coupled to a very clean, The Magnastat produced a very clean, high-level output from 800 Hz to beyond 20 kHz. Unfortunately, the device proved to be too costly to manufacture.

shet surely 2 and in will great the mos the ince the au- mis "gs re-

AUDIO • June 1980

of Vega's bounding

It was then that we were invited to a gentleman whose company I'd been recruited with high-efficiency speaker designs. Gene, the former head of Cerwin-Vega, the man I know best in these parts, had a hard time in these days. He was worried about his own demonstrations with their air demonstration levels. But one source pressure engineer with him, a very serious engineer which help him understand with high SPL his design philosophy. Like many engineers in the audio industry, he was involved with a number of distractions in the aerospace industry. In the Aero Corp. he worked on high speed transducers and related equipment, and at Douglas Aircraft Company, he was instrumental for ultra-acoustic instrumentation, and vibration phenomena, including the design of wide-range speaker systems capable of 150 dB SPL.

Gene founded Vega Labs in 1954 as a part-time adjunct to his aerospace work. In 1957 he introduced the first hi-fi state amplifier, with 125-watt output, a huge amount, back then in hi-fi. Gene's love of music and audio remained, he left the aerospace industry, he changed the name of his company to Cerwin-Vega, and devoted his energies to its growth. With his commitment to high-efficiency speaker design he became a big OEM supplier to the musical instrument companies in the early 70s. Gene was supplying 3000-watt amplifiers systems and huge high-efficiency

AUDIO • June 1980

CERWIN VEGA "BEHIND THE SCENES"

JUNE 1980

"Loud is beautiful . . . if it's clean," has always been the motto of founder Gene Czerwinski and his company, Cerwin Vega. In the 70's it was a 50,000 watt amplifier system, huge high-efficiency speaker stacks for rock concerts, and the special effects speaker for the film "Earthquake." In the 80's it was Cerwin Vega's Digital Series speakers, the world's first truly "digital ready" line of hi-fi speakers. Today, Cerwin Vega continues to build some of the finest and loudest speakers one can buy.



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CIFCLE NO. 79 ON READER SERVICE CARD



MILLER & KREISEL SOUND

M&K SOUND SATELLITE-1A AND VOLKSWOOFER-A LOUDSPEAKERS

APRIL 1982

Congratulations on reaching 50. In just two years, M&K Sound will be halfway there! Since 1974, M&K Sound has been the leader in high performance Satellite & Powered subwoofer speaker systems for music and home theater. In the April 1982 issue, *Audio* reviewed M&K's Satellite-Volkwoofer system, a prime example of M&K's pioneering work in the area of Satellite-Subwoofer speakers. The late Richard Heyser, who set the standard for modern loudspeaker reviews, commented "overall, the combination delivered excellent stereo imaging and it could handle enormous peaks without breakup of sound." In 1997, M&K Sound continues to lead the industry in manufacturing high-performance speaker systems for stereo and 5.1 multichannel systems.

I can genuinely recommend using the Volkwoofers for low bass augmentation on even the very finest loudspeaker systems.

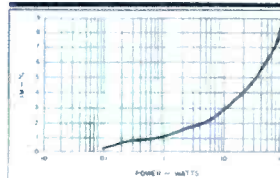


Fig. 10—10% distortion for the tones of E₂ (82.6 Hz) and A₂ (440 Hz) mixed in a one-to-one ratio.

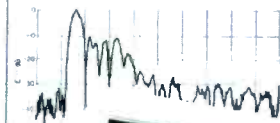


Fig. 11—Energy response.

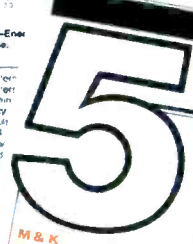
subdued German Domo sound. Exotic, ascription to the contrary, this gave the most accurate sound to my ears. The Volkwoofers were placed directly beneath the Satellite-1As, which were mounted one meter off the floor.

My overall impression of the complete system (Satellite-1A and Volkwoofer) is that the Volkwoofer is truly the star performer of the two in terms of uniformity and accuracy of sound. To my ears, at least, I could not get completely accurate tonal balance for the system, perhaps and subtle portions of the spectrum. The sound was clear, overall stereo imaging was excellent, and the system handled enormous peaks without breakup. Bass pulse and number vocal didn't present a strong illusion of some presence, in my opinion. However, those last two tests are among the most difficult for a speaker.

Part of this relates to a change of instrumental timbre with listening position relative to the Satellite speakers. There is a preferred listening position, an M&K points out in their brochure, and when one is in this specific position, the sound can be equalized to be reasonably accurate. Moving away from this position, particularly up or down, alters the tonal balance.

The Volkwoofers, on the other hand, do not need to be so carefully positioned. They deliver accurate sound whether their listener is seated, from almost any reasonable room location, and go right downstairs to deliver solid, yet bass. The deep resonance together with say, a low angle, beta factor or a warped record or someone walking past a door mounted turntable can drive the cone to its excursion limits and perhaps beyond so that a listener should be aware of the possibility.

It is the only transducer capable of reproducing the dynamic range of a live performance. It is the only transducer made a variant effort at reproducing the dynamics of a live performance.



EQUIPMENT PROFILE

M & K SATELLITE-1A and VOLKSWOOFER-A LOUDSPEAKERS

Use #
 For room, wood, etc. 31-11-11-11-11

Manufacturer's Specifications
 Internal Amplifier Power: 60 watts
 Input Impedance: 200 ohms
 Frequency Response: 18 to 100 Hz
 Driver: 12 inch oval, v.d. 200
 Cabinet Finish: Walnut with black grille

Power Requirements 120 v a.c. 50/60 Hz, 1000 watt consumption 75 watts

Dimensions 17 1/2" x 14 1/2" x 14 1/2" (43.02 cm) x 36.83 cm x 36.83 cm
 Price: \$595.00 each

Satellite-1A Manufacturer's Specifications
 Input Impedance: 200 ohms
 Frequency Response: 50 to 22 kHz
 Drivers: two 7-inch domes and two 5-inch cones

Minimum Power 7.5 watts per channel (no) Maximum Power: 200 watts (with) with 100 dB peaks (at 100 Hz)

Dimensions 21" x (53.34 cm) x 7 1/2" x 19.05 cm x 19.05 cm
 Price: \$210.00 each



CIRCLE NO. 93 ON READER SERVICE CARD

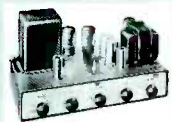
M&K SOUND CORP. 10391 JEFFERSON BLVD. CULVER CITY, CA 90232 PHONE (310) 204-2854 FAX (310) 202-8782

AUDIO MILESTONES

THE MARCH of TECHNOLOGY



one



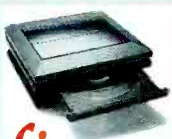
two



three



four



five

Audio was already old when *Audio* was founded. Much had happened in the 70 years since Thomas Edison's invention of the phonograph: Disc recordings had replaced cylinders, electric motors had replaced clockwork, and recording and reproduction had become electronic. Radio now carried music through the air (almost entirely on AM). Tube types had multiplied, and distortion had been reduced by feedback. Speakers had permanent magnets that required no power supplies, and designers had learned the importance of baffles and enclosures. Tape recording was known, but hardly anyone used it. And everything (aside from Walt Disney's *Fantasia*) was monophonic.

Admittedly, audio progress in those 70 years was slowed by two World Wars, but its pace has been dizzying since then. Phonograph records changed from short, brittle 78s to more durable LPs that could hold whole symphonies—and then gave way to the digital Compact Disc. Music radio has mainly shifted from AM to FM, with some music broadcast digitally, via satellite. Tubes have been largely displaced by transistors and integrated circuits. Speakers have improved in every possible respect while mostly becoming smaller—and radical new driver types are about to emerge from the labs. Tape became common, then convenient and, for some users, digital. We've gone from mono to stereo to 5.1-channel home theater.

Audio can claim a drop of credit for all this: The Audio Engineering Society began among our then largely professional readership. But most of the credit goes to the many people who worked to develop the new technologies that we have reported on. And some of it belongs to the physicists and others who gave us such science fiction marvels as transistors, lasers, and digital technology.

In the next few pages, you'll find some specifics on the past half-century of audio history, by veterans who've participated in and observed it.

Joseph Grado—who went from watchmaking to designing cartridges, tonearms, headphones, and other audio products (pausing along the way to sing opera professionally)—leads off with a brief overview of record-playing. As proprietor of Joseph Grado Signature Products, Mr. Grado devotes most of his time to research in microphone design, sound recording, and other technologies.

Eascom H. King, a longtime amplifier designer and *Audio* reviewer, covers some highlights of amplifier history. Mr. King has been a consultant to many well-known audio companies and is now working on digital circuitry.

Our history of home recording comes from Robert Long, who worked in radio and commercial recording before becoming a journalist. During the '70s and '80s, he was Audio-Video Editor of *High Fidelity*, where he instituted new test procedures. Like Bascom King, Mr. Long is one of *Audio's* Contributing Editors.

Ken Kantor, who has written several articles for *Audio*, outlines recent speaker history. Mr. Kantor is Vice President of Technology for Now Hear This (NHT). Before co-founding NHT, he was director of R&D at Teledyne Acoustic Research and has been an executive of the Audio Engineering Society and other professional organizations.

Finally, as a reminder that not all developments work out as planned, we present Robert Long's summary of audio follies.

Ivan Berger

AUDIO MILESTONES

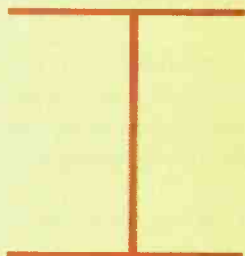
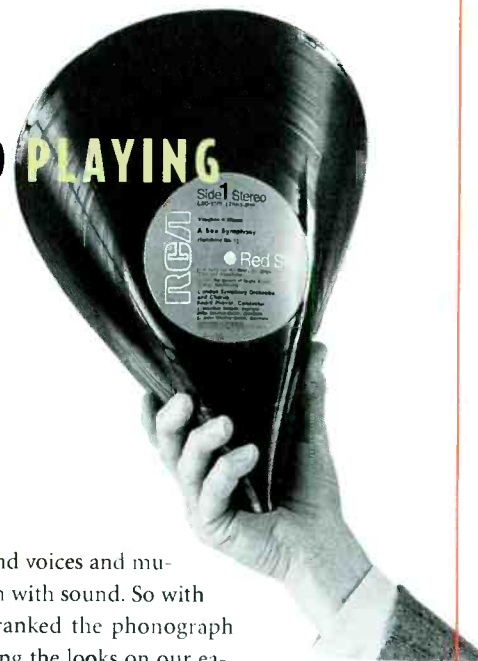
THE MARCH *of* TECHNOLOGY

50th ANNIVERSARY

one

50 YEARS AND MORE OF RECORD PLAYING

by Joseph Grado



It was almost 70 years ago that I heard my first phonograph record, and it is a moment that I will remember and cherish for the rest of my life. It was a Sunday morning, and while my mother was preparing one of her fabulous Sunday dinners my father busied himself carrying a rather large box into the dining

room. There obviously had to be something very special in this box, because he had a look of anticipation on his face that I had never seen before. He placed the box on the dining room table, and after he had unpacked it my brothers and I looked with awe upon this beautiful machine of polished wood and shining metal.

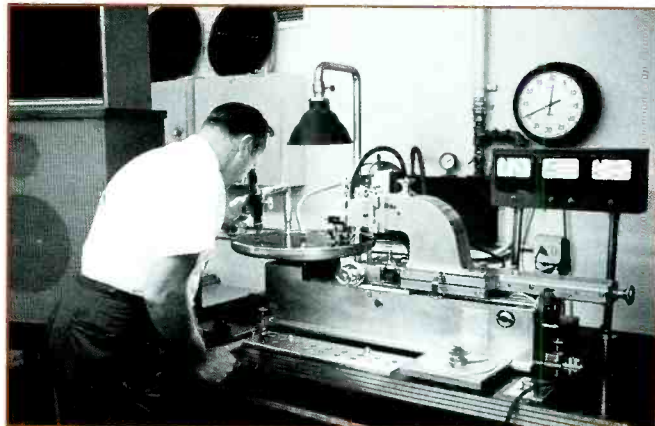
But what was it? If it were a toy, how did it work? My father smiled and proclaimed with all of the pride he could muster, "This is a phonograph machine. It talks, it sings and makes wonderful music." We all laughed heartily; he was joking, of course—how could people fit into that tiny little machine?

Seeing our confusion, he sat us down and explained to us: First he would crank up the machine. Then he would put the flat black disc on the flat metal plate with the green velvet pad, and when the black disc was turning, he would put the shining metal tube (the needle), which was attached to the great

horn, onto the disc, and voices and music would fill the room with sound. So with great ceremony he cranked the phonograph machine while watching the looks on our eager faces. He then very carefully placed the black disc on the green velvet pad, and then, with the greatest of precision, he set the needle onto the disc. The first sound I heard from a phonograph was the voice of Enrico Caruso singing "Celeste Aida." It was the most beautiful sound I had ever

LP records were much harder to break than 78s, but when RCA made some so thin they could be bent, skepticism reigned.

A Scully record-cutting lathe.



SONY®

Audio

NOVEMBER 1982 • \$1.50 • E06030

**EXCLUSIVE!!
FIRST TEST!!**

**SONY'S NEW
COMPACT DIGITAL
DISC PLAYER**

**REVIEWS:
AKAI GX-F66RC
CASSETTE
DECK**

**SHURE V-15 V
CARTRIDGE**

**CAMBRIDGE 310
SPEAKER**

**MISSION 777
POWER AMP**

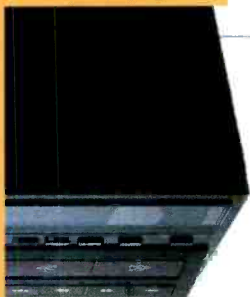


SONY CDP-101 CD PLAYER

NOVEMBER 1982

In November, 1982, *Audio* had the distinction to review the Sony CDP-101, the world's first production Compact Disc player. Len Feldman wrote "I feel as though I am witness to the birth of a new audio era."

Since then, the words *Sony* and *digital* have become synonymous, as exemplified by the latest Sony benchmark, the CDP-XA7ES.



SONY'S DIGITAL COMPACT DISC PLAYER

LEONARD FELDMAN

these small digital audio discs so many times that I wanted to see for myself, with a Sony Esprit system, if they were really as good as I had thought. To put it in as few words as possible: They are—and then some!

So much has been written about the compact digital audio disc, a joint development of Sony and Philips of Holland, that I don't think I need repeat the basic principles of operation of the disc and its player. It has been argued by some that once digital players and discs become standard, there will be no difference between



AUDIO/NOVEMBER 1982

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CIRCLE NO. 108 ON READER SERVICE CARD





Consoles like this 1960 Ampex Crescendo (\$1,995) looked good in living rooms. However, vibration from the built-in speakers (covered here by sliding tambour doors) affected their fidelity.

or qualities and seemingly endless potential. In the late 1940s, the quality of the 33 $\frac{1}{3}$ -rpm records allowed the phono pickup designers to really advance the state of the art. Then the improvement of sound really began to accelerate, creating a realm of equipment separate and distinct from the conventional consumer

heard. My brothers and I of course begged my father to play it again and again, not that he really needed any urging. The more he played it, the more we wanted. It was a truly wonderful experience, and in that moment my life began.

boombox console, furniture-oriented music systems. By the early 1950s, this quality-sound mini-industry had achieved its own full-fledged identity; it was now officially called the "high-fidelity industry," and its soul (not a misspelling) purpose was to create the best possible sound, no matter what the obstacle. Although the phono system, as it was now called, played a major part in the creation and evolution of high-fidelity sound, it was fully supported by the other components in the overall system.

THE FIRST SOUND I EVER HEARD FROM A PHONOGRAPH WAS CARUSO SINGING "CELESTE AIDA," THE MOST BEAUTIFUL SOUND I'D EVER HEARD.

The people who were the high-fidelity industry at that time were by and large ordinary audiophiles who had an insatiable curiosity and desire to make things sound better

Since that Sunday in the year of 1928, much has happened to the phonograph system. Electronic reproduction was added to the system a few years later, and evolutionary changes to the phonograph pickup itself continued steadily until World War II intervened.

During the War, the phonograph played a major part in sustaining the morale of the human race both in and out of the military. When people played their sentimental recordings of the day, it made them feel closer to their loved ones fighting the War thousands of miles away.

When the War ended in 1945, the world community started the monumental task of putting itself in order. One must remember that for almost six years virtually no civilian products of any kind were manufactured, and the whole world had to be once again resupplied. It was at this time that the 78-rpm record was reaching the end of its zenith and the new, revolutionary long-play 33 $\frac{1}{3}$ -rpm record was beginning to make inroads, soon to establish itself as the new standard of the world. Imagine, instead of ten to twenty 78-rpm records to hear one symphonic piece, you could now hear it from one record, unbreakable and with better sound. The old 78-rpm records were very brittle and would shatter when dropped on the floor. The new 33 $\frac{1}{3}$ -rpm records were made of a plastic material that was virtually unbreakable.

It was the 33 $\frac{1}{3}$ -rpm record that made the first large contribution to the birth of the high-fidelity industry, because of its superi-

and to share it with other people. It was during this period that I realized my credo in life, which is: "Although perfection is never achieved, it must always be the



Life was simpler for makers of monophonic cartridges like the Fairchild 225-A, Joseph Grado's first audio design.

General Electric made some of the most popular monophonic cartridges, but the company's stereo pickups, like this VR-22, were less well accepted.



PIONEER®

PIONEER CLD-900 LASER DISC PLAYER

FEBRUARY 1985

Pioneer, the leader in laser disc technology for 12 years, unveiled its breakthrough unit, the CLD-900 in February 1985. Len Feldman commented, "You're not likely to tire of the excellent video reproduction and, now, excellent sound quality you can get from this combination player." Pioneer continues to be on the forefront of optical disc technology in 1997 with the only combination laser disc/DVD players on the market.

Audio

FEBRUARY 1985 • \$2.00

MFSJ'S
ROLLING STONES
COLLECTION

**BREAKTHROUGH UNIT:
PIONEER CLD-900
PLAYS LASER DISCS
AND COMPACT DISCS!**

**NOISE-REDUCTION
ADD-ON UNITS:
ONE FOR TAPE, ONE
FOR ANY SOURCE**



EQUIPMENT PROFILE

1

PIONEER CLD-900 COMPACT DISC/ LASERDISC PLAYER

**Manufacturer's Specifications
CD Player Section Only**
Frequency Response: 5 Hz to 20 kHz ±0.5 dB
SN Ratio: 96 dB
Channel Separation: 94 dB
THD: 0.003% at 1 kHz
Output Level: 2.6 V at 0 dB level
Power Consumption: 42 watts
Size: 16.8 cm H x 142 cm W x 144.7 cm D
Weight: 35 lb 3 oz (16 kg)
Price (Approximate): \$1,700
Company Address: Pioneer Video
200 West Grand Ave., Monroeville, PA 15146
For literature, circle No. 90

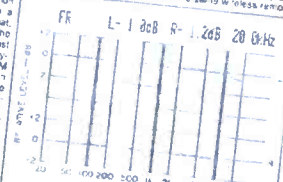
It was bound to happen sooner or later. Nearly two years ago, after speaking to Bob Lockhart, a leading technical executive at Pioneer on the West Coast, I was struck by the prospect of a common element—their products—CD players and LaserDisc or video disc players. I asked that player could do both to make a comparison of program sources. At the recent Japan Audio Fair in October 1984, I was able to see the new Pioneer CLD-900 combination player. A month or so later, I was given a production prototype of the machine as well as a copy of the Pioneer magazine article.

What Mr. Lockhart failed to tell me during our discussion was that it is possible to record the soundtracks on a LaserDisc or video disc using the compact disc (CD) format and that such discs would be compatible with the combination player. It became a reality indeed that is what has happened. With the full combination CD/LD player, I was given a videotape which contains not only the stereo frequency-modulated audio tracks which have been the standard in a disc format since the ATM technology was introduced in 1978, but also a stereo of excellent quality. Both kinds of audio are of course, essential for the sound reproduction capabilities of the new Pioneer CLD-900 combination player.

There has been a lot of talk about the more obvious advantages of the LaserDisc and Compact Disc players, but they have gone beyond that. It was also impressed by the clever way in which they have designed their remote controls. The design of the LaserDisc remote control was by the design of the LaserDisc player itself. The design of the Compact Disc remote control was by the design of the Compact Disc player itself. I believe that

when playing a Compact Disc you would also have the video output of the unit connected to your TV set or video monitor. This being the case, they are good for that video screen to display all the information sometimes found on CD players. Therefore, the front panel of the CLD-900 remains relatively uncluttered, considering the great number of controls and features it supports.

As for the LaserVision features, they are just about the same as those found in Pioneer's dedicated LaserDisc players, such as the VL Mode-LD 700. The same wireless remote



CIRCLE NO. 108 ON READER SERVICE CARD

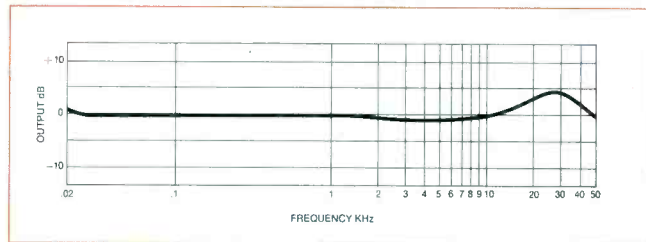
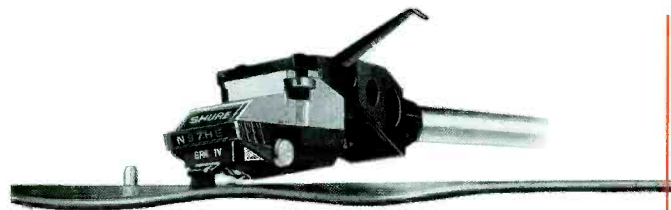
PIONEER 2265 E. 220TH STREET LONG BEACH, CA 90810 PHONE (213) 746-6337 FAX (310) 952-2260

goal, for mediocrity begins only when things are good enough." This credo is still my guiding light to this day. For all of us, money was never the goal. If we had enough to pay the bills and some left over to pay for more research (in those days it was actually tinkering and experimenting), we were satisfied. The dealers were also manufacturers of sorts, since in the early days of high fidelity, loudspeakers were supplied primarily as component drivers, so the dealers had to design and build their own speaker systems from scratch. Everybody was an engineer, and everybody was a manufacturer, but mainly everybody was a devoted audiophile obsessed with the quest for better sound. In essence, everybody who loved quality sound, every fellow who made components in his garage, along with the music lovers at home who helped guide us with their critiques, were part of the creation and growth of the high-fidelity industry. Dealers, like the new audiophile consumers, would audition every new product, and only the best would be chosen for sale to the ever more critical audiophile. It was this upward thrust for absolute quality of performance that was and is responsible for an almost trillion-dollar audio/video industry today.

But here I am off the beaten track. *Audio* magazine asked me to write an article on the evolution of the phono system from 1947 or

Shure's Dynamic Stabilizer brush helped cartridges track warped discs; sweeping the groove was a secondary benefit.

For CD-4 quadrasonic LPs, cartridges needed high output above the audio band, as shown here for a Shure M24H.

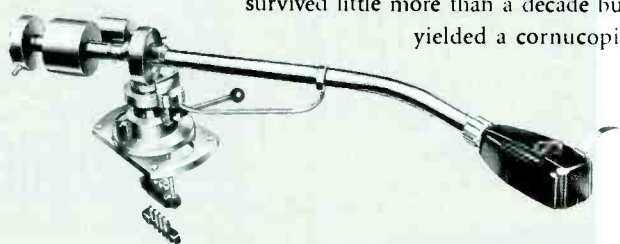


The Grado Micro-Balance arm was made of walnut and originally cost \$29.95.

IF WE AUDIO PIONEERS HAD ENOUGH TO PAY THE BILLS, WITH SOME LEFT OVER FOR SEAT-OF-THE-PANTS RESEARCH, WE WERE SATISFIED.

so until the present day, and here I am reminiscing. But how can one really tell about the present without at least describing a little about the past?

The monophonic 33 $\frac{1}{3}$ -rpm vinyl phono disc survived little more than a decade but yielded a cornucopia



An early version of the famed SME tonearm.

of engineering information to show us what was necessary to create better, better, and even better sound. It was about

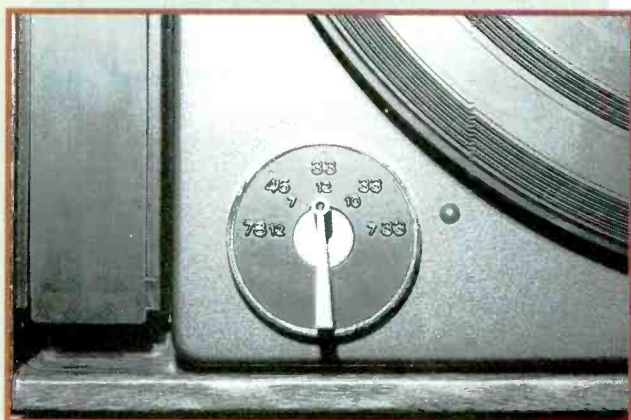
1955 when the high-fidelity industry was getting very serious about something now called stereophonic sound. (It had once been called bin-aural.) This stereo sound, as it quickly became known, was supposed to be the magic carpet to the ultimate sound reproduction, and indeed it was for a while. But like anything else in life, the new knowledge created as many problems as it solved.

Stereo was a bonanza for some manufacturers but a nightmare for the phono industry. While speaker, microphone, and other manufacturers simply doubled their production and profits, phonograph manufacturers had to design a new and infinitely more complex phono pickup, manufacture it, and sell it for the same price as the old mono pickup.

Phono pickups, as they were called for several decades, were a real challenge for conversion to stereo. But allow me to correct myself: The mono pickup *could not*

be converted into a stereo pickup; a stereo pickup required a totally new design. In a mono pickup of the day, the cantilever had to move only in the horizontal plane and to achieve an upper-frequency response of 20 kHz with a distortion level of about 2% while tracking at 3 grams. A stereo pickup cantilever has to have a 360° range of motion and achieve a frequency response beyond 20 kHz with a distortion level of 1% while tracking at 1.5 grams or less. This indeed presented some monumental problems to the designer, because to achieve a perfect 360° vectored compliance was virtually impossible—the application of any sort of vertical tracking force made the compliance asymmetrical, thereby causing the pickup performance to deteriorate.

Moreover, there were dozens of different mechanical and electromagnetic concepts of phono pickup design, and the time allowed phono pickup manufacturers to design totally new stereo phono cartridges (from the industry choice of the Westrex stereo system to the introduction of stereo product to the general public) was virtually overnight. This made life for the phono pickup designer a vir-



tual living hell. But, as always, the designers came through. And thank goodness, because without the phono pickup there would have to be a stereo postponement, since phono records were the main source of recorded musical entertainment.

During the 1960s, phono pickup performance improved steadily, and more attention was now being paid to the shortcomings of tonearm design. Tonearms at that time were of the large, massive studio type, barely capable of tracking at 3 to 5 grams. One pickup manufacturer designed a beautiful, light-mass tonearm made of hand-rubbed walnut and well capable of tracking at one-quarter of a gram. For the first time a tonearm was not only pleasing to the eye but truly functional. Its “into the future performance” allowed phono pickup designers using it as a design tool to make huge gains in the state of their art. That was how it was: One person would make a breakthrough in his product design, which helped others make advances in their products, and so on.

Early arms were comparatively heavy, yet this Rek-O-Kut arm and turntable were top sellers in the late '50s.



It was about this time that the phono pickup makers became somewhat irritated that their products were regarded as nothing but accessories and were being used as giveaway incentives, such as buy a turntable and get a phono pickup for a penny. One manufacturer started a luxury line of signature phono pickups made by hand by the designer himself, with guaranteed super performance and selling at five times the price of the then most expensive top-of-the-line phono pickups. These high-priced phono pickups were such a success and of such consistently high quality that within a very short time the word “signature” became synonymous with top quality. The signature label was, and still is, used by some of the most prestigious names in the world, including Mercedes-Benz automobiles.

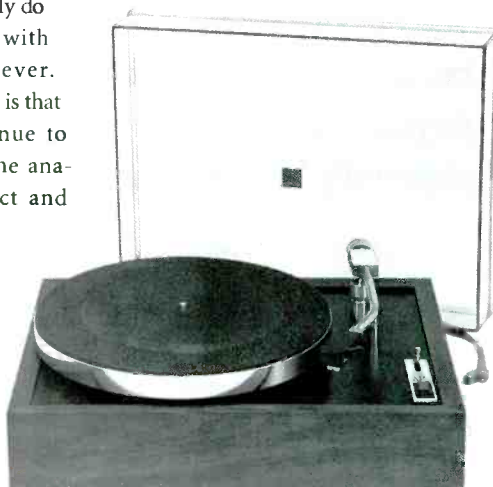
Controls to set disc size and select speed, as on Garrard's SL95 changer, were notably absent from most single-play turntables.

Other phono pickup makers followed suit and introduced luxury-line cartridges of their own. Phono pickups, which only a few years before had a top list price of \$75, were now vastly improved and selling for as much as \$3,000. The performance of phono pickups soared, and even with the success of CD, the phono pickup business

remains healthy and the quality of record playback is still considered by many to be better by far than that of all other formats, including the CD.

I personally do not agree with this, however. What I find is that as I continue to improve the analog product and

Simple yet satisfying, the AR turntable offered high quality at a moderate price.



DENON

EQUIPMENT PROFILE

4

**DENON
DCD-1500
COMPACT DISC
PLAYER**

Manufacturer's Specifications
Frequency Response: 5 Hz to 20 kHz, +0.3 dB
Dynamic Range: 96 dB
S/N Ratio: 96 dB (A-weighted)
THD: 0.005% at 1 kHz
Channel Separation: 95 dB
Number of Programmable Selections: 99
Output Level: 1.4 V (1.4 mV rms) with 16 Ω load
Dimensions: 17 1/2" W x 3 1/2" H x 14 1/4" D (44.5 cm x 8.9 cm x 36.5 cm)
Weight: 12.2 lbs (5.5 kg)
Price: \$529.95, wood side panels \$430 per pair
Company Address: 27 Low D, Fairfield, NJ 07006
 For literature, circle No. 84



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AUDIO JUNE 1986

DENON DCD-1500 COMPACT DISC

JUNE 1986

Denon, the first name in digital audio and now the first name in digital home theater, has produced some of the finest gear along the way. According to the legendary Len Feldman, the DCD-1500, reviewed in June 1986, "had sound as good as any CD player . . . a price a good deal lower than many . . . a winner on every count." Now, as the digital era continues to evolve, Denon will continue to lead the way.

With sound as good as any CD player I've tested so far, and a price a good deal lower than many, this unit is a winner in my book on every count.

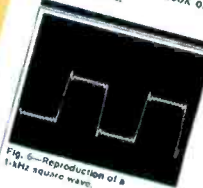


Fig. 6—Reproduction of a 1-kHz square wave.

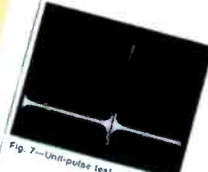


Fig. 7—Unit-pulse test.

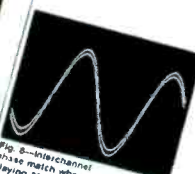


Fig. 8—Inter-channel phase match when playing 20-kHz test tone shows that separate D/A converters are used in each channel.

In some other way, in any case, a dynamic range capability of 91 dB is certainly going to be achieved by the player's circuits.

Output level for the DCD-1500 measured 2.02 V on one channel and 2.06 V on the other for an imbalance of 0.02 V, or a 3.4 dB conversion. This imbalance results in the reproduction shown in Fig. 8. What happens in the reproduction shown in Fig. 8 is that the two channels are not being reproduced with the same accuracy. The imbalance would be needed in order to avoid a performance error that could occur when a reproduced unit pulse is symmetrically reproduced in phase with both channels and the two channels are not being reproduced with the same accuracy. The imbalance would be needed in order to avoid a performance error that could occur when a reproduced unit pulse is symmetrically reproduced in phase with both channels and the two channels are not being reproduced with the same accuracy.

The technique employed two independent D/A converters for each channel to produce a 19-bit DAC converter in each channel. It is not clear how many bits are used in each channel, but the fact that the two channels are not being reproduced with the same accuracy suggests that the two channels are not being reproduced with the same accuracy.

Use and Listening Tests

I suspect that I am sometimes accused of what I might call "psychoacoustic reproduction." In order to judge the product, I used a variety of test tones and music. The DCD-1500 seemed to reproduce the test tones with a high degree of accuracy. The music, however, was reproduced with a high degree of accuracy. The DCD-1500 seemed to reproduce the music with a high degree of accuracy.



CIRCLE NO. 83 ON READER SERVICE CARD

DENON 222 NEW ROAD PARSIPPANY, NJ 07054 PHONE (201) 575-7810 FAX (201) 808-1608



The Linn Sondek LP12 revised people's thinking about the difference a turntable could make.

goal that we were all working to achieve, to make the best possible sound! It has been said that a small group of men started the high-fidelity industry. If that is so, we were not really aware of it at the time. We were just having such a great time doing the thing we all loved best, and one day we turned around and found that a new industry had grown around our efforts.

As you know by the heading of this article, I am Joe Grado, that so-called "pioneer" of the audio industry who still has a devil of a time finding his burro and pickaxe. I have been in this industry for the better part of 50 years, and I just want to take a few lines to tell you about someone among us in audio who was a real giant of a man. His name

was C. G. McProud, a dear friend and colleague. C. G. McProud was the founder of *Audio* magazine, and as its longtime publisher and editor held a position of very high esteem and power, yet he never

as I continue to improve the digital product, they are becoming one and the same in sound quality. I am sure there are new concepts being developed at this moment that will ultimately bring us to the point of one sound, the best sound regardless of format.

When the 33 $\frac{1}{3}$ -rpm long-play record became an industry standard, manufacturers introduced some superb record changers and turntables. Removing the 78- and 45-rpm speeds from their products allowed them to concentrate on the design of 33 $\frac{1}{3}$ -rpm-only turntables. Eliminating the mechanical problems associated with providing unnecessary speeds resulted in a marked improvement in turntable performance. The puck-drive, rim-driven turntables and their inherent noise problems were soon almost entirely supplanted, and in their place came a new breed of belt-drive and direct-drive turntables. It was very quickly determined that the turntable suspension created a definite interface problem that affected tonearm and phono pickup performance at low frequencies. Although great strides have been made in this area of turntable design, the basic problem still has not been reduced to a truly acceptable level—and if anyone would care to challenge this last statement, I would dearly love to have a good, old-fashioned (with love) wham-bang discussion about it.

You may have noticed that I have not mentioned any names in this article. I've done this purposely, since I believe no one person should be praised more than another. We all had our moments of glory, and Lord knows we also had a solid attitude of competitiveness, but beneath it all was a common

Adapted from a jukebox, this Seeburg held 50 LPs, selected by your choice of local or remote telephone dials.

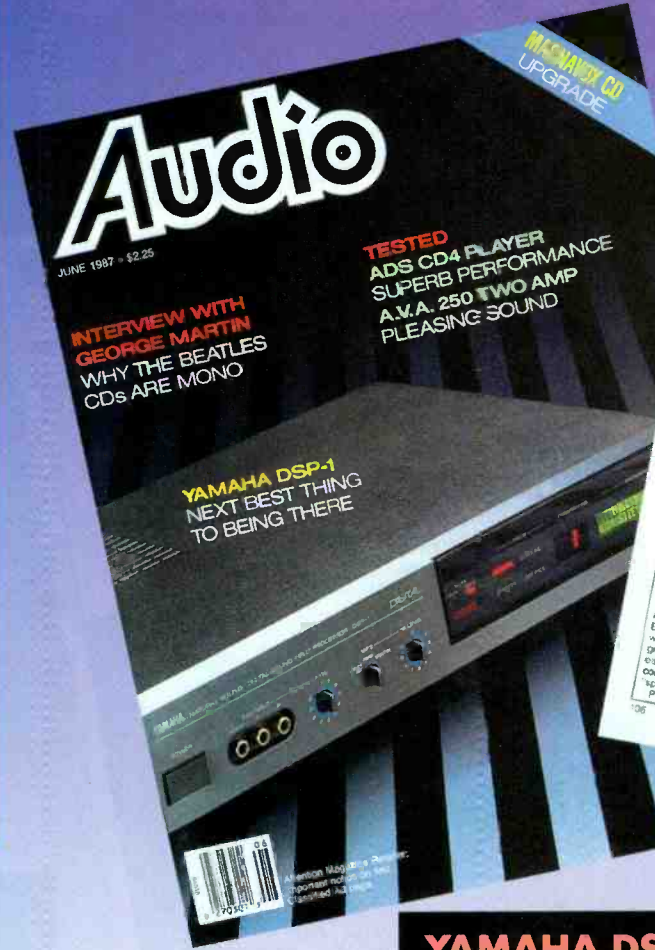
STEREO WAS A BONANZA FOR SOME MANUFACTURERS BUT A NIGHTMARE FOR DESIGNERS OF PHONO CARTRIDGES.

used his position of power for any other purpose but to help his fellow man, no matter how insignificant he happened to be. I know because I was one of those insignificant people starting out in audio whom he befriended and helped with no thought of repayment. It is people like C. G. McProud who were in a large way responsible for the growth of the high-fidelity industry. He brought the word to the public and did so with a great dignity. C. G., wherever you are, God bless you. A



YAMAHA

This unit has done more than anything that's come before it to simulate a feeling of "being there."



Functions of the unit depend on the "Program" keys mode being used.

The "Sound Ejector"
I had the chance to discuss the characteristics of the "Sound Ejector" program with people who are more knowledgeable than I on what they might do in specific situations—with a keyboard, for example. Their response was enthusiastic, but I thought their "response" was primarily keyboard. I decided to use the "Sound Ejector" program, and I had a ball. I had all of the things that were both interesting and enjoyable. I found that the music from the "Sound Ejector" was particularly amenable to being delayed, "banged," modulated, phased and carried around in the room in all directions. These manipulations were not obnoxious with any of the other music I tried, but it was great fun with a "Jazz" CD.

Conclusions
I'm not going to say much detail on what I did (and what didn't) with the DSP-1. I certainly hope I can't convince you to listen to music. Any of the controls can be used without the modification of any parameters. Even if the program if changes are made, they are many to recall to create the most accurate listening experience. The Yamaha DSP-1 stands as a unique device in that it gives the user the ability to create a unique sound field. The DSP-1 has a goal to do something that no other device in the world has attempted to accomplish in many different ways that include "being there." The DSP-1 has achieved more over normal stereo reproduction than any other device including the reproduction of the CD. Having the stereo sound stage, with a minimum loss of detail, is a goal that has not been achieved by any other device. In the next issue, we'll see how the DSP-1, the sound in a listening room, a more "better" sound through the orchestra really more than other devices. It is not an expensive device, but with improvements for its cost than any other comparable effect processors can be added as the budget permits. From the future, we can expect the DSP-1 to be a "must have" for the audiophile.

Popular music was represented by Christopher Chesnut

YAMAHA DSP-1 DIGITAL SOUND FIELD PROCESSOR

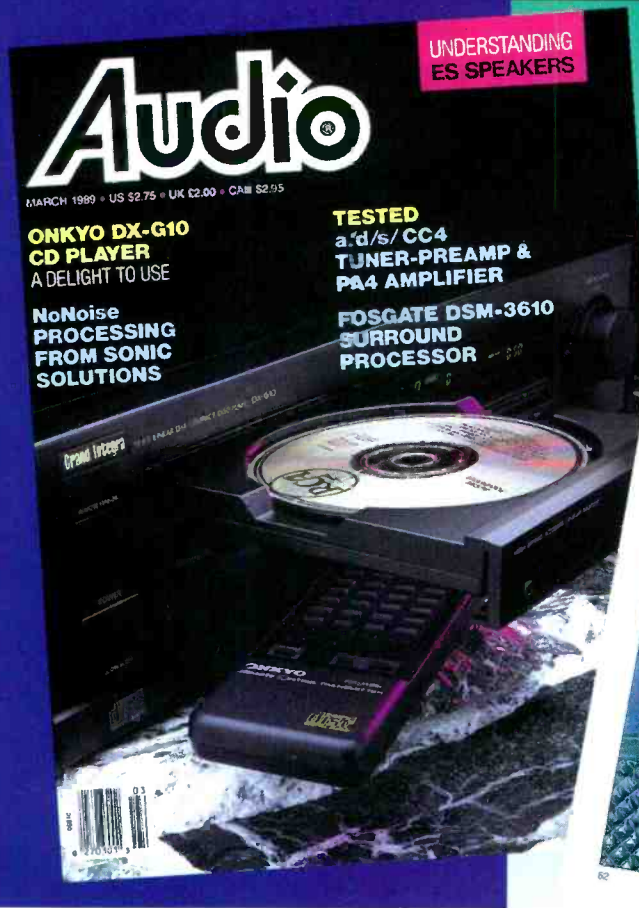
JUNE 1987

"Being there" is a goal many manufacturers strive for with their electronics that are designed for surround sound processing. In *Audio's* June 1987 issue, the Yamaha DSP-1 Digital Sound Field Processor "achieved more over normal stereo reproduction than anything else, including the introduction of the CD." For more than a decade, Yamaha Cinema DSP technology has kept Yamaha at the forefront of home theater.



Artistry in Sound

ONKYO®



**ONKYO
GRAND INTEGRA DX-G10**

MARCH 1989

In March of 1989, Len Feldman had this to say about the DX-G10: "Onkyo must have asked its engineers for the finest, most rugged, sophisticated CD player they could make . . ." That same philosophy holds true for our engineers today. Whether we're designing an entry level home theater receiver or an advanced Integra amplifier, Onkyo continues to set standards not only for the industry, but for ourselves as well.



AUDIO MILESTONES

THE MARCH *of* TECHNOLOGY

50th ANNIVERSARY

two

50 YEARS OF AMPLIFIERS

by Bascom King



Williamson amps, like this Heathkit, had triode-connected pentode output tubes.

In the beginning, there was the triode. Even back in the '30s, single-ended and push-pull amplifiers using these three-element tubes were considered to have very good audio quality, though their power output was usually limited. Output tubes having more elements, such as four-element tetrodes (beam-power tubes) and five-element pentodes, could produce greater power output but with greater and more irritating kinds of distortion. (For the sake of brevity, I'll lump beam-power tubes together with pentodes from here on.)

A great debate raged in the '40s and '50s about the relative sonic merits of triode and pentode power amps. In the midst of this debate, in 1947, this magazine was born. I remember being impressed with the sophistication of many construction articles and circuit descriptions in its early issues; some of these amplifiers would probably sound very good today.

The Williamson amplifier circuit came into being about the same time as Au-

dio. It had triode-connected pentodes for output tubes (807s, if my memory serves me) and required an extraordinarily good output transformer to perform properly with the 20 dB of feedback it used. Many spinoffs of this circuit, most not as stable and well behaved as the original, appeared over the next 10 to 15 years.

Several developments in the '50s made the use of pentode power tubes more acceptable sonically. The first of these, the McIntosh circuit, was introduced in 1950 in a professional 50-watt amp. Its pentode output tubes were connected in a new way, termed unity coupling, which split the load evenly between the plate and cathode circuits; the wires from the plate and cathode in the output transformer's primary were wound together in what is known as quadrifilar winding, for closer coupling between the two

halves of the push-pull output stage. This allowed the output stage to draw less power when idling than conventional output stages yet still avoid high-fre-



Eico, another kit maker, also used the Williamson design.



The Marantz Model 2 delivered 40 watts in Ultra-Linear mode or 20 watts in triode mode, selected by a toggle switch near the output tubes.

quency switching transients (which would otherwise occur at the waveform's zero crossings under this near-Class-B condition). The result was an amplifier having high power output, high efficiency, and low distortion.

The Ultra-Linear circuit, of 1952, offered another way to improve the performance of pentode output stages. Before this, a pentode output tube's screen grids had been connected either to the output transformer's center tap (for pentode-mode operation) or to the same transformer tap as the tube's plates (for triode mode). In this new circuit, the screen grids were connected to a point about 40% of the way between the center tap and the plate connection; this gave the output stage most of the power of pentode mode, together with the lower distortion and lower output impedance of triode mode. Many, if not most, subsequent tube amplifiers had this kind of output stage. The first commercial amplifiers taking this approach were made by Acrosound, but the most popular Ultra-Linear amplifiers were the various Dynaco and Dynaki models, probably the best-selling tube amps ever. Some of the most highly regarded Ultra-Linear amplifiers of the era were the Marantz Models 8B and 9 (the latter switchable between triode and Ultra-Linear operation), designed by Sidney Smith; they are still coveted today.

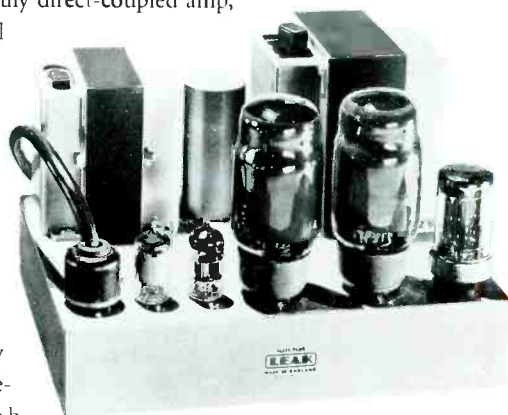
In the middle to late '50s, a new form of amplifying device, the transistor, was reaching commercial viability. The first commercial transistor amplifier was a little integrated unit made by TEC in 1956. It was small and cute and put out some 15 watts per channel. These early solid-state amps used germanium transistors, which were not terribly reliable. They also tended to be noisy in the small-signal versions used for amplifiers' early stages and were leaky, fragile, and very slow in the large-signal versions made for output stages. Faster and more linear germanium power transistors did appear, such as RCA's drift-field and Delco's Nu-Base devices. Some of the amplifiers made with them were pretty good, but reliability still remained a problem. Silicon transistors gradually replaced germanium, and by the mid-'60s, virtually all solid-state amplifiers were using them.

Up to the early '70s, most solid-state amplifiers had quasi-complementary output stages. These were push-pull circuits that used power transistors of the same polarity (usually NPN), because good complementary devices of opposite polarities weren't available. Half of the push-pull stage used a compound connection to provide a more or less complementary match for the other half, a Darlington connection of two series-connected emitter followers. When truly complementary NPN and PNP high-power output transistors became available, JBL introduced its T-circuit power amplifiers. Designed by Bart Locanthi, they had triple Darlington complementary output stages. Another good complementary output stage could be found in Marantz's Model 15 and subsequent designs. And the Hadley 622, of roughly the same era, was the first all-silicon amp to have a full-bridge output stage.

Transistor amplifiers gradually became more powerful. One of the first high-power models was the Crown DC-300, introduced in 1967, which was rated at 150 watts per channel into 8 ohms. This was the first truly direct-coupled amp,

with identical DC and AC gain. In 1972 came an amp that delivered 350 watts per channel into 8-ohm loads. That was the Phase Linear 700, an early and notable design from Bob Carver.

In early 1973, SAE introduced the 50-watt/channel Model 31B, which started a new trend in amplifier design. The 31B was the first to use fully complementary circuitry from input to output, including a complementary differential input amplifier. In 1974, the 31B's designer, James Bongiorno, formed The Great American Sound Company, where he produced Ampzilla, the first high-powered amplifier with fully complementary circuitry that



In the '60s, the English company Leak proudly named its amps "Point One" for their low, 0.1%, distortion. The well-regarded C/M Laboratories solid-state amp, which came a few years later in the decade, was far more modern looking.

Paradigm

Audio

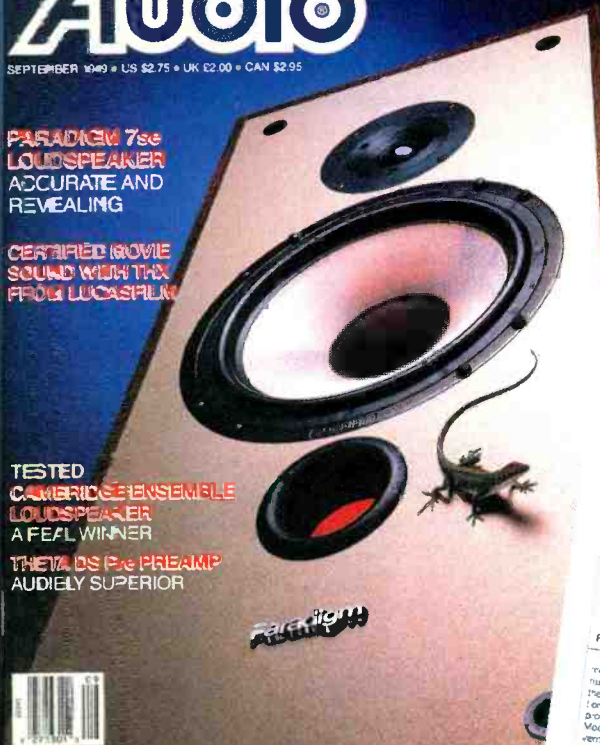
SEPTEMBER 1989 • US \$2.75 • UK £2.00 • CAN \$2.95

INTERVIEW
EMORY COOK
PIONEER

PARADIGM 7se
LOUDSPEAKER
ACCURATE AND
REVEALING

CERTIFIED MOVIE
SOUND WITH THX
FROM LUCASFILM

TESTED
CAMBRIDGE ENSEMBLE
LOUDSPEAKER
A FEEL WINNER
THETA DS PRE-AMP
AUDIELY SUPERIOR



EQUIPMENT PROFILE

1

PARADIGM 7se LOUDSPEAKER

Manufacturer's Specifications
System Type: Bookshelf-style, two-way, sealed box with critically-tuned ports
Drivers: Bessel (200-ohm) woofer, 1-inch (25 mm) dome tweeter
Frequency Range: On axis, 60 Hz to 20 kHz; ±2 dB 30° off horizontal axis, 50 Hz to 15 kHz; ±2 dB
Sensitivity: 86 dB SPL at 1 meter for 2.83 V rms input
Crossover Frequency: 2.3 kHz
Impedance: 8 ohms nominal
Recommended Amplifier Power: 15 to 100 watts at 10% distortion
Dimensions: 24 in H x 10 1/2 in W x 11 1/2 in D (61 cm x 26.7 cm x 29.3 cm)
Weight: 5.5 lbs (2.5 kg) per pair
Price: \$499 per pair
Company Address: 100 Audubon Falls, N.Y. 14202
 For literature circle No. 30



Paradigm (par' a dim), South Springfield as an example of how something should be done. This is an idea that the Canadian "Paradigm" line of loudspeakers. This distinctive product they make. The review describes the Paradigm Model 7se, a moderate size, relatively low cost, two-way speaker system with an 8-inch woofer and 1-inch dome tweeter. Read on to find out how well the 7se matched the price and how well it matched the 7se's reputation for accuracy and revealing sound. This is one of a number of search and test facilities made available by the Canadian government through its National Research Council (NRC).

The NRC is the Canadian equivalent of our National Bureau of Standards but with the added mandate of performing research that helps Canada be competitive in the world market. Through a national information network available through articles and NRC research publications in the audio industry would be proud to call their own. These facilities include anechoic and reverberation chambers with an IEC (International) Class 10000 measurement equipment. The NRC Acoustics Department is headed by Dr. Floyd Thiele, who is well known in the U.S. audio community because of his involvement in the Audio Engineering Society and the Acoustical Society of America. Dr. Thiele has written a

PARADIGM 7SE LOUDSPEAKER

SEPTEMBER 1989

In September of 1989, *Audio* reviewed the 7SE loudspeaker from a little known company called Paradigm, which stated . . . "A very accurate and revealing system that was a pleasure to listen to." Paradigm has since grown to become a major speaker brand worldwide!



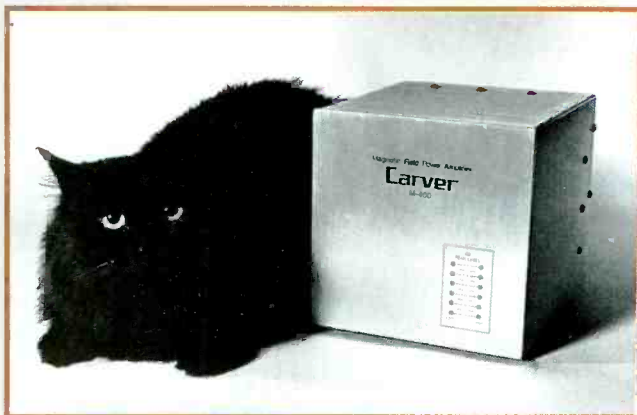


could be assembled from a kit. (Bongiorno later founded Sumo, as well.) Fully complementary circuitry has been

used in many subsequent solid-state designs, right up to the present day.

Other circuits and devices helped improve the sound of solid-state amps during the last two decades. Cascode connection yielded amplifier stages with reduced input capacitance, wider bandwidth, greater linearity, and higher gain. Class-A output stages were joined by more efficient quasi-Class-A designs, including those with sliding bias. Many amps now use little or no global feedback. More and more output stages were designed with high current capability. Better passive components became available, as did improved active devices, such as MOS-FETs and insulated-gate bipolar transistors (which combine FET inputs with bipolar outputs).

During the late '70s, Infinity produced a Class-D, or switching, amp; Sony introduced one soon after. Switching amps have great efficiency because they treat the signal as a chain of full-amplitude pulses, altering the audio output's amplitude by changing the pulses' duty cycle. John Ulrich, one of the principal designers of the original Infinity amplifier, currently makes a very good-sounding high-power switching amplifier under the Spectron name. Infinity gave up on switching amps for a long time but has recently been making them for car stereo; others offer Class-D car amps, too.



Another technique to enhance efficiency, output-stage power supplies with multi-tiered supply rails, appeared at about this time. In multi-tier designs, the voltage to the output transistors is switched up or down to meet the demands of the signal; examples include Class-G and Class-H designs and Carver's Magnetic Field Amplifiers (his 6¼-inch cube, which could produce 200 watts per channel, is shown below). More recent designs from Carver's fertile mind use modulated switching power supplies that continuously track the output voltage. This keeps the supply voltage across the output transistors low and constant, yielding high efficiency.

Transistor amps have always had better steady-state measurements and higher power than tube amps. Nevertheless, many listeners in the late '60s and early '70s felt that transistor amplifiers didn't sound as musically satisfying as most tube designs. My own experience through this period, as a designer and later as a reviewer for *Audio*, bore this out. Today, most critics would probably agree that the current high-performance solid-state amplifiers are musically satisfying and realistic. Despite my special fondness for the sound of good tube amps, I have certainly found this to be true.

Yet a tube resurgence has occurred in the last ten years, bringing this amp history full circle. Tube amps and preamps become more and more numerous each year. Recently there's even been a trend toward single-ended designs, the predecessors of the more common push-pull amplifiers. Proponents claim that single-ended amps sound more lifelike and believable, although their low power makes them practical only for high-efficiency speakers. Even solid-state single-ended amps are available, notably those designed by Nelson Pass of Pass Labs, whose topologies have been ingeniously modified to yield fairly high power while keeping down the even harmonics that raise the THD measurements of single-ended tube designs.

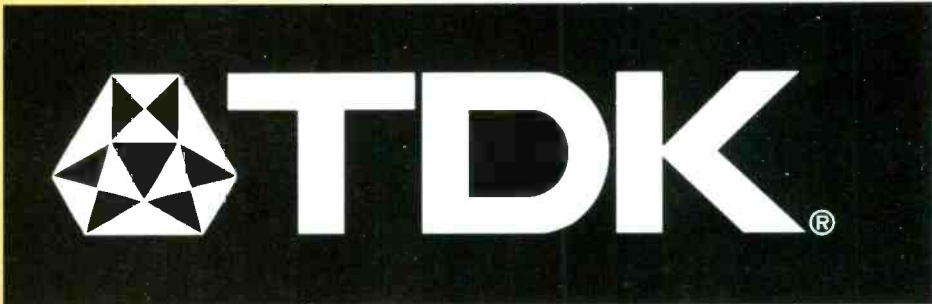
Carver's Magnetic Field Amplifiers were small and efficient; this model delivered 200 watts per channel from a 6¼-inch cube.

"Seven Hundred Watts R.M.S." proclaimed the front panel of the Phase Linear 700, the total for both channels of this extraordinarily powerful amp.



All in all, it's been an interesting 50 years of amplifier development, and I feel privileged to have been a part of it for 35 of those years. May the next half century of audio bring even more interesting and exciting advances.

A



GREATEST CASSETTE TEST EVER

88 TAPES TESTED

Howard A. Robertson

In November 1987, *Audio* published "Mass Cassette Test: The Review"

TDK CASSETTE TEST

MARCH 1990/JUNE 1993

In 1990, *Audio* conducted "the greatest cassette test ever." TDK's top of the line tape emerged victorious. What did we do for an encore? We won "the second greatest

cassette test ever" in 1993. Both tests demonstrated our commitment to leadership in recording technology, a commitment that goes on today. So this isn't about one TDK tape or another, it's about TDK itself.

MASS TAPE TEST

51 CASSETTES

EDWARD J. FOSTER

THE SECOND GREATEST CASSETTE TEST EVER



Approximately every three years, audio manufacturers introduce cassette tapes. The field isn't static, and it can be difficult to keep up with improvements—major or minor—even to tell whether any changes have occurred. Some manufacturers make every slight change in formulation with a sparkling new name, but others—especially those with well-recognized brands—do not. Why rebrandize sales of a well-recognized label, they reason, simply because it's been improved? So even when names don't



CIRCLE NO. 109 ON READER SERVICE CARD

AUDIO MILESTONES

THE MARCH *of* TECHNOLOGY

50th ANNIVERSARY

three

50 YEARS OF HOME RECORDING

by Robert Long



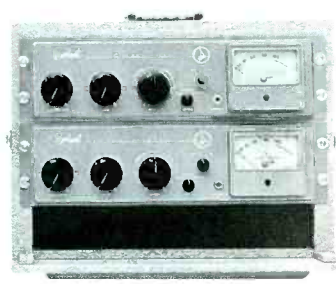
With only lacquer phonograph discs at their disposal, amateur recordists were few and far between as World War II ended. But by the time the War's dust settled and people had put their lives back together, disc recorders were fast giving way to a tape deck, the Brush Sound-

tapes recorded on it never really sounded right on Ampex transports, which had become the standard in professional work. But since few amateurs could afford an Ampex, Magnecord found a market in the semipro field.

mirror. The Soundmirror used quarter-inch open-reel tape manufactured by 3M; otherwise, however, it was an imprecise predictor of what was to come.

That first 3M Scotch recording tape had a paper backing and a black oxide magnetic coating. By switching to an acetate substrate with a brown oxide coating, 3M could accommodate the decks that were then under development by Ampex. The result was the classic Scotch 111 recording tape, the foundation of everything that was to follow.

Magnecord was the first transport manufacturer in the United States to realize that portability might be an important asset for live recording. Unfortunately, the first "Mag-gie" design chose its own route through the EQ/bias forest;



When this Ampex 350 first appeared, it was considered portable.

Regarded as semiprofessional, the Berlant Concertone had line and mike mixing inputs.

This 3M Wollensak model was a best-seller for years.



EQUIPMENT PROFILE

2

NHT MODEL II SPEAKER

Manufacturer's Specifications
System Type: Tower style, three-way dual-chamber acoustic suspension.
Drivers: Two 6 1/2-in. (165-mm) polypropylene cone woofers, and 6 1/2-in. (165-mm) treated paper cone woofer/reticulated and one 1-in. hard-pressed aluminum tweeter.
Frequency Response: On axis, 43 Hz to 22 kHz \pm 3 dB.
Sensitivity: 87 dB SPL at 1 meter for 2.85 V rms band limited pink noise input.
Crossover Frequencies: 60 Hz and 3.3 kHz.
Impedance: 8 ohms nominal (3.3 ohms minimum at 65 Hz, measured).
Recommended Amplifier Power: 35 to 200 watts per channel.
Dimensions: 37 in. H x 7 in. W x 12 in. D (94 cm x 17.8 cm x 30.5 cm).
Weight: 44 lbs (20 kg).
Price: \$360 per pair.
Company Address: Now Hear This, 537 Stone Rd., Building E, Benicia, CA 94510.
 For literature, circle No. 91.



AUDIOJULY 1990

NHT

NHT MODEL II SPEAKER

JULY 1990

In its ten years, NHT has grown quickly in status and success. The Model I (1987), and the Model II speaker reviewed in July 1990, have helped propel NHT to the front of the speaker pack. Today, NHT offers a full line of audio and home theater speakers for the critical listener.

"... a broad, well defined soundstage. The stereo image was quite precise..."

—D.B. Keele
 Audio, July 1990

Now Hear This, a not-so-crazy name for a sound company, partially involved in manufacturing loudspeakers, produces the system evaluated in this review. The Model II, even though listed as a three-way system, is unconventional in the sense that it is essentially a small-format two-way system with added tweeters that is housed in a 36-in. high glass black tower structure also available in oak veneer. The system is deeper than it is wide and stands about 3 feet high with attached stabilizer bars. These speakers are targeted toward the mainstream consumer rather than the audiophile market in this market, appearance, value, and good sound for the money are quite important. The Model II's appearance was well liked by all members of my family, including me.

The two most noticeable visual traits of the system are its shiny, black, machined finish and its wide slanted front panel. The 22° slanted front baffle orients the driver, and inward towards the center of the listening area. This, according to the manufacturer, improves its imaging qualities in a concert hall or in a room. NHT calls it Focused Image Geometry. The design is said to minimize excessive side-wall reflections and reduce interaural cross-correlation and thereby maintain a consistent soundstage and stereo perspective throughout a broad listening area. Because of the slanted baffle, the speakers are only cold in mirror-image pairs.

The Model II is a direct descendant of NHT's first product, the compact two-way four-speaker Model I speaker, which was released in 1987, and it uses many of the same components as the Model I. Kenneth L. Kantor, a founding partner of NHT (formerly of Acoustic Research, NAD, and Pector), is NHT's primary designer and was the driving force behind the Model I and II. (Kantor, no stranger to this page of this magazine, has written a number of informative "Audio Bits and Pieces" columns by design, published in November and December, 1988, is particularly informative and shows some of the trade-offs a system designer must juggle to come up with a workable design.)

Small-format, two-way loudspeaker systems have always had a reputation for very good pinpoint imaging and stereo-to-mono capabilities, due primarily to their small size and strictly using a single driver to cover the entire low and middle frequency ranges eliminates the problems of a crossover point that inevitably shows up in the critical mid-band region or 200 Hz to 1 kHz. Unfortunately, the bass response suffers in this format because of small physical size. The Model II essentially gets around this problem by making a small two-way system with an acoustic-suspension bass system consisting of two small high-excursion woofers, and then packaging the whole in a tall, narrow tower. The system can be thought of as a small two-way system using drivers over four-in. diameter and speaker stand, as NHT points out. In the last few years, a more logical solution to this dilemma has grown very popular: the three-driver design that uses two small-tare-tweeters with a separate woofer or subwoofer.

The two bottom woofers of the system have like-increasing capability of 100-cm-diameter woofers with the width of only a 6 1/2-in. woofer. This allows the Model II to maintain the narrowness of a typical small-format, two-way system but have the bass response of a single, wider system. The

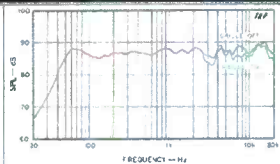


Fig. 1—On-axis frequency response.

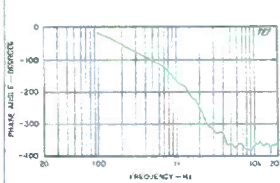


Fig. 2—On-axis phase response, corrected for tweeter arrival time.

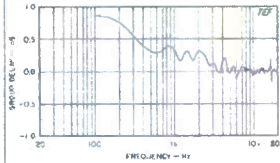


Fig. 3—Group delay corresponding to phase response of Fig. 2.

AUDIOJULY 1990

61

CIRCLE NO. 95 ON READER SERVICE CARD

NHT 535 GETTY CT. BENICIA, CA 94510 PHONE (707) 747-3300 FAX (707) 747-1252



ADCOM®

ADCOM GFA-565 MONO AMP GFP-565 PREAMP

OCTOBER 1990

Details you can hear, but don't have to pay for, has always been the common thread of all the Adcom products reviewed by *Audio*. The October 1990 reviews of the GFP-565 preamp and the GFA-565 mono amp proved no exception. Anthony Cordesman concluded that the GFP-565 was an "excellent value . . . will make a superb introduction to the high end" and the GFA-565 was "the first practical option in creating a high end system using demanding speakers." What else would you expect from components that are every bit pure Adcom?





The Crown 800 ran at 7½ ips and either 15 or 3¾ ips, depending on the setting of a rear-panel selector.

The brand of hi-fi choice by the early 1950s, however, was Concertone. By the mid-'50s, even less expensive decks began appearing in profusion—Pentron, Wilcox-Gay, Webster-Chicago, Wollensak, and many other companies had begun turning out recorders of various descriptions. Several later models, such as the Pentron Dynacord, aspired to pro or semipro status, but their performance fell short and the companies that manufactured them have mostly disappeared.

A transport speed of 15 inches per second had become the de facto standard in pro work; some engineers preferred working at 7½ ips for sounds (such as pipe organ) that were rich in very long wavelengths, which recorded better at the slower speed. The early rule of thumb was that the transport speed (in ips) more or less coincided with the highest frequency (in kilocycles per second—kHz, to us) that could be properly recorded at that speed. In other words, a tape recorded at 15 ips should remain quite flat up to at least 15 kHz, and response at the new, budget consumer speed of 3¾ ips might be rolling off by about 4 kHz. But tapes, heads, transports, and electronics were all improving steadily, gradually

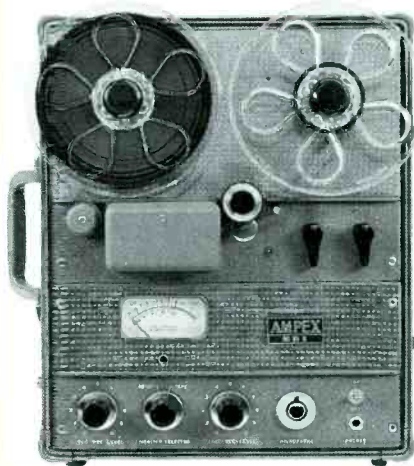
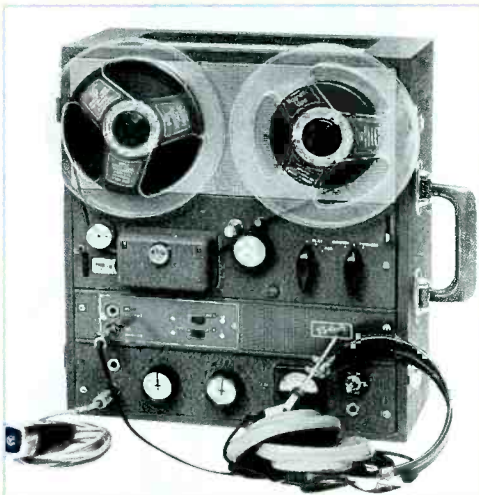
long. Its counterpart at the low end of the consumer field in the late 1950s and early 1960s was Viking.

Tandberg made the 1½-ips speed respectable, paving the way for acceptance of the cassette.

The Revox Model G36's photosensitive tape-break switch would also stop the tape wherever you rubbed off the oxide or spliced in some transparent leader.

extending high-frequency response at the slow speeds.

The eventual leader in the inexpensive-pro/premium-consumer market was Crown International, which began with a recorder resembling the Maggie but soon switched to a format more like that of the Ampex 350 studio deck. Crown International was, in fact, the only American company to stay in the semipro field for



Of the challenges that these companies had to face in the '50s, the most daunting was stereo. Early recorders had used the full width of the ¼-inch tape as a single track, so it could be recorded or played in one direction only. For consumer use, a double-sided

Some of the Akai-built Roberts models (far left) were styled to resemble Ampex's professional 600 Series.



KLH's Model Forty-One was the first home deck with Dolby noise reduction.

“half-track” format soon became the standard. Its mono track occupied a little less than half the tape width for each direction of travel. The earliest stereo format preserved that track for one channel and added a second head, a short distance away, to record and play the other channel from the tape’s other track. But single

PHILIPS' VISIONARY LICENSING POLICY HELPED ENSURE THE CASSETTE'S WORLDWIDE ACCEPTANCE.

heads equipped for both channels quickly replaced this “staggered-head” kluge with what came to be known as stacked-head or in-line-head stereo. In the mid-1950s, Pentron offered a model that could play both stereo formats.

Tandberg of Norway set the field on its ear in the late '50s by introducing quarter-track recording and the 1 7/8-ips transport speed. This new slow speed doubled recording time yet delivered surprisingly respectable sound. The quarter-track head configuration interlaced the tracks for the two directions of travel, permitting stereo in both directions and again doubling recording time per tape as compared to half-track stereo. Tandberg’s formula eventually inherited the earth, and the vast majority of prerecorded tapes manufactured—most of them by Ampex—used this format.

By the early '60s, some European brands and OEM versions of Japanese recorders had begun to dominate the United States market. Aside from Tandberg, Uher was most prominent among the Europeans, followed by an early Revox model. The Japanese entries were led by Sony, sold under its own name by Superscope; Panasonic models, sold under the Concord brand name; and Akai decks, originally sold here under the Roberts

brand. Teac was yet to come but would be among the leaders by the end of the decade.

One American company bravely ventured into this field in the mid-'60s: KLH. Henry Kloss, its CEO, reasoned that if a simplified version of the recently introduced Dolby professional noise-reduction system could be applied to a home deck, then the major failing of 3 3/4 ips and slower speeds, audible hiss, might be conquered and a new ratio of performance per tape dollar achieved. Although the resulting Model Forty-One deck was a failure commercially and is generally blamed for delivering the *coup de grâce* to KLH, its influence lingered.

Throughout the '50s and '60s, designers struggled to make open-reel tape easier to handle. Ampex and Bell & Howell offered automatic tape threading, Akai was among the earliest with auto reverse, and Sony even had an open-reel changer, which always attracted attention at hi-fi shows but made little dent in the market. Most of these designs proved problematic.

The housebreaking of magnetic tape had to await a pop-in format that required no handling of the tape itself—i.e., the cassette. By 1965, that format was a fact, but certainly not a factor. Philips had designed the Compact Cassette as a dictation medium, although some few mono

music cassettes were beginning to appear in France. Short-term, several other convenience



Before the cassette came, most portable recorders resembled this Philips-built Norelco open-reel model. The early Norelco cassette recorder was far more portable and convenient, but its innocuous appearance belied the revolutionary impact the format would have.



B&W

EQUIPMENT PROFILE

2

B & W 801 MATRIX SERIES 2 SPEAKER

Manufacturer's Specifications

System Type:

Three-way, vented, sealed, modular with optional electronic high-pass driver for low and midrange.

Drivers: One 2-in. (300-mm) polypropylene cone woofer, one 5/8-in. (25-mm) Kevlar cone midrange, one 1-in. (25-mm) metal dome tweeter.

Free-Field Frequency Response (With Filter-Equalizer): 20 Hz to 20 kHz ± 2.5 dB; 6.3 dB at 1 Hz, 15 Hz and 20 kHz.

Dispersion (20 Hz to 15 kHz): horizontal $\pm 0^\circ$ to 3.16 within 1.0° ; vertical $\pm 0^\circ$ to 3.16 within 1.0° .

Sensitivity: 87 dB SPL at 1 meter for 1 W/1 m.

Crossover Frequencies: 380 Hz ± 3 dB; 1.5 kHz ± 1 dB.

Impedance: 8 ohms nominal, 4 ohms minimum.

Recommended Amplifier Power: 50 to 600 watts per channel.



Dimensions: 300 mm (11 7/8 in.) x 320 mm (12 5/8 in.) x 432 mm (17 1/4 in.)
Weight: 11.2 kg (25 kg) each
Price: \$5,300 per pair

Company Address: B & W Loudspeakers, P.O. Box 653, Buffalo, NY 14240
Circle No. 91

Very few speaker systems are held in high regard by both recording engineers and high-end audio devotees, but the B & W 801 Matrix Series 2 is just such a system. Even though promoted primarily as a dedicated monitor or studio speaker, it enjoys high popularity in the audiophile home market. The recording engineer prizes high emphasis on sibilants, which adds an immediacy and "bite" to the vocal output capabilities (among other qualities, which otherwise studio-grade speakers such as accuracy, imaging and frequency response that is wide, flat and smooth. The 801's 30-cm cone woofer and 25-mm dome tweeter are typical of the high-end community.

B & W Loudspeakers, one of Britain's premier loudspeaker companies, was founded by John Bowers in 1966 as Bowers and Vickers Loudspeakers Ltd. The company had its humble beginnings in a workshop, behind the Bowers and Vickers Hi-Fi Shop in Worthing, England, where Bowers would design and repair loudspeakers for the shops' clientele. B & W now employs over 250 people in the U.K. and supports a substantial research and development facility that employs over 200 full-time personnel. B & W has been a world leader in applying high technology to the field of loudspeaker development and manufacturing, and is credited with some of the most important

AUDIO/NOVEMBER 1990

The external radiator and alignment filter makes the bass response flat down to 20 Hz, then the roll-off any subsonic energy.

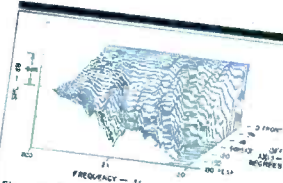


Fig. 4—Horizontal off-axis frequency responses, taken from the front, around the side, and to the rear of the speaker and normalized to the on-axis response; see text.

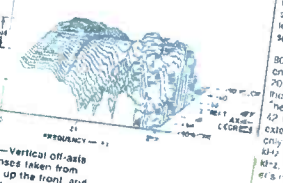


Fig. 5—Vertical off-axis frequency responses, taken from above, up the front, and to the top of the speaker and normalized to the on-axis response; see text.

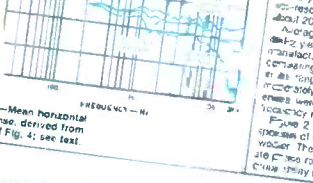


Fig. 6—Mean horizontal response, derived from data of Fig. 4; see text.

Measurements
A number of measurements were performed on the 801 to assess its performance. These included on- and off-axis frequency response, harmonic and THD distortion, impedance variation, and output capabilities. The measurements were performed at a number of locations, including the listening room and lab and outdoors on a dry, overcast day. The test equipment consisted of a Technon TEF System 12 condenser microphone (Technon Micro Tech MA 2400) powered by an Audio Research (AR) 8-K-4007 power amplifier and a LeCroy 8000 oscilloscope. The listening room elevated floor, rear-wall and ground plane measurements were taken at a distance of 2 meters, normal to the front baffle driver. The rear level was 2.83 V rms, which is equivalent to a level of 1 watt into the system's nominal 8-ohm impedance. The off-axis response was corrected to the front-baffle mounting filter was used to display the data and a response for easier interpretation.
The off-axis frequency response measurement was done at a distance of 2 meters, normal to the front baffle driver. The rear level was 2.83 V rms, which is equivalent to a level of 1 watt into the system's nominal 8-ohm impedance. The off-axis response was corrected to the front-baffle mounting filter was used to display the data and a response for easier interpretation.
The off-axis frequency response of the 801 is shown in Fig. 4. The curve was taken with all units on 20 Hz, rather than the usual 20 Hz to 20 kHz. Also shown is the low frequency effect of the high-pass alignment filter (20 Hz to 20 kHz) ± 2.5 dB, with the filter extending from about 3.9 dB down to 20 Hz. The response above 20 kHz first shows a dip at 25 kHz and a peak at 27 kHz, which is presumably due to a resonance of the filter.
The filter's reaction to signal content loading the 801 is shown in Fig. 5. The curve was taken with all units on 20 Hz, thus minimizing the effect of possible high-frequency resonance in the program material. This is fortunate because, as the measurements in the review revealed, the system could handle music only about 10 to 15 watts of input. The off-axis frequency response (horizontal dispersion range) of the 801 is shown in Fig. 6. The curve shows that the off-axis response is very good, with a dip at 25 kHz and a peak at 27 kHz, which is presumably due to a resonance of the filter.
Adding the external radiator and alignment filter makes the bass response flat down to 20 Hz, then the roll-off any subsonic energy.

B&W 801 MATRIX SERIES 2 SPEAKER

NOVEMBER 1990

In the November 1990 issue of *Audio*, D.B. Keele, Jr. described the Matrix 801 Series 2 as "... revealing, neutral, wide-range, great low end, effortless, loud and clean."
Now available in Series 3, the Matrix 801 continues to improve upon its legendary performance.

B&W 54 CONCORD STREET P.O. BOX 8 NORTH READING, MA 0364



CIRCLE NO. 73 ON READER SERVICE CARD

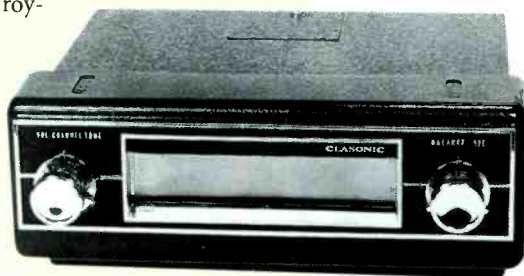
formats had already been successful. The Muntz 4-track cartridge, for example, enjoyed great popularity in cars and homes for a time but gave way to the Lear Jet 8-track cartridge, which was otherwise similar. Other convenience formats failed ignominiously.

But Philips had given its cassette one sterling property: free, though required, licensing. That is, to make use of the patented Philips design, manufacturers had to sign a royalty-free licensing agreement that stated they could not alter any of the design's specifics. Compatibility of all manufacturers' products was thus assured. And the design was basically good, if utilitarian: half-track mono in each direction, at 1 7/8 ips.

Advent Corporation, started by some of the KLH crew, was the prime mover in getting Philips to relax its licensing and permit a modern stereo cassette deck. The elements needed were the Kloss-inspired Dolby B noise reduction, altered equalization (needed for maximum hiss suppression with the equally new du Pont Crolyn chromium dioxide tape), and the stereo track format itself. The resulting high-fidelity decks set a standard that remains to this day.

The primary introductions over the next several years concerned noise reduction and related matters. Around 1980, it was a ques-

Concord's Mark 8 could play open-reel or 8-track tapes.



The Muntz 4-track tape-cartridge player (top left) gave way to Lear Jet's 8-track system.

ANALOG STILL RULES HOME RECORDING, BUT DIGITAL FORMATS ARE COMING THICK AND FAST.



tion of using either dbx or Dolby C to fight tape noise, with the latter finally gaining the upper hand. Then came Dolby's HX Pro headroom extension system, followed by the

Ray Dolby in front of an Advent Dolby noise-reduction box and cassette deck.

Dolby S noise-reduction system. Otherwise, the cassette has remained fundamentally unchanged, despite continuous upgrades in tape formulations. In later years, cassette decks acquired a host of bells and whistles: automatic reverse, programmable playback, automatic switching of bias and EQ, bias fine-tuning, dual-well transports, and many more. In the end, open-reel survived mainly for its one unique capability, editability, which left it filling the tiniest of audiophile niches.

By the late 1980s, there were rumors of home digital tape formats in the industry's R&D labs. First to surface—and now the tape medium of choice among most serious audiophiles—was DAT. The more recent CD-R (recordable CD) shares DAT's use of conventional linear PCM audio coding. Audiophiles seem less confident in the lossy compression systems of the DCC (on which Philips is said to have ceased production) and Sony's MiniDisc. Waiting in the wings is the recordable DVD, though its enormous capacity may be overkill for most home recording purposes.

ALPINE®

EQUIPMENT PROFILE

3

ALPINE 7909 CAR TUNER/CD PLAYER

Manufacturer's Specifications	
Tuner Section	
Monophonic Usable Sensitivity:	16.3 dB
Monophonic 50-dB Quieting Sensitivity:	70.7 dB
Alternate-Channel Selectivity:	20 dB
EN Ratio:	60 dB
Separation:	35 dB
Capture Ratio:	23 dB
AM Suppression:	45 dB
AM Tuner Sensitivity:	0.4 µV
CD Player Section	
Frequency Response:	5 Hz to 20 kHz ± 0.5 dB
S/N Ratio:	10 dB
Dynamic Range:	100 dB
THD:	0.002% at 1 kHz
Separation:	15 dB @ 1 kHz
Oversampling Rate:	Eight-bit
Quantization System:	
Number of D/A Converters:	Two
General Specifications	
Power Requirement:	14.4 V d.c. ± 1.0 V (16.5 V allowable)
Output Voltage:	50C -IV with voltage x 100 (no load)
Range of Tone Controls:	Bass ±18 dB at 50 Hz; Treble ±15 dB at 10 kHz
Dimensions:	Chassis: 7.0" W x 2.0" H x 1.6" D (37.8 cm x 5.0 cm x 4.0 cm)
Weight:	5.0 lb. (2.2 kg)
Price:	\$199
Company Address:	19145 Gramercy, Torrance, CA 90501
For legal use:	circle No. 63



mode, one and sound tally

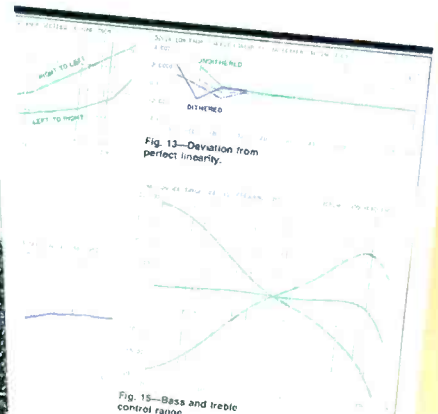


Fig. 15—Bass and treble control range.

that is turned off on the Alpine is a major control CD set. Of the radio tuner section, I was particularly impressed. On the other hand, I was not particularly impressed with the CD player section. I had heard that the Alpine had a better AM section than my reference unit, but I had also heard that the Alpine's AM section was not as good as my reference unit. In the CD balance control, I had heard that the Alpine was not as good as my reference unit. In the CD balance control, I had heard that the Alpine was not as good as my reference unit.

ALPINE 7909 CAR TUNER/CD PLAYER

JANUARY 1991

There hasn't been an Alpine car audio component reviewed by *Audio* that's been less than impressive, including the 7909 Car Tuner/CD Player reviewed in January 1991. Equally impressive was Alpine's CDA-7832 CD receiver, recently reviewed (March/April 1997) by *Audio's* sister magazine, *Car Stereo Review*. In it, Ken Pohlman labeled the CDA-7832, "a great head unit . . . both the CD player and tuner were absolutely excellent."



CIRCLE NO. 63 ON READER SERVICE CARD



psb SPEAKERS

**PSB
STRATUS GOLD
LOUDSPEAKER**
NOVEMBER 1991

It's hard to improve on the speaker that *Audio* originally dubbed "the 10,000 watt speaker." In a November 1991 review of the Stratus Gold, D.B. Keele Jr. praised the Gold for "very clean, wide-range sound" and for power capabilities that "handled difficult passages without a whimper." Later this year, PSB will introduce a new Gold with an updated enclosure and other small but worthy improvements that will push an "ultimate" speaker still higher.

EQUIPMENT PROFILE

1



PSB STRATUS GOLD SPEAKER

Manufacturer's Specifications
System Type: Three-way tower, stereo, surround bar system.
Drivers: 10-in. soft-woofer, 6-in. cone tweeter, 1-in. aluminum-voice coil, 1-in. aluminum-voice coil.
Frequency Response: 36-12,000 Hz, ±1 dB, on axis; 36 Hz to 10 kHz, ±1 dB, off-axis; 36 Hz to 10 kHz, ±3 dB, off-axis; 36 Hz to 10 kHz, ±3 dB, off-axis; 36 Hz to 10 kHz, ±3 dB, off-axis.
Crossover Frequencies and Filter Slopes: 250 Hz (18 dB/octave), 2.2 kHz (24 dB/octave).
Impedance: 8 ohms nominal.
Recommended Amplifier Power: 10 to 250 watts per channel.
Dimensions: 13 1/2" x 11 1/2" x 43 1/2" (H x W x D), 37.5 cm x 29.2 cm x 110 cm (H x W x D), excluding protrusions; 13 1/2" x 11 1/2" x 43 1/2" (H x W x D), 34.0 cm x 28.7 cm x 110 cm (H x W x D).
Weight: 95 lbs (43 kg) for single system.
Price: \$2,000 per pair. Available in premium dark oak, black oak, or light oak.
Company Address: 633 Granite Court, Pickering, Ont., Canada L1W 3K1. For literature, circle No. 80.

The Stratus Gold is the top of Canadian manufacturer PSB's loudspeaker line, which also includes a standard standing tower system with a vintage low-frequency driver. PSB was the first Canadian loudspeaker company to take advantage of the advanced testing facilities and design expertise of the National Research Council (NRC) in 1989. "Testing at Canada's NRC," Audio Systems, whose mandate is to help Canadian manufacturers become competitive in world markets, PSB has made extensive use of NRC facilities, including 50-day listening tests in 1989.

International Electroacoustic Commission (IEC) Standard listening room (after which both Audio's new Verano and my own were patterned) to optimize the Stratus Gold's performance.

PSB has emphasized minimizing resonances within a cavity via over-venting, especially to their design. The large cabinet of the Stratus Gold employs multiple resonances, and weights in an ES planar suspension. To make the baffle a diffuse reflector in the high-frequency range, PSB uses a phase plug in the form of a 1/2-inch diameter rigid disk held about 0.050 inch above

45

AUDIO NOVEMBER 1991



CIRCLE NO. 102 ON READER SERVICE CARD

PSB SPEAKERS 633 GRANITE COURT, PICKERING, ONT CANADA L1W 3K1 PHONE (800) 263-4641 WORLD-WIDE WEB: psbspeakers.com

AUDIO MILESTONES

THE MARCH *of* TECHNOLOGY

50th ANNIVERSARY

four

50 YEARS OF LOUDSPEAKERS

by Ken Kantor



Big speaker cabinets were once the way to go.

Please forgive any errors or oversights on the part of your narrator, as I was but –9 years old when our story begins. It was 1947, and Dad had been home from the service for just over a year. Although he and Mom had intentions to create the corporeal me, they hadn't yet managed to do so. Yet even at this rela-

tivistically early age, I had an unusual fascination with music and the devices that made it. Since I was unable to sleep or eat at that age, or even physically touch my own body, listening to music occupied a very important and pleasurable part of my time.

Lacking physical substance, I was forced to do all of my critical auditioning while floating around in odd corners of my parents' New York apartment. My massless

In the '50s, speaker cabinets were often offered with a choice of drivers; buyers of Stromberg-Carlson's RH-414 slot-loaded Acoustic Labyrinth had two such choices.



state made me supremely sensitive to vibrations of every possible sort, and I came to particularly appreciate the almost erotic waves of energy that would bathe over and through me from my Dad's loudspeaker. Gradually, interest blossomed into obsession, and I began to see it as my mission to understand and chronicle the evolution of the mod-

ern loudspeaker. Here are some of my observations from the last 50 years.

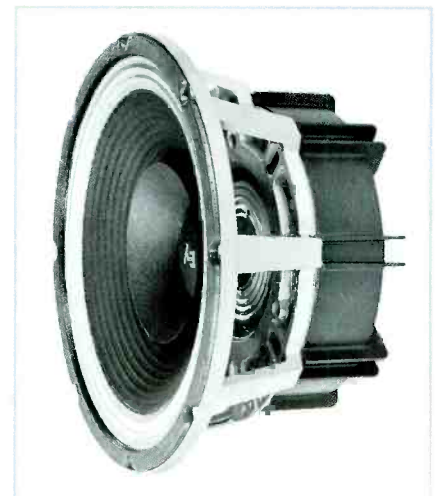
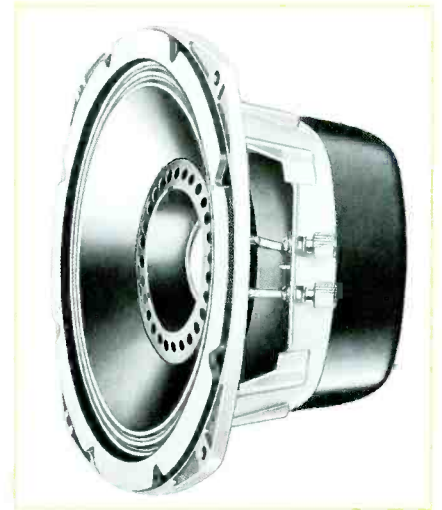
In retrospect, it's almost funny how huge and ungainly loudspeakers were in 1947. They were veritable dinosaurs: Bafflodocus, Threewayosaurus Rex, Folded Hornociraptor. Primitively engineered, yet capable of metabolizing meager watts of food into earthshaking power. In hindsight, they were mostly pretty mean-sounding, though I did not think so at the time. I was just glad to be able to hear the lovely crescendos with only 4 watts of amp, which is all my Dad could afford—and he wasn't skimping. Much. After all, a new kind of record was just coming out,

and the folks were buying as much new music as they could afford.

As the years ticked slowly by, I had plenty of time to notice a subtle change going on around me. Up until I was about 4, most of our informal family gatherings centered around the hi-fi speaker. Now, as my birth was nearing, a new device seemed to get more and more attention: the television. It eventually got to the point that Mom suggested, and Dad fully agreed, that the speaker should be moved off to the side of the room to make way for our latest, larger TV set, and the speaker found less and less use. This did not sit well with me. In contrast to the soothing and stimulating vibrations I felt from the hi-fi, I felt nothing from this TV contraption. Of course, in the end, the grotesque speaker fell completely from favor, and the refrigerator-sized space it occupied was reclaimed to hold the crib in which I would soon lie. What bitter irony.

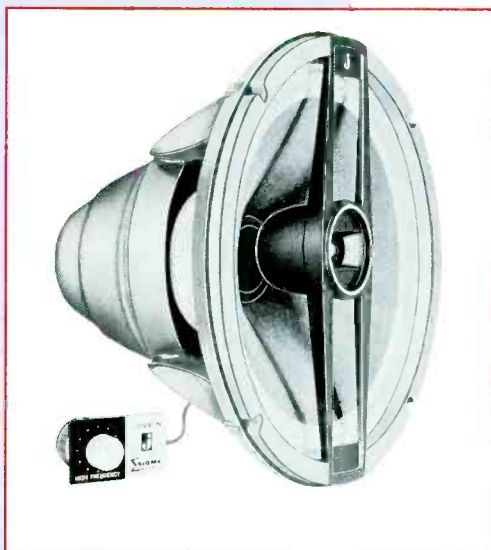
Indeed, the first few years of my life were a dreary time. Not realizing that I had had many years of existence before

Before separately driven tweeters became universal, speaker makers added stiff attachments to their woofer cones, to boost and extend treble output. University's Diffusicone was perforated, while Electro-Voice's Radax was not.



THE SPEAKERS OF 1947 WERE HUGE AND UNGAINLY, VERITABLE DINOSAURS: THREWAYOSAURUS REX, FOLDED HORNOCIRAPTOR.

my birth to learn the intricacies of thought and language (it was speech that eluded me), my parents insisted on trying to communicate with me via monosyllabic drivel. (They spent the rest of their time either at work or watching the infernal TV down in the fallout shelter.) Sure, there were lots of new brands of speakers coming out and many clever ideas for trying to improve their sound. There were folded horns and corner horns and infinite baffles and slot-loaded labyrinths. There were RCA Duocones and Altec Lansing Diacones and University Diffusicones. There was the Stephens Co-Spiral, the Electro-Voice Radax, the Jensen Triax, and James B. Lansing and Klipsch and Wharfedale.



Sound quality varied, but the problem was always the same: The speakers were big. Too big for my parents' apartment and its burgeoning TV console.

Then, in 1958, just before my second birthday—hope! Dad began talking about the need to get a new speaker. In fact, he wanted two, for some special sound effect he kept calling "stereo," which I did not fully understand. Nor could I understand the family wanting or even tolerating two new behemoths, when even one was too many before. When

the speakers did arrive in our home, my heart sank. They were tiny little things, just a fraction of the size of our old Triaxitops. Not even two of these could make any serious noise, I was convinced.

But I was wrong. These AR-3s, as Dad called them, used a technology called acoustic suspension. I learned that acoustic suspension first started a few years back, in 1954, and was a way to get deep, powerful bass from a

Jensen's SG-300 12-inch Triax speaker had a coaxially mounted woofer, midrange, and tweeter.

Westlake Audio

WESTLAKE AUDIO BBSM-6F SPEAKER

DECEMBER 1991

The early seventies mark the grassroots era for Westlake Audio; designing and manufacturing high-end speaker systems for the professional audio industry. In 1991 Westlake introduced the first high-resolution speaker system to the American hi-fi consumer. D.B. Keele summarized in *Audio's* December 1991 issue that the Westlake BBSM-6Fs "deliver a number of important attributes . . . accuracy, precise imaging, smoothness, and even coverage." Today a broad range of high-end home audio speaker systems are available. The latest evolution is the Lc-Series—satellite and subwoofer components for the discriminating audiophile and the home theater enthusiast who demand the best.

In a relatively small package, the BBSM-6Fs deliver even coverage, high output, accuracy, and smoothness.

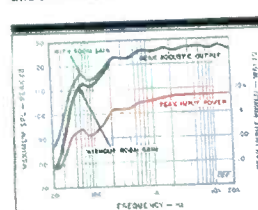


Fig. 14—Maximum peak input power and maximum peak sound output vs. frequency at 1 meter on axis.

of the loud. The horizontal orientation of the drivers initially looked strange as compared to the normal vertical orientation of other similarly sized speakers. Initial listening revealed a system that was significantly more sensitive than my reference B & W 801 Mainz Series 2. The Westlake Audio BBSM-6Fs had good overall balance and excellent imaging; however, they had significantly less bass impact than the reference and a somewhat forward sound. The BBSM-6Fs just about equalled the high-frequency response and extent of my reference but exhibited some strange tonal differences that were not to my taste. The BBSM-6Fs' excellent peak output and dynamic range capability were demonstrated very well on Heizo Kobayashi's *Light and Color* CD of Brazilian-style music (JVC VIC-3611), which I recently brought back from Japan. The dynamic range and high-level clarity of the system were demonstrated by the reproduction of Dai Gakuya's low-range orchestral works played by Tel and Goshimayon (Sony SK 49386). The Westlake speakers exhibited a smooth upper midrange and treble, which allowed me to listen very closely to the individual flute parts over the harpsichord and piano backing on the *Rampal, Kudo, and Peter* CD of music by Teromin, Kunlun, Bach, Mozart, and Dopper (Sony Classical SK 46452). The system portrayed a very realistic room sound and reverberation decay on the same CD.

EQUIPMENT PROFILE

2

WESTLAKE AUDIO BBSM-6F SPEAKER

Manufacturer's Specifications
System Type: Three-way, vented-box system.
Drivers: Two 6 in. cone woofers, 3 1/2-in. cone tweeter, and 1-in. soft-dome tweeter.
Frequency Response: 50 Hz to 18 kHz, -3 dB on axis.
Sensitivity: 91 dB, -0.5 dB at 1 meter, with 2.83 V rms applied.
Crossover Frequencies: 630 Hz and 6 kHz, 2nd, 24 dB/octave phase-compensated filters, 3 dB rolloff minimum.
Impedance: 4 ohms nominal, 2 ohms minimum.
Nominal Power Rating: 80 watts DC at 600 Hz, 50 watts from 6.3 Hz to 6 kHz, 30 watts above 6 kHz.
Recommended Amplifier Power: Minimum of 100 watts per channel.

Dimensions: 22 in. W x 10 1/2 in. H x 33 cm D (35.9 cm x 27.3 cm x 33 cm)
Weight: 50 lbs. (22.7 kg) each
Price: \$2,400 per pair in solid mahogany optional BVR-0410 D-type cables \$448 per pair
Company Address: 2696 Lavery Ct., Newbury Park, CA 91320
 For literature, circle No. 91

Westlake Audio is best known in the market as a manufacturer of professional sound recording studios. They are a major supplier of monitors for countless hi-fi systems ranging from the small, \$1,500 three-way SV-11F that can be purchased complete with electronic crossovers and preselector for \$50,000 (see page 112).

I evaluated the third system in Westlake's monitor line, the BBSM-6F, a recent addition to the consumer market. In my first listening, the BBSM-6F has been designed for "wide band stereo imaging" and a "shorter wavelength" (the most distinguishing feature of the BBSM-6F is its use of dual



Photo: Lawrence L. G. Photo: Lawrence L. G. PHOTOGRAPHY DECEMBER 1991



CIRCLE NO. 112 ON READER SERVICE CARD



James B. Lansing drivers were known for their handsome appearance as well as their sound.

ed shape yielded a wide, even radiation pattern, and distortion was kept low since the voice coil pushed the rigid diaphragm very evenly. I had to admit, speakers were finally making progress.

small speaker by using the air inside the box as a spring to assist the woofer. Many people were very skeptical of the idea that really deep bass could come from a tiny box, as I was. Yet by making the air in the small box part of the solution, instead of part of the problem, acoustic suspension set new standards for deep clean bass, for any size box. The days of the dinospeaker were clearly numbered.

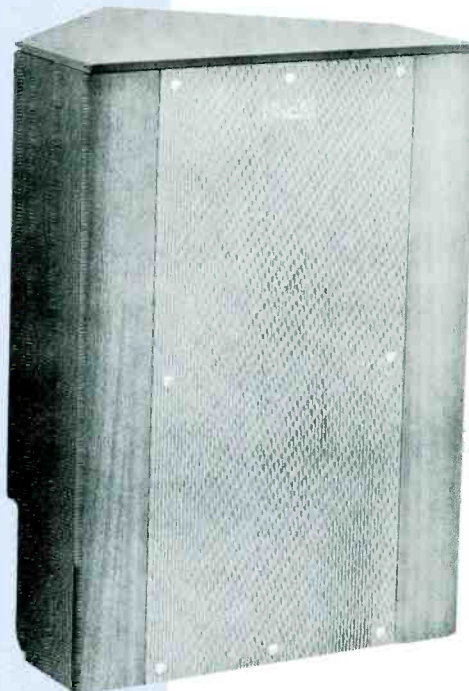
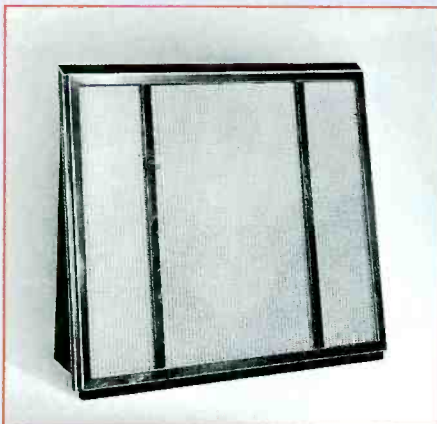
The wildest thing of all was this stereo stuff. As good as the speakers sounded from their (comparatively) tiny boxes, the music seemed to come from the zone between and around them, where

The AR-3s put that great bass together with a brand-new kind of midrange and tweeter design, called a dome. These little domes seemed such a logical idea, which might explain why a couple of different companies fought over bragging rights. Almost anywhere in the room I could crawl, the dome gave a smooth, even sound. Its small size and round-

**THIELE, SMALL, HEYSER, AND OTHERS
CHANGED SPEAKER DESIGN
FROM INSPIRED GUESSWORK
TO PREDICTABLE SCIENCE.**

Klipsch pioneered the corner horn.

The baffle of this Wharfedale three-way speaker had sand-filled walls, to reduce panel resonance.



no speaker was. It was as if the musicians were ethereal, like I used to be, and were floating around the room invisibly yet seemingly quite real. This was a radical step closer to live music, though at the time I didn't know what that was. (I guess I wasn't much different from today's typical audiophile in that regard.)

By the time the '60s came along, things were really rocking. Lots of people were getting into music and finding out what great sound they could get from modest speakers. The commercialization of the transistor gave us the kind of powerful yet affordable amplifiers that small speakers needed to really sing—especially since the songs were getting louder and louder. Four watts seemed like the Stone Age; now we talked 10 times that or more. Even more important, in the early '60s engineers were beginning to

CANTON

EQUIPMENT PROFILE

3

CANTON ERGO 100 SPEAKER

Manufacturer's Specifications
System Type: Three-way, lower-tyle, semi-bass
Drivers: Two 6 1/2" cone woofers, one 6 1/2" cone tweeter and one 1 1/2" dome tweeter
Frequency Range: 15 Hz to 30 kHz
Sensitivity: 83 dB at 1 meter with 2.83 V rms applied
Crossover Frequencies: 300 Hz and 3 kHz
Impedance: 4 ohms nominal
Power Handling: 150 watts
Recommended Amplifier Power: Up to 250 watts per channel
Dimensions: 11" x 3 1/2" x 26 1/2" (H x W x D) (28 cm x 9.1 cm x 67.3 cm)
Weight: 28 1/2 lbs. (12.8 kg) net
Price: \$3,500 per pair in walnut, oak, mahogany, or black or white ash veneer, \$5,000 per pair in 1-ply glass doors, white or mahogany
Company Address: 915 Washington Ave. South, Minneapolis, MN 55415
 For literature circle No. 76



Canton was founded in 1973 in the village of Neudorf in the former East Germany, and now exports to more than 26 countries. The name is taken from the Latin word *ergo*, to sing, and the German word *ton*, sound. According to Steve Teachout, president of Canton's American operations, they prefer to be known as a company that uses the laws of acoustics and physics competently, with known and proven methods and materials rather than a company that believes "new ways to move air."

The Ergo 100 uses the top of Canton's extensive range of home speakers, a well-tuned, three-way, direct-radiating system with two woofers operating in parallel. All drivers are made by Canton. The midrange and bass drivers have graphite-reinforced polypropylene diaphragms. This material is said to provide high mid-banging, which suppresses unwanted mechanical vibrations of the diaphragm electrically than conventional coated paper cones. This midrange driver is mounted in its own chamber and isolated from the tweeter. Canton feels that such the enclosure reproduces the important human voice range of music, it should be as good as the topmost position in the cabinet to correspond with the ear level of a seated listener. The system's main

The cabinet's rounded contours not only enhance the system's appearance but improve its sound by minimizing reflections.

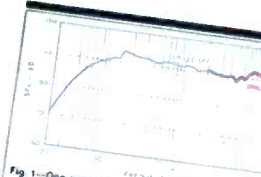


Fig. 1—One-meter, on-axis, anechoic frequency response for an input of 2 watts into 4 ohms (2.83 V)

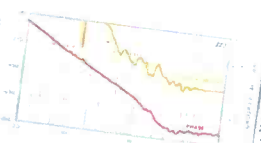


Fig. 2—On-axis phase response and group delay, corrected for tweeter arrival time.



Fig. 3—One-meter, on-axis energy-time curve.

Some teacher is made of aluminum and manganese with a soft fabric surface and it has a different layer to minimize reflections. According to Canton, the crossover network has been designed especially with regard to phase lock reproduction and constant envelope delay times. This is said to reach the listener's ear at the same time. The Ergo 100's cabinet incorporates a computer-optimized, bass-reflex (ported) design and also has die-cast aluminum drivers. The tweeter is mounted on the back of the cabinet with a black sound absorbing felt material which is a groove. Connections are made through a set of 1/8" diameter posts at the bottom rear of the cabinet. The standard 1/8" posts are spaced apart by more than 1/2" to prevent plugging, so they cannot accept normal double-

Measurements
 Figure 1 shows the on-axis frequency response of the Ergo 100 with and without the grille. Measurements were taken with 2.83 V rms applied at a distance of 1 meter on the floor 3 and 10 meters above the bottom of the system, and then referenced back to 1 meter. A stable response of about 150 dB and a modest lowering of level of about 2 to 3 dB at 10 kHz and a moderate lowering of level of about 2 to 3 dB at 20 kHz were observed. The curve has a roll-off rate of about 18 dB/octave below 30 Hz. Curves supplied by Canton were about 7 inches above the top of the enclosure, which is 7.5 inches above the ears of a seated listener. The curve over the range from 250 Hz to 4 kHz lowering of level through the upper midrange region corresponds to the below 10 kHz. The grille has only a slight effect on the response from 10 to 10 kHz, but the grille does reduce the response by about 20 dB (not shown). The grille reduces the response by about 20 dB and the response reached a match of 0.5 dB. Comparing right and left sides revealed a match of 0.5 dB.

Figure 2 shows the phase and group delay responses of the speaker's arrival time. The midrange lags 3.5 ms at crossover. This delay is purely due to electrical delays inherent in the crossover filter and parts of electrical "onset." One significant feature of the curve is a resonance at 150 Hz, which coincides with the top of the tweeter's response.

Figure 3 shows the energy-time response of the system at 1 meter on axis at 2.83 V rms. The response below 10 ms is the main arrival, at 3 ms is the first reflection.

CANTON ERGO 100 SPEAKER

MARCH 1992

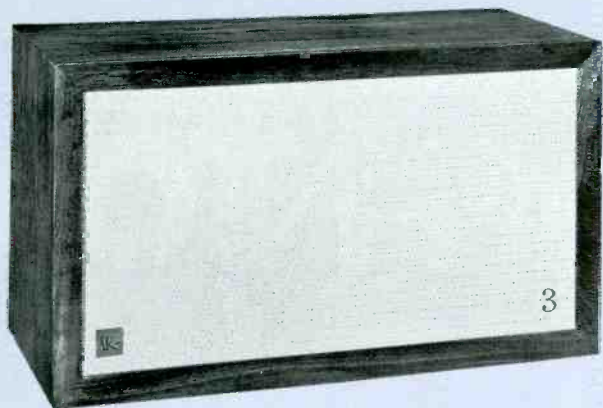
"A company that applies the laws of acoustics and physics competently," is how Steve Teachout, President of Canton America, described Canton. Reviewer D.B. Keele, Jr. agreed.

Keele summed up his review of the Ergo 100s, describing them as having, "high sensitivity and good looks, combined with smooth, balanced sound, good imaging and low distortion, a very worthy contender in the tower loudspeaker competition."



CIRCLE NO. 76 ON READER SERVICE CARD

CANTON 915 WASHINGTON AVENUE SOUTH MINNEAPOLIS, MN 55415-1245 PHONE (612) 333-1150 FAX (612) 338-8129



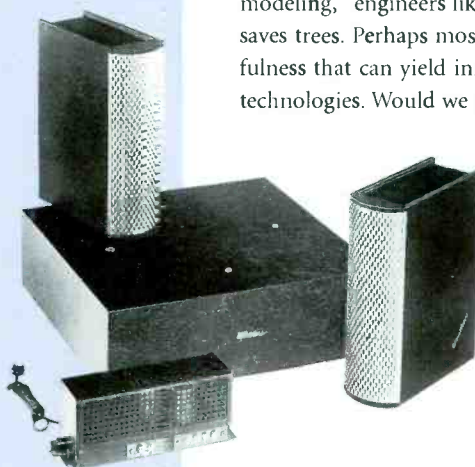
The AR-3 and other acoustic-suspension speakers delivered deep, powerful bass from small boxes.

learn how to test speakers intelligently. Terms like “pink noise” and “transient response” were entering the audio lexicon. Small was “in.” Soon dozens of new brands were jumping into the market, the competition bringing further improvements in sound and visual appeal. Even some pretty old ideas, such as the electrostatic speaker, were being born again, this time with a space-age flair for modern technology and lots of new materials to solve old problems. Hi-fi was such big business that many highly automated factories were built just to make woofers and tweeters, achieving a previously unheard of level of manufacturing precision and consistency. It was indeed a Golden Age.

By now, I was grown up enough to get out and about a bit. For one thing, I finally learned what live music was all about. And, after losing the Mr. Nude Preteen contest at Woodstock, I realized why so many people preferred their stereos.

While I was busy wrestling with my hormones, older and more disciplined people were wrestling with the science of loudspeakers. Although we had landed a man on the moon, nobody on earth knew how speakers really, really worked. Sure, we could test them after we built them. And we could describe the basic physics of their operation. But there was no simple and reliable way to design a speaker from the ground up with any assurance it would sound good. Too much was left to trial and error. Which woofer should go in which box? Should we use a vented or a sealed enclosure? How big should the port be? How do we

JBL's Paragon used one enclosure for stereo's two channels, not that it saved much space.



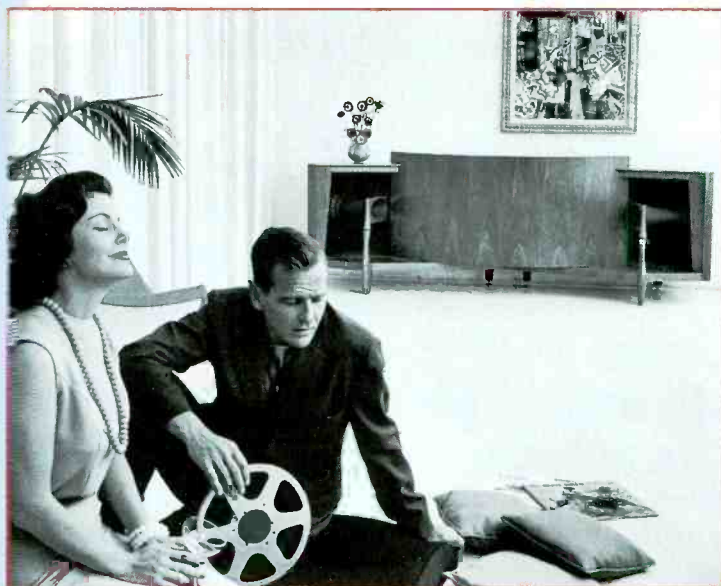
find the right tweeter to match? Guesswork that didn't sit very well with the science-freak audio-nut crowd. There had to be some logic to the process.

By the early 1970s, brains like Neville Thiele, Richard Small, Don Keele, Dick Heyser, Roy Allison, and others had consolidated the earlier mathematical and practical acoustics of Leo Beranek, Harry Olson, James Novak, Paul Klipsch, et al. to develop simpler methods of loudspeaker design. (Me, I hadn't even scored yet.) But “simpler” is in the eye of the beholder, and even these new methods were tedious to do by hand. It wasn't until the late '70s and early '80s that things really exploded. (And I'm not talking about my sex life anymore. I worked that out.)

With the introduction of powerful, low-cost computing, the Golden Age went Platinum. The combination of computing power and acoustical “new math” meant that speakers could be designed on paper before any trees had to die to make cabinets. “Computer modeling,” engineers like to call it. It saves time. It saves money. It saves trees. Perhaps most important, it encourages a kind of playfulness that can yield innovative technologies. Would we have the

When small was in, Weathers produced this early satellite/subwoofer system whose satellites could masquerade as books on your shelf.

bandpass subwoofer without computers? No. Would we have sixth-order time-coherent crossovers without the computer? Noooo. (Hmmm, maybe I better think more about the implications of this whole computer thing.)



TEAC®

A Passion for Excellence.

EQUIPMENT PROFILE

2

TEAC ESOTERIC X-1 CD PLAYER

Manufacturer's Specifications
Frequency Response: Unbalanced input, 0 Hz to 20 kHz ± 0.5 dB; balanced output, 20 Hz to 20 kHz ± 0.5 dB
S/N: 93 dB (the) 113 dB
Dynamic Range: Greater than 102 dB
Harmonic Distortion: 0.0012% or less at 1 kHz
Channel Separation: Greater than 110 dB at 1 kHz
Analog Output Level: Unbalanced, 2.0 V rms, balanced, 19.6 dBm (7.3 V rms)
Digital Output Level: Coaxial, 0.5 V, peak to peak, optical ± 15 dB
Number of Programmable Tracks: 20
Power Requirements: 120 V A.C.
Dimensions: 17 1/2 in. W x 5 1/2 in. H x 15 1/2 in. D (45.1 cm x 13.7 cm x 40 cm)

Weight: 6.0 lbs (2.7 kg)
Price: \$5995
Company Address: 7733 Telegraph Rd., Montebello, CA 90640
 For literature, circle 113 on card



AUDIO/NOVEMBER 1992

The Esoteric X-1 is superb, and even if you can't afford this gem, please do yourself a favor and go hear it.

crossed level. For another signal, harmonic components arising from over-tracks of the stereo range, with the detector connections disconnected, those bit noise level increments disappeared, from 120 to 125 dB. This excellent TEAC's noise level is attributable to design build error.

Separation, shown in Fig. 4, measures 118 dB for the left channel and 116 dB for the right channel at 1 kHz, remains greater than 100 dB for both channels.

Fig. 4—Separation vs. frequency.

Overall signal-to-noise ratio, measured while playing a "two signal" track of the CBS CD 111 disc was 110 dB for the left channel and an almost identical 110.1 dB for the right channel. The E-X-1 dynamic range measured 108.7 dB for the left channel and 108.0 dB for the right channel. A spectrum analysis plot of the residual noise produced by the Esoteric X-1 is shown in Fig. 5. Note that even at 80 kHz, where I normally expect to see a peak caused by the power supply's fundamental frequency, the noise floor maximum recorded level is only 123 dB.

Fig. 5—Spectrum analysis of residual noise when playing "no signal" test track.

As shown, deviation from linearity with unfiltered signals is almost perfect from 0 dB to 120 dB, with deviations less than 1.0 dB down to levels of -80 dB. The X-1's excellent resolution system using filtered products even better, as shown I could detect measurable deviation from linearity at -100 dB.

Fig. 6—Deviation from perfect linearity.

As the system's EIA dynamic range, which is approximately 115 dB, for SMP-BV distortion was measured at 0.00049% for the left channel and 0.0025% for the right channel. Clock accuracy was within 0.0109% of perfection.

Fig. 7—Fade-to-noise test.

Use and Listening Tests

Using the special Para-Variety "delta" disc, I determined that this player could handle missing data without error for 1.0 min. That's not the best I have measured for a CD player, but it is well above the minimum standards listed in the Philips "Red Book of CD Specifications" for CD players and recorders. On the other hand, the X-1 is so stable and meticulous in its external attention that I literally had to pause on the sides of the unit for the system to reload.

For my listening tests, I chose a disc of new CDs that recently acquired Teac's choice of Ortophonic's Gene Manesque 100 (8329), played by the Cincinnati Pops Orchestra under the direction of Erich Kunze. On a lesser CD player, however, this recording seemed overly strident (an effect that some CD players have been known to produce on many discs released). No such stridency was evident when the recording was played on the X-1.

A second CD that I previously reviewed on the X-1 was a CD by Protopos solo songs by two modern composers, Carter Burwell and Frank Zappa. Expecting to hear an assortment of idiosyncrasies, was pleased and surprised, particularly by the Blackwood Solo Works, Op. 31. As in approach as nearly as possible, I gave the disc a "5" rating. I had discovered the had been until 1985, but as it may be the first copy of the solo collection in the place since through with not the slightest evidence of roughness that sometimes accompanies early recordings of a "mid" or "lesser" CD players.

In fact, the TEAC Esoteric X-1 is a superb instrument in which great sound quality has obviously been placed on a relatively low cost package. Even if you can't afford to own this gem of a CD player, do yourself a favor and give the Esoteric X-1 a listening else you will have a reference against which to compare CD players that you can afford!

Lechman Feldman

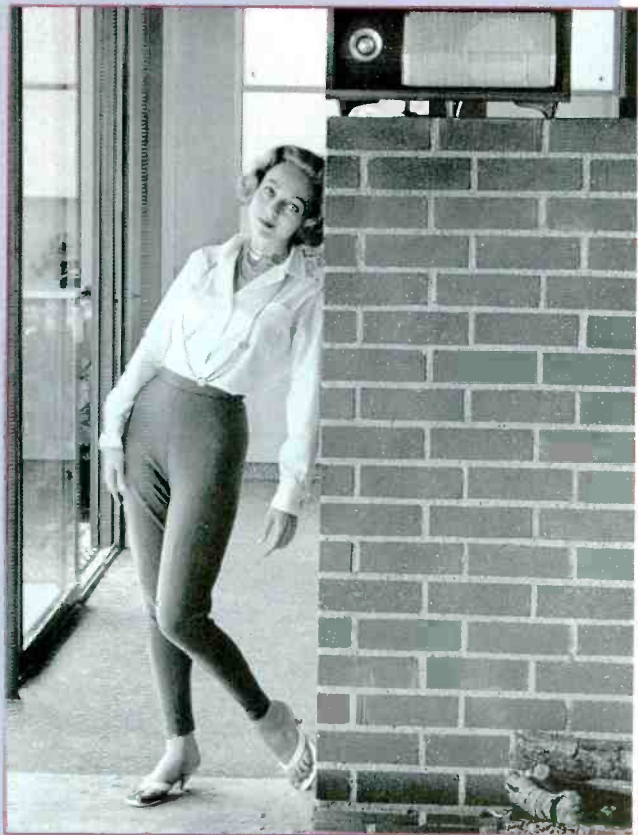
AUDIO/NOVEMBER 1992

TEAC ESOTERIC X-1 CD Player

NOVEMBER 1992

In November of 1992, Len Feldman wrote, "... the TEAC X-1 is a superb instrument in which great emphasis has obviously been placed on sound quality as well as performance reliability." It's been that way with us for over 40 years. TEAC... A Passion For Excellence.





In the '50s, dreams of smaller speakers led to this James B. Lansing Bel-Aire.

Well, anyway, armed with microphones, computers can test loudspeakers in whole new ways, dissecting the sound moment by moment and finding details and errors that couldn't possibly be seen before. This, in itself, helped designers refine speaker sound to

IF WE CAN NOW DO ANYTHING WE WANT WITH SPEAKERS, IT'S TIME TO FIGURE OUT JUST WHAT WE NEED TO DO.

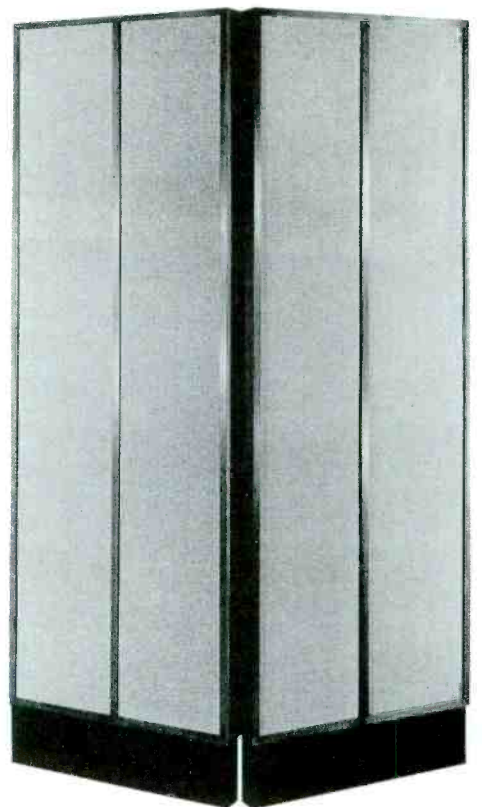
a much greater degree than in the past. Armed with a laser, a computer can tell you how and where a woofer cone is breaking up or precisely how a tweeter is resonating, so the basic parts that speaker designers had to work with got better, too.

All of which pretty well brings us up to the '90s and my present, quite corporeal state. A decade in which TVs and speakers finally learned to just get along. Fifty years of trial and error, of science and technology, have taught us a lot and left us with some

Not all speakers of the '60s were compact, as witness the KLH Model Nine, a full-range electrostatic.

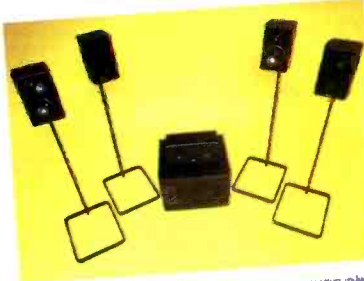
very memorable (if never quite perfect) loudspeakers. But it has also left us with a nagging question: If we can do anything we want, what do we want to do? The answer is not obvious. Not obvious at all. Think about it: A speaker has to do more than reproduce a simple signal. It has to answer to the human brain. It has to play a critical part in creating an illusion of musical reality. As just one example, when a microphone picks up a sound, it combines what it hears from all directions into one signal. All an amp or CD player has to do is pass along that signal as purely as possible. But a speaker has to rebuild a roomful of sound and direction. It has to undo what the microphone did, and it has to do it in a completely different room.

It may seem an impossible task, but it is not. Just as stereo boosted the realism of hi-fi, so will new multichannel media—once we learn how to use them well. Much of the burden, however, still remains with the loudspeaker. What is the “proper” radiation pattern, if there is one? How do we adapt a speaker to different rooms or even different recording techniques? What measurements correlate best with what we hear? Now that we have gotten the basics of loudspeakers down pat, it's time to look for the answers to these harder questions about acoustics, recording, and perception. I think this is the path that will lead to true realism in audio reproduction. By now, we certainly ought to have learned that digital jitter or amp THD isn't the Holy Grail of perfection. It's kind of scary. But then, we're not —9 anymore, are we, kids? A



Atlantic TECHNOLOGY

AURICLE ATLANTIC TECHNOLOGY SYSTEM 150 HT SURROUND SPEAKERS



Just from the moment I unpacked this complete home theater speaker system, I sensed that Atlantic Technology's objective in creating it was total flexibility. The speakers in the system—a pair of Model 151 HT two-way front speakers, a Model 153 C center-channel speaker, a pair of Model 154 SB surround speakers, and a Model 152 PB2 amplified subwoofer—all are built separately and in various combinations designed for specific needs. From a \$4,000 to a \$6,000 three-piece satellite/subwoofer system installed in series on the System 150 (200-1279), designed for those who must add surround to

Company Address: 343 Vanderbilt Ave., Norwood, MA 02062. Call for literature, circle No. 93

AUDIO/FEBRUARY 1993

with-car be used to power the subwoofer alone. In an alternative home theater setup, the amplifier can channel 70 watts to the subwoofer and 30 watts to each of two satellite speakers. Another alternative would be to use the subwoofer as a center channel speaker. The 152 PB2 has two detachable crossover speakers: 60 or 120 Hz (120 dB/octave) low pass, 12 or 24 Hz (12 dB/octave) high pass. In my listening tests, I found that the 120 Hz setting was preferable when the 152 PB2 was used with the rest of the system. The 120 Hz setting delivered a bassy, lush, one-note bass that might appeal to 16- to 18-year-olds but seemed out of place with the more musical music.

The 153 C, impressively stacked center channel speaker (151 W) has two drivers: a tweeter and a 5.25-inch driver. The tweeter is a 1.5-inch dome speaker, providing a wide dispersion of center speakers. A variable listening effect is used by the use of widely spaced multiple drivers. This effect gives music dialog with an air in precise positioning. With the 153 C, however, dialog remained punchy, as if it could be on all the listening seats. This is why the speaker can handle up to 110 watts of power. Like the other speakers in the system, has a detachable high speaker, as well as 110 watts of power from external amplifiers. As seen on A/C receiver. Therefore, you will be able to use an external amplifier to drive it without affecting the dynamic demand of a home theater system.

Atlantic refers to the 154 SB surround speakers as "cassette" because their size (10 1/2 inches) allows them to be used in a 120 Hz or 24 Hz setting. The 154 SB is a 10 1/2-inch driver with a 100 Hz crossover. The speaker is designed to avoid distortion despite the unusual driver configuration. Also, the two drivers are wired with opposite polarity. The purpose of all this is to match the

center of most of today's overly bright and forceful CTR. In fact, if the sound of the speaker is too bright and forceful, the tone bar and surround may well be your ideal units.

I was also struck by the ability of the 154 SB to handle the placement of the center channel speaker. The 154 SB is a 10 1/2-inch driver with a 100 Hz crossover. The speaker is designed to avoid distortion despite the unusual driver configuration. Also, the two drivers are wired with opposite polarity. The purpose of all this is to match the

OVERALL RESPONSE IS SMOOTH AND MUSICAL WITH PLENTY OF DETAIL BUT NO HARSHNESS

When I first tried the speakers, I was struck by the ability of the 154 SB to handle the placement of the center channel speaker. The 154 SB is a 10 1/2-inch driver with a 100 Hz crossover. The speaker is designed to avoid distortion despite the unusual driver configuration. Also, the two drivers are wired with opposite polarity. The purpose of all this is to match the

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Continued from page 78
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ATLANTIC TECHNOLOGY SYSTEM 150 HOME THEATER SPEAKERS

FEBRUARY 1993

Back in February of 1993, Len Feldman writes "The System 150 certainly puts to rest the notion that a good home theater installation has to cost \$20,000, \$30,000 or more. Here, for under \$1000, is a six-module system that provides all of the speakers required for a superb home theater setup . . ." With our new System 250.1 and System 350THX®, Atlantic Technology continues to be the leader in performance and value in innovative home theater speaker systems.



Paradigm

PARADIGM STUDIO MONITOR LOUDSPEAKER

APRIL 1993

... "Does the Studio Monitor meet it's goal of keeping up with the big-guy, high end systems at only half the price? You bet!

Check them out for yourself!" was a quote from Paradigm's Studio Monitor review in the April '93 issue of *Audio*. This superb model further established Paradigm as a leader in high performance speakers!



EQUIPMENT PROFILE

PARADIGM STUDIO MONITOR LOUDSPEAKER



The recently-updated Paradigm Studio Monitor has its top of the line, most expensive state-of-the-art system, high-end materials, and a cabinet that's about 20 years old. The speaker's design is a testament to the fact that the Studio Monitor continued the tradition of the other Paradigm speakers. The speaker's design is a testament to the fact that the Studio Monitor continued the tradition of the other Paradigm speakers. The speaker's design is a testament to the fact that the Studio Monitor continued the tradition of the other Paradigm speakers.

high bypasses in synthetic horn suspension" (patented) is used. The similarly designed ferrofluid cooled tweeter utilizes a carbonium core of the same material that exhibits "exceptional ruffness versus mass and excellent internal damping."



The ferrofluid-cooled tweeter uses a low-profile, convex aluminum dome, which is used to push the dome's first breakup-resonance frequency far above the audible range and a treated textile suspension. The tweeter is also a close-mounted diaphragm less over the center of the dome to smooth and reduce its response. Coupled with other design features, the tweeter is said to exhibit exceptional power handling and freedom from dynamic compression.

ABOVE 500 Hz, THE PARADIGM'S POWER HANDLING KEPT UP WITH ANY SYSTEM I'VE TESTED.

The Studio Monitor's crossover contains four resistors, one inductor, four capacitors, and six diodes, one counting parallel units. All parts are high quality and very close tolerance ($\pm 2\%$). The crossover is factory-adjusted to allow the level of the tweeter to be set for close cabinet-to-cabinet matching. The woofer and midrange inductors are zinc and ferrite cores, respectively, while the tweeter coil is an air-core type. The crossover is said to be of quasi-Butterworth design. The crossover is used as a point of reference for the speaker's design.

cabinets for the Monitor line but obtains the savings and features from Vifa, which makes them to Paradigm's specifications. The system, which is deeper than it is wide, is nearly 4 feet tall. It contains a vertical array of drivers with the tweeter on the bottom, and the midrange and woofer mounted above, all on the center line of the front panel.

The high-efficiency, 8-inch woofer uses large, 8-oz. magnets and 1.5-inch diameter voice-coils, and are mounted in die-cast aluminum frames. The motor uses "flushed-back" magnetic geometry and high-temperature neodymium voice-coils mounted on a vented, aluminum and copper frame. In order to minimize distortion, Paradigm uses a special cone and surround material that they call "mineral-filled copolymer polypropylene" pressed to a

SPECS

System Type: Three-way, quasi-third-order resistor-pass system.
Drivers: Two 8-in. cone woofers, 5-in. cone midrange, and 1.5-in. diaphragm dome tweeter.
Frequency Response: 30 Hz to 20 kHz, ± 2 dB, on axis; 30 Hz to 15 kHz, ± 2 dB, 30° off axis.
Sensitivity: 87 dB at 1 meter with 2.83 V rms applied.
Crossover Frequencies and Filter Slopes: 273 Hz (second-order electrostatic) and 2.5 kHz (third-order electrostatic).
Impedance: Nominal, 8 ohm minimum, 6 ohms.
Recommended Amplifier Power: 15 to 500 watts per channel.

and the other is a reader board for the low-frequency components.

The rear of the cabinet contains the large connection panel, with three pairs of heavy-duty, double banana jacks for the woofer, midrange, and tweeter. This allows for wiring of mid-wiring the system. (The cable manufacturers love Paradigm! After all, having all three pairs of the system separately available is a boon to us reviewers who like to investigate customer relationships, red-off shops, etc.). The bases of the jacks will accept large cable, up to 0.2 inch (40 AWG) in diameter. In standard single-wire configurations, long gold-plated straps are provided to connect the three sets of terminals.

The main structure of the Studio Monitor's cabinet are constructed from high-density composite hard board, which is said to have high internal damping to minimize resonances. Flat iron braces, made from Modite fiberboard, located around the full perimeter, also reduce resonances. The "Car-Span" damping material used to reduce internal standing waves is said to be acoustically transparent at lower frequencies where the vented-box cabinet operates. The midrange operates in its own sealed sub-cabinet that connects the front and rear of the cabinet. Red sound absorber is used on the top, sides, and rear of the cabinet, while the front panel is finished in Paradigm's traditional wood-grain.

Measurements

Figure 1 shows the on-axis anechoic frequency response of the Studio Monitor, taken with and without the grille. Measurements were taken at a distance of 2 meters from the cabinet's front, on the tweeter's axis, with a voltage of 5.66 V rms, and referenced back to 1 meter. The response below 600 Hz was derived from 2-meter ground plane measurements with input level of 2.83 V rms to compensate for the ground plane's 6-dB boost.

The only significant trend in the response is a gradual slope in the response of about 0.8 dB/octave from about 70 Hz to 9

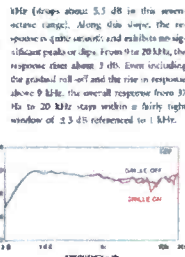


Fig. 1—Anechoic frequency response.

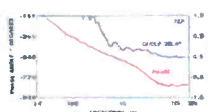


Fig. 2—Phase response and group delay.

Below 10 kHz, the main effect of the grille is a 4-dB notch in the response at about 7 kHz. Otherwise the grille's effect on the response is minimal, decreased only in the range from 250 Hz to 1 kHz, the sensitivity of the system is 86.8 dB, essentially equaling Paradigm's 87-dB rating. Right-left matching was a very tight ± 0.5 dB from 100 Hz to 20 kHz.

Figure 2 shows the phase and the group delay responses of the Studio Monitor to the tweeter's arrival time. Both these curves are quite smooth and well behaved. Between 1 and 20 kHz, the phase curve rotates a significant 210°. This rotation is due to a combination of crossover design and mid-range tweeter acoustic center offset. Between 1 and 3 kHz, the midrange output lags the tweeter by about 0.17 ms.

THE MARCH *of* TECHNOLOGY

five

50 YEARS OF FOLLIES—IDEAS THAT DIDN'T FLY

by Robert Long

50th ANNIVERSARY



Sansui's QS-500 four-channel amplifier included a decoder for QS-encoded records.

By creating a three-dimensional sound field, we were told, the new technology would offer listening excitement and verisimilitude unknown in the fewer-dimensional world of stereophonics. The question was: How should the four channels of sound be delivered? The record companies generally preferred matrixing, using phase relationships within the stereo LP groove to carry spatial information that an appropriate decoder could reconstruct into a reasonable sound field. The most successful of the matrix systems was Columbia Records' SQ, but there were several alternatives, of which Sansui's QS gained a few adherents among the record companies.

The alternative to matrixing was discrete quad (a usage that made Quad, a manufacturer who'd been using that name since monophonic days, most unhappy). Tape had an obvious advantage



Pioneer's QX-949 receiver had decoders for SQ and CD-4 quadrasonic LPs and a four-channel balance display.

Reviewing the audio projects that failed to make the cut over the last half century, I'm reminded of a line from Milton: "They also serve who only stand and wait." Many so-called failures ended up succeeding, in a way. Some were just plain ahead of their time, while others failed to find their public before their developers' initial funding ran out. But in each case, somebody somewhere believed in them for a reason, and in many cases those reasons bear reexamination.

Certainly this is true of that notorious 1970s boondoggle, quadrasonics. Or quadriphonics. Or tetrasonics. Or quadrisonics. At the time, nobody could seem to agree even about the name. The IHF (Institute of High Fidelity) finally adopted the spelling "quadriphonics"; this satisfied dictionaries but not philologists, who objected to the mixing of Greek and Latin roots. It was in vain, however; though "quadrasonics" used a nonexistent combining form, it was already well established in the marketplace.

I hardly need rehash the hype or the often acrimonious infighting that attended quadra-

in this respect, because each of the signal's four channels could be fed directly to one of the four tracks on quarter-track tape—or to half of the tracks in an 8-track tape cartridge, which was still a popular medium at the time. And JVC, an active participant in the record business, developed a “discrete-quad” LP, CD-4, whose rear-channel information was conveyed by ultrasonic carriers mixed in with the front-channel signals. Both RCA and Vanguard adopted CD-4. But it took special phono cartridges with controlled high-frequency resonance to read the ultrasonic signals, and even they didn't always succeed—especially if playback by ordinary cartridges had worn down the carriers. So JVC's CD-4 LPs proved the most trouble-prone of the major delivery systems.

The entire quadraphonic edifice collapsed from a combination of three main factors, I believe. One certainly was the vituperative and ultimately destructive competition among companies who genuinely thought that theirs was the best system. A second was the gross failure of record producers to make good use of the medium. Those of us who believed in “surround sound” expected that, just as stereo eventually surpassed its “ping-pong” beginnings, so quad would blossom into the medium of choice. It never happened.

Elcaset decks, such as Sony's EL-5, offered higher fidelity than cassette but not enough to outweigh its greater bulk and cost.

The third inhibiting factor was probably the most significant: In the brouhaha over delivery systems, the recording industry never got around to examining the fundamentals closely enough. The aural mechanics of side sound sources, particularly those in motion, were never thought through until they were reexamined recently for home theater systems. Thus, quad-

3M's Revere recorder could play through a 15-hour stack of 20 stereo cartridges.



raphonics laid much of the groundwork for home theater and, like a stage mother, succeeded vicariously in the end.

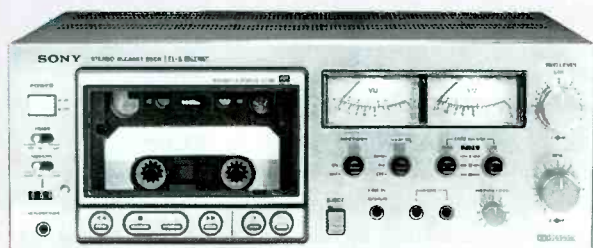
One point that mitigated against quad LPs was the fear that record company executives have of any double-inventory system, a fear born around the same time as *Audio*. In the late '40s, record dealers found they had to stock LPs, 45s, and 78s if they were to be all things to all customers, and they hated it. So when stereo came along, the cry was “compatibility!”

British Decca's earliest experimental stereo LPs, made with the first Teldec/Neumann stereo cutter, had one channel recorded laterally, like a mono LP, and the other recorded vertically. To make both channels readable by mono equipment, the modulation directions were rotated by 45° so that one channel was recorded on each wall of the groove. But it didn't work: The heavy, uncompliant mono pickups of the day wreaked havoc with the complex grooves of stereo LPs, and stereo recordings had to be issued additionally in mono pressings to satisfy the less adventurous or less affluent consumers.

The double-inventory issue came up again in the 1980s, when CBS Records issued the CX series of LPs. At the time, most of the major recording companies were compressing classical recordings (and perhaps other types) to tame dynamics for home playback. Audiophiles naturally were scornful of the practice. CBS thought a relatively simple, reversible compression design would make possible housebroken mass-market recordings that could still yield full dynamic range to audiophiles, via a reciprocal expander. But almost

immediately there was demand, justified or otherwise, for the same recordings without the CX processing. That meant double inventory, so the series disappeared within months.

The vast success of the Philips Compact Cassette can be said to justify the many tape cartridge systems that sought to simplify the often galling problems of dealing with open reels. A near miss was the Cousino endless-loop cartridge, which enjoyed some success in audio/visual devices but never secured a beachhead in the home market. A nearer



Viking called this playback-only deck “the turntable of the tape age.” It played quarter- and half-track mono or stereo tapes at 7½ or 3¾ ips.



PARASOUND

EQUIPMENT PROFILE

PARASOUND HCA-2200[®] AMP



The Parasound HCA-2200[®] is very personally affectionate, deserving all the praise it has received. It is designed in high end audio. It is not a small power amplifier, nor only because it rates at some 220 watts per channel into 8 ohm loads, but also because it maintains Class A operation up to an output of 8 watts. The output output stage uses 120 pairs of output devices for classic three device per channel for classic three device per channel current sharing.

The HCA-2200 is attractive in its black vinyl finish. Its front panel is 19 inches wide, 19 inches high by the standard 19 inches wide, inches high by the standard 19 inches wide, inches high by the standard 19 inches wide. It has a pair of built-in handles to assist in lifting and moving the amp. To the left of the handles is on the rear, a master power switch, accompanied by a pair of LEDs. The red "Standby" LED glows when the unit is first switched on, and the green "Normal" LED

glows on a few seconds later, when the amp is ready for operation. Red LEDs monitor the right channel. "Current Overheat" and "Output Stage Overheat" are each equipped with a small LED, located in the heavy-duty socket on the rear panel, beside the heavy-duty socket. On the rear panel, there are four handles for each channel, one for the positive and negative side, and one for the positive and negative side, and one for the positive and negative side, and one for the positive and negative side.

WITH JUNCTION FEE AS INPUT DEVICES, THIS AMP DOES NOT NEED CONSTANT CURRENT SOURCES PER SE.

ther: the unbalanced or balanced input for each channel, and a single toggle switch for selecting stereo or bridged stereo mode. Mechanical construction is unrelenting wood, using the two side-mounted heat sinks as the foundation that everything else is built upon. A front sub-panel and the rear panel, both in the front, and the top and bottom covers (all in black) are also used normal, about 1/2 inch thick) are used on the rear with stainless screws to lift on the rear panel and front sub-panel. The top and bottom are also bolted to the sub-panel, which ties them back along with the heat sinks as well. Two

SPECS

- Power Output: 20 W to 20 kHz
- Stereo: 120 watts/channel into 8 ohms, 165 watts/channel into 4 ohms, 165 watts/channel into 2 ohms, mono: 750 watts into 8 ohms, 1,000 watts into 4 ohms
- Current Capacity: Continuous, 90 ampere peak, 90 ampere
- Dynamic Headroom: Greater than 15 dB
- THD: At 100 watts, less than 0.05% at typical power levels, less than 0.005%
- IM Distortion: Less than 0.01%
- Transient Intermodulation Distortion: Unmeasurable
- Frequency Response: 3 Hz to 95 kHz, ± 0.5 dB
- SN Ratio: Greater than 135 Voids
- SN Ratio: Greater than 118 dB
- A-weighted, with noise, better than 88 dB in 1 kHz and greater than 74 dB at 10 kHz
- Channel Separation: Greater than 88 dB in 1 kHz and greater than 74 dB at 10 kHz
- Input Impedance: Unbalanced, 120 kilohms, balanced, 200 kilohms
- A.C. Power Requirement: 1,800 watts
- Damping Factor: Greater than 1,000 at 20 Hz
- Dimensions: 19 in. W X 7 in. H X 19 in. D (46.3 cm X 17.8 cm X 48.1 cm)
- Weight: 90 lbs. (41.3 kg)
- Price: \$1,995
- Company Address: 950 Battery St., San Francisco, Cal. 94111
- For literature, circle No. 99

AUGUST 1993



toroidal power transformer, one per channel, are stacked inside the enclosure at the front and are attached to the bottom panel with a huge bolt. Approximately the middle third of the enclosure is taken up by four main floor capacitors and the attendant circuit needs mounted atop them. These capacitors hold numerous bypass capacitors for the main filter capacitors, plus the circuitry for the bias and power supply and regulators. The main audio input is built on a PCB that takes about the rear third of the area and is attached horizontally near the top of the amp.

Circuit Description
 Revolutionary is the way I would describe the use of completely complementary circuitry throughout this design (well, revolutionary for John Curl, anyway, as he's known for using completely complementary circuitry). The input stage is a complementary differential amplifier using matched dual Motorola and Philips 1.8EETs. The complete input stage is formed by cascading the 1.8EETs with bipolar transistors. In a design like this, where 1.8EETs are the input devices, there is no need for constant current sources per se. The 1.8EET source circuits of the two bipolar are tied together with a common resistor that sets the overall operating current for the input stage. Both collector of the outputs of each complementary input differential amplifier are coupled to two complementary differential second stage, which are bipolar transistors. The appropriate selection of this second stage are tied together through a bias-setting resistor and drive the input of the output stage's complementary circuit and the other

or their passes through two amplifier channels. However, to do it in a more balanced way would require more four end amplification for polarity inversion, which could affect the sound. Elaborate protection circuitry monitors output stage current, output dc offset, and

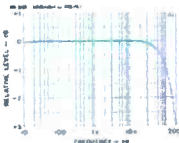


Fig. 1—Frequency response for open circuit, 8-ohm and 4-ohm loads.

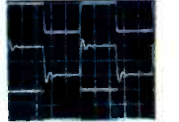


Fig. 2—Square wave response of the amp. 10 kHz, 8 ohms (20 V/div), 10 kHz, 8 ohms & 2 V (20 V/div), 40 Hz, 8 ohms (5 mV/div, at 1 V/div on vertical scale).

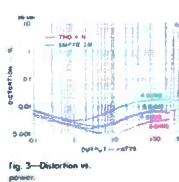


Fig. 3—Distortion vs. power.

PARASOUND HCA-2200[®] POWER AMP

AUGUST 1993

For its unprecedented performance-to-price ratio, Parasound's HCA-2200[®] power amp was hailed as "revolutionary" when it was reviewed in August 1993. The HCA-2200[®], created by legendary high end designer John Curl, performed "flawlessly," according to Audio's Bascom H. King. It's seldom that a veteran reviewer is able to report performance that's flawless, and it helps explain why the HCA-2200[®] is still made and is already considered to be a classic. It illustrates why Parasound is acknowledged as the leader in providing the highest quality audio and home theater components priced between \$250 to \$2,500.



CIRCLE NO. 99 ON READER SERVICE CARD

miss was 3M's Revere cartridge system, which was licensed to Columbia Records. It contained a single "reel" of tape that fed automatically into the player. But the 3M system used half-width tape running at 1 7/8 inches per second; its narrow track width and slow transport speed pressed the '60s technology very hard, inhibiting credibility.

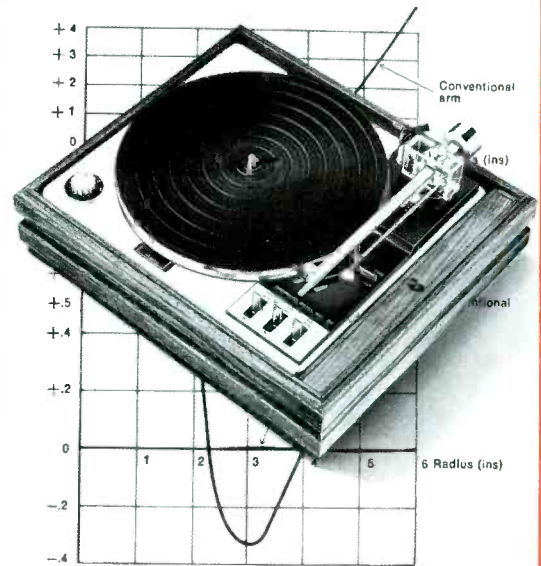
Far less innovative technologically was the RCA cartridge of about the same era. This cartridge's two tape hubs were in a single housing and held quarter-inch tape that ran at 3 3/4 inches per second. The eventual winner in the cartridge sweepstakes, the Compact Cassette, was essentially a miniaturization of the RCA cartridge but with the tape speed and virtually the same tape width as the 3M Revere system's. Another design, the semipro Elcaset, used the same tape width and speed as the RCA cartridge but had a slightly smaller shell; the tape was pulled out of the shell during playback or recording, for smoother travel. Keyways in the Elcaset's shell told recorders and players what bias and equalization to use. These features prefigured the way that cassettes for various applications have been designed more recently. (The original Compact Cassette had only a single pair of keyways, with tabs that could be broken out to protect either side against accidental rerecording.)

Among other failed ideas in the tape field were magic-eye (Tandberg) and neon-bulb (Ampex) level



Even though it was used for a few LPs as well as tapes, the dbx noise-reduction system lost out to Dolby C NR.

Garrard's Zero 100 had a pantographic arm that kept the cartridge reasonably tangent to the groove over the whole disc, to reduce tracking error.



AUDIO IMPROVEMENTS HAVE OFTEN FOUNDERED ON THE SHOALS OF COMPATIBILITY.

peak-reading displays give us the best of both worlds. Another failed idea was playback-only decks, as offered by Tandberg, Sony, Viking, and others. Since a record/play head must compromise between a narrow head gap for good high-frequency playback performance and a wide gap for good recording performance, dispensing with the recording mode made sense. But the buying public evidently didn't agree.

indicators. They were much more precise, particularly in reading transients, than were the cheap meters of the day, but the public wanted "professional-looking" meters, even if they didn't act like the professional varieties.

Today's



Nor did the public ultimately take to the consumer version of dbx noise reduction, thanks at least in part to Dolby Labs' campaign on behalf of the competing Dolby C; nevertheless, it spawned a series of dbx-encoded prerecorded cassettes and even some dbx LPs. Another once-hot development was ferrichrome tape, in which a ferric layer handled the low frequencies and a chromium-dioxide surface layer handled the highs. A particularly intelligent and forthright representative of 3M once told me that, as "Type III," it would ultimately dominate the cassette market. But metal-particle tape technology (Type IV) swept ferrichrome aside within a couple of years.

The Rabco was probably the most successful straight-line-tracking arm.

The struggle for tangent tracking of record grooves goes back to the B-J pantographic tonearm of the 1950s, an idea later resurrected by Garrard. The most prestigious design was probably the Rabco linear-tracking arm, which was eventually acquired



McCORMACK

15 YEARS OF UNSURPASSED VALUE

AURICLE

McCORMACK AUDIO DNA-1 AMP AND ALD-1 PREAMP



McCormack Audio has seen like a new high-end firm to many readers. However, Steven McCormack is a leading high-end designer who began his work by modifying products of other firms back in the early

Company Address: 512 North Highway 101, Tecoma, CA 92021
For literature, circle 260, 92

AUDIO/AUGUST 1993
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not have a balance control, a feature that has been dropped from some other pure designs. While many audiophiles never



make any use of the balance control, I find it to be extremely important in adjusting the sound; to provide the precise balance that locks in the left-to-right imaging, thereby centering the soundstage.

Two other features of the ALD-1 are of special interest. The power supply provides 2.2 V d.c. regulators for each channel, using a discrete circuit that has very fast response times. McCormack feels this method is sonically superior to conventional IC regulators.

The McCormack Power Drive DNA-1 amplifier has the same styling as the ALD-1 and costs \$1,995. Its only fresh-pace features are a power switch and power and protection-circuit LEDs. The back has RCA

input and power connectors in the signal path.

At \$1,745, the ALD-1 Active Line Drive preamp combines excellent Harman-licensed styling with a set of features that offer maximum flexibility with the least possible interference with the input signal. The source selector handles five high-level inputs, though an optional plug-in phono preamplifier card is available for one of these inputs. This card can be used with both moving-coil and moving-magnet cartridges, and it has a switch to

THE ALD-1 PREAMP CAN BE OPERATED EITHER WITH GAIN OR WITHOUT IT.

choose between 40- or 35-dB gain. The phono preamp is used to meet the RIAA frequency response curve within 0.2 dB and to have a S/N ratio of better than 70 dB with moving-coil cartridges and about 60 dB with moving-magnet cartridges.

The source selector has a tape selector switch that allows you to choose between source and two of dual-mono buffered tape heads. A separate switch, with LED indicators, controls the two tape monitors. To allow bidirectional dubbing, it disconnects the tape buffer outputs from the main audio circuitry to eliminate any distortion from the tape decks and associated variability when they are being used. The McCormack ALD-1 also has a master switch with LED indicators that can mute the output of either or both channels.

The tape monitor control feeds a switchboard buffer stage with two complementary JFET transistors in each channel that act as an impedance transformer with a gain of one. The output of this stage feeds a switch that allows you to choose between the normal inputs with gain

channels (50 watts into 8 ohms, 300 watts into 4 ohms, or 500 watts into 2 ohms, and can be easily modified to drive even 1-ohm loads.

A high-current design, the DNA-1 is capable of 90 amperes peak current per channel and has a moderately high damping factor of greater than 100 into 8 ohms at 1,000 Hz. This is enough power and current to drive virtually all modern speakers, although it's not the kind of brute-force design that offers extremely high damping factor, power, and control into the most demanding loads.

The circuit is a direct-coupled, low-feedback design using J-FETs, MOS-FETs, and bipolar devices in a fully complementary configuration. At the input, two J-FETs are connected as a complementary differential amplifier, with source degeneration. The two sections of this stage produce signals of opposite polarity, which are direct-coupled to the gates of a complementary MOS-FET pair, operating Class A, push-pull, and with a gain of approximately 10. This stage provides low-impedance drive for the bipolar output section.

The output stage consists of four complementary poles of bipolar transistors (eight devices per channel). These are used in parallel, as emitter followers, to provide an output current capability exceeding 90

ampères. A low-value (0.47-ohm) emitter resistor is used with each output device to equalize current under very high drive conditions.

A d.c. servo amplifier reduces output offset to below 5 mV and allows the use of a direct-coupled circuit with a very low-frequency cutoff. The output of this servo connects through an isolation resistor to the bottom of the feedback resistor at the input of the amplifier. The servo response is set below 1 Hz, providing stability without limiting the DNA-1 amplifier's low-frequency performance.

Unlike the ALD-1, the DNA-1 does use limited amounts of feedback. An RC network provides approximately 0 dB of voltage feedback to the input source's resistance.

The speaker of loading is that protection with a 19 X 7 X 0.010-in. plated steel rod-though, sick copper f parts, each also and 1/16 Toluene and uniform 10 0.75 ohms of 1.0 V less than 0.1 1/2, offer of 5 Hz to 250 2 µs, and a delivers (per ampère) 4 ohms, 300 watts into 2 ohms, and can be easily modified to drive even 1-ohm loads.

McCORMACK AUDIO DNA-1 AMP ALD-1 PREAMP

AUGUST 1993

McCormack Audio is celebrating its 15th Anniversary with an enviable reputation for unsurpassed value. In August 1993, Audio published a review of the Power Drive DNA-1 Amp and Line Drive ALD-1 Preamp.

Anthony Cordesman concluded, "This pair is an excellent choice for listeners who place a premium on musical accuracy." Today the new Power Drive DNA-2, a fully balanced 300-watt beauty, leads an impressive collection of products that are beyond your expectations, but within your reach.

RATHER THAN CALLING MY ATTENTION TO ITS SONIC DETAILS, THE AMP INVOLVED ME IN THE PERFORMANCE.

This provides gain consistency and further reduces any small distortion products that may be generated in the earlier stages. No inductive or RC networks are required at the output because the amplifier circuit already is stable at all applicable frequencies.

The output stage's power-supply rails are fed by a high-current winding on the power transformer. There are separate ultra-high-speed, 25-ampere bridge-rectifier blocks for each amplifier channel. The power filtration is handled by eight distributed 4,700-µF capacitors per channel, located close to the right-output transistors, and each bypassed by high-quality film-type capacitors. This provides low impedance and fast current-delivery response to each output device. These capacitors are considered individual current-reservoir nodes, giving the unit its Distributed Noise Amplifier designation.

Like many modern high-quality line-stage preamps, the McCormack ALD-1 has comparatively little sound character of its own. Further, you can bypass much of the little sonic character the preamp does have





Tracing the LP's groove only by reflected light, the Finial promised an end to record wear.



JVC's Globe Speaker Baffle could hang from a chain or be stand-mounted; a small arrow marks this as the speaker's front.

by Harman Kardon. Several other companies—including Marantz, Bang & Olufsen, and Technics—produced linear-tracking arms, as separates or integrated with turntables. While these arms generally solved the tracking-geometry problem, they tended to be fussy and expensive, and only the Rabco remained available for long.

The idea that analog disc grooves could be traced without wear by a light beam goes back to just after World War II, when it appeared in a Philco console phonograph. Its most persistent exemplar in strictly hi-fi circles was a design from A. Bernard Smith. The idea reemerged most recently just at the dawn of the CD era, in the Finial Technology laser turntable. Though that design went into only limited production, the laser pickup used for CDs, laserdiscs, and DVDs is its exact counterpart in the digital realm.

In analog days, "direct-to-disc" recording was considered to be the purest of technologies for preserving sonic freshness. Also valued, although little used, was the 12-inch 45-rpm format. Its higher rotation speed created less pinch effect on inner grooves, in comparison to LPs,



A baffling choice of art? The pictures above the couch are Fisher Sound Panel speakers.

but that higher speed limited maximum recording time somewhat. Both direct-to-disc and 12-inch 45-rpm records have been pretty well obviated by digital recording.

Loudspeakers also have had their share of flops. During the '60s, the many makers of cylindrical and spherical systems claimed propagation and resonance advantages, not to mention advantages in decor, over flat-surfaced boxes. Empire's floor-standing cylinders with tabletops and the spheres from JVC (then sold here as Nivico) are but two examples. The most radical was the eighth-of-a-sphere Bose 2201, which used reflections from the walls and floor to create the other, virtual, $\frac{7}{8}$ of the sphere. The design ultimately evolved into the classic Bose 901, but the shape is no longer around, if you'll pardon the pun.

Flat-panel speakers, the opposite extreme, are still with us in various planar-magnetic, electrostatic, and ribbon-speaker designs. However, low-end panel speakers—which promised fine sound and compact, decorator-friendly appearance in inexpensive packages—have traditionally been losers. Most prominent were Bertagni's plastic models, originally introduced in the United States in Fisher wall-mount speakers that looked like exceptionally tasteless paintings. On the other hand, flat-panel speakers of

THE PROPONENTS OF THESE FOLLIES HAD THEIR REASONS, AND TIME PROVED SOME OF THEM RIGHT.

relatively simple construction may be an idea whose time has finally come ("Mondo Audio," February).

Along the same quasi-decorator lines have been lampshade and ceramic-vase speakers. Even more bizarre was the ionic speaker because its byproduct, ozone, can be toxic. This technology has surfaced repeatedly during the last 50 years. By driving the ionized air directly with an electrostatic field, designers hoped to create a particularly "pure" transducer, free of the electromechanical resonances of traditional drivers.

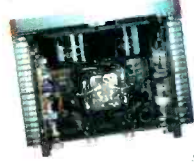
Electronics have seen a great many corporate failures and some fairly bizarre designs, but few concepts that have clearly been blind alleys have made it to production. Solid-state circuitry came close during the era when H. H. Scott amplifiers were failing in droves because few people, at Scott or elsewhere, realized how low the impedance curves of some popular loudspeakers actually dropped. The most bizarre touch during those years was, in retrospect, Harman Kardon's announcement that germanium transistors were superior to silicon for audio circuitry and that the company would create the world's only all-germanium electronics line. That phase passed quickly, and Harman Kardon survived, though Scott did not.

And then there was Dolby FM . . .

A

ROTEL®

AURICLE ROTEL RHB-10 AMP AND RHA-10 PREAMP



I usually associated these two components with some top-flight audio far too many Japanese companies' attempts at high end amps and preamps have emphasized features that sound good to the technical audience if it only seemed to be the product of a combination of engineers' assumptions. The end result has been products that have not standing up to the performance level that I have come to expect from products such as the RHB-10 and RHA-10. However, after a long and detailed comparison with the products I have been using, I have decided to design team, the conclusion of how good the RHB-10 power amplifier came from my ears. I do not give a good deal of my amplifying and listening work and my personal satisfaction is not based on the specifications of the RHB-10, but on the actual listening experience.

I've heard a lot of things about the RHB-10, and I've read a lot of things about the RHA-10, but I've never heard anything that would make me want to own them.

I've heard a lot of things about the RHB-10, and I've read a lot of things about the RHA-10, but I've never heard anything that would make me want to own them.

ROTEL'S DESIGN TEAM, WHICH CAN REALLY LISTEN, HAS PRODUCED AN EXCELLENT AMP AND PREAMP.

ROTEL RHB-10 AMP AND RHA-10 PREAMP JANUARY 1994

For more than 35 years, Rotel engineers have designed audio components that emphasize both technical and musical excellence. In the January 1994 issue of *Audio*, Anthony H. Cordesman summed up the company's design philosophy with his description of the RHA-10 pre-amplifier.

"Rotel has produced two excellent high-end units and has a design team that can listen!"

Company Address: P.O. Box 8, North Reading, Mass. 01864, For literature circle No. 95

The RHB-10 is a very good sounding amp, but I have heard a lot of things about the RHB-10, and I've read a lot of things about the RHA-10, but I've never heard anything that would make me want to own them.

The RHB-10 is a very good sounding amp, but I have heard a lot of things about the RHB-10, and I've read a lot of things about the RHA-10, but I've never heard anything that would make me want to own them.

With the RHB-10, you won't have to fear that a voice will go hard or flat.

The RHB-10 is a very good sounding amp, but I have heard a lot of things about the RHB-10, and I've read a lot of things about the RHA-10, but I've never heard anything that would make me want to own them.

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McIntosh

AUDIO THE EQUIPMENT AUTHORITY WHY SUBWOOFERS? 2

FEBRUARY 1994
SHOCKINGLY GOOD
McINTOSH MC 1000
POWER AMPLIFIER

"DON'T TURN IT DOWN!"
 SOUNDPROOFING A TEENAGER'S BEDROOM

TESTED EXCELLENT



McINTOSH
MC1000 MONO AMP
 FEBRUARY 1994

Gracing the front cover of *Audio's* February 1994 issue, was the "Shockingly Good" McIntosh MC1000 Power Amplifier. With an "output capability that is most awesome," the MC1000 "operated flawlessly" according to *Audio's* Bascom H. King. These 1000-watt monsters proudly continue the McIntosh tradition that began almost 50 years ago. *McIntosh amplifiers have been built in the USA since 1949 . . . and they still are.*

EQUIPMENT PROFILE
McINTOSH MC 1000
MONO AMPLIFIER



AS CAN BE SEEN, THE McINTOSH MC 1000'S OUTPUT CAPABILITY IS MOST AWESOME!

Needless to say, the MC 1000 is McIntosh's top-of-the-line amplifier. The amp weighs in at a hefty 50 pounds each, and their performance specifications are most impressive. For instance, continuous output for a 16-ohm load on the 8-ohm tap is a not-so-fancy 3 kilowatts. Better power is a not-so-fancy 20-watt tube board with the same loading in stereo at 4 kV. Total harmonic distortion is rated at less than 0.003% from 500 mW to rated power of 1 kW, from 20 Hz to 20 kHz. Optimum load matching is provided for 2-, 4-, and 8-ohm loads. Balanced or unbalanced inputs can be used. Front-panel controls consist of a pair of rock handles, a rotary meter-needle switch

for instantaneous readings. "Hold" to display the highest meter peak level. A "Power Guard" light that glows if output distortion is more than 0.5% is connected to the input, an output switch, and finally, the peak-responding power output meter. This enormous blue meter, which dominates the front panel, responds to both output voltage and current so as to display actual delivered power in equivalent sine-wave watts.

There is nothing on the rear of the amplifier, as the input and output sockets are located on the top, near the rear of the chassis. To be let, as seen from the front, are the input connections (all BNC), a phono jack for unbalanced input and a gold-plated XLR connector for balanced input. In the main section are three pairs of free wire binding posts, one each for 2-, 4-, and 8-ohm loads. These output terminals are on pins—no common terminal—because the amplifier output is balanced about ground. There are two output wires for each output tap. At the right of this panel is an IEC connector for the power cord and a circuit breaker.

The MC 1000 is built on a large chassis chosen somewhat like the ones on which some classic tube amplifiers were built



remember first seeing these big McIntosh amplifiers at the 1962 Las Vegas CES and saying to myself, "Wow, these amps look neat! A pair of 1,000-watt monsters! And, they shall receive 10 minutes! Ask, they shall receive!" I didn't really risk at least one would, but the reviewer has compared to go the part of MC 1000s to review. When the boxes were delivered and I tried to help one, I thought that this time I'd really need a forklift in case of an accident. But after uncrating the amps, I found I could actually lift them and move them into position for listening.

AUTHOR: FEBRUARY 1994
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CIRCLE NO. 92 ON READER SERVICE CARD

through the looking glass

in our offices are bound volumes containing every issue of *Audio* ever published, all the way back to May 1947. Preparing for this 50th Anniversary extravaganza, the editors spent a lot of time thumbing through those volumes, and through old files, looking for items of historical interest. I always get a kick out of reading early hi-fi magazines. What I often find most absorbing, however, is not the work of our editorial predecessors, but rather the ads. It's like watching old TV commercials: You get a feel not only for the products, but also, in concentrated form, for the culture of the time and the expectations and aspirations of the viewers (or readers, in our case). The advertising of the day mirrors the prevailing way of life. And brings back memories of one's own life, in years long gone. So, to share a little bit of that fun, we've pulled together some representative ads from *Audio's* first five years, plus a few from its 10th Anniversary year, 1957. Hope you enjoy looking at them as much as we enjoyed collecting them.

Michael Riggs

1947

thru

1957

Apogee Acoustics

AURICLE

APOGEE ACOUSTICS STUDIO GRAND SPEAKERS



range Studio Grand Ribbon Array (much as in-line stacked) placed on top of two matching subwoofers. You'll need two channels of high power amplification for each side, which means two stereo or four mono amplifiers. I would suggest at least 100 watts per amplifier and 200 or more will do no harm if you really want full orchestral or rock music at performance levels.

The Studio Grand Ribbon Array weighs 95 pounds each, measures 35 inches high, 20 inches wide, and 3 inches deep, and costs \$7,500 per pair separately. Mounting them on the

CLOSE LISTENING TO THE STUDIO GRANDS REVEALS MOMENT AFTER MOMENT OF SPECIAL CLARITY.

ribbons and a remarkably or so the subwoofer (electrostatic, and ribbon drivers) lacked bass extension or obtained them at the expense of changes in the mid range shall in several subwoofers. I would like to be heard in a lack of definition and a similar transient sense, that if frequency used the in the crossover slope is, with these designs a surprisingly low frequency reminded that they is not quite sure that far too much.

At the bottom of many high-end very deep bass very best subwoofers and deep speed and detail below 50 Hz to 20 Hz. The ribbon array used in the Studio Grand is gradually increasing in 10 dB, and this can be followed. Bass sound level is rated at 102 dB and the nominal impedance is 8 ohms. A switch allows small upward or downward adjustment in the driver level of the ribbon array.

These ribbon drivers are a significant advance over the normal Apogee used in the Dura and Herba Speakers. Their rich, conductive

ribbons and a remarkably bass and guitar on Ray Brown's *Musings* (Sesame CD-123). Grand's piano was excellent, and the mid-range to lower frequencies differences in the character of a defined.

If you have already heard the midrange speaker, you have a general idea of how good the midrange of the Studio Grand can be. The Studio Grand, however, had a previous Apogee, particularly in one-level through clearly in comparing the Studio Grand to the Apogee Acoustics Two-Speaker system for years.

I was impressed by the smooth and female voices. The Studio Grand synthesized mix of voices and chamber orchestra such as on *Brown's* recording (NAXOS 9014). This midrange transparency and reflection was also reflected in the sound of grand opera and really complex orchestral music like Shostakovich's Eighth Symphony. The Studio Grand did not add any artificial warmth or any euphonic coloration to specific

voices, but they reveal great power and complexity of the orchestra in the recording between solo voice and supporting chorus.

There is a slight downward tilt in upper energy compared to such good reference speakers as the Thiel CS-5 and TSV sound of free source dipoles like the Apogee. At the same time, the upper frequencies have better horizontal dispersion than any previous Apogee Acoustics. Directivity with range frequency than most electrostatics. I preferred them in my listening room with the treble control on the

function 6-2225-00) or the combination of bass and guitar on Ray Brown's *Musings* (Sesame CD-123). Grand's piano was excellent, and the mid-range to lower frequencies differences in the character of a defined.

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ribbon panel set to high, but I never felt I was missing any part of the top octave. These speakers provide smooth upper midrange and treble response, and excellent detail, transparency, and transient. Psychological listening to the Studio Grand reveals moment after moment when both have special clarity or when detail in the upper midrange and treble.

The soundstage presentation is especially wide and deep, and center fill appears soundstage during minor field movements that characterize some planar speakers. The apparent listening position is without exaggerated depth or any tendency towards a slightly forward sound. The Studio Grand does very well with both small ensembles and a full orchestra—as well as with the hands of a virtuoso pianist in a recording like *The Stravinsky: Moscow Virtuoso* (Mercury CD-1100). They appear almost alluring instruments size and location.

I should also praise the Studio Grand's ability to handle midrange dynamics and transients. They can handle the dynamic peaks and also render lower level dynamics. This ability really helps with brass and piano, and the Studio Grand has tremendous life and bite.

By my good recording of *Sam Saito's* *Third Symphony* (the first and second movements, not just the third). Better, it is in the Italian Wind *Symphony* recording of *Poly & Pops* (Reference Recordings RR-58-CD).

The Studio Grand stand out as one of the finest speakers systems I have ever heard, and is one of the most revealing of musical nuances and textures in audio history. They deliver every octave with full power, excellent detail, and superb coherence. They not only provide great listening pleasure but are also the kind of speaker you should audition, rather than read about simply to see what the state of the art can do.

YOU SHOULD AUDITION THE STUDIO GRANDS, IF ONLY TO APPRECIATE THE STATE OF THE ART.

The Apogee Acoustics Studio Grand is the most successful combination of an electrostatic or ribbon wide range driver with a cone subwoofer that I have yet encountered. They give you all the advantages of a full range ribbon speaker (superior in many ways to the ideas that I have used as a refer-

ence in the past, plus the large dynamic range of the best cone systems. So much so that it is deep, powerful, quick, and detailed as I have yet

heard. The Studio Grand is made up of two flat

Company Address: 35 York Ave.
Randolph, Mass. 01568
For literature, circle No. 93

AUDIO/TELE 1994

APOGEE ACOUSTICS STUDIO GRAND SPEAKERS

JULY 1994

Anthony Cordesman's review of the Apogee Acoustic Studio Grand Speakers in *Audio's* July 1994 issue, prompted the question—How do you improve on perfection? Cordesman concludes, "The Studio Grand's stand out as one of the finest speaker systems I have ever heard . . . delivering every octave with full power, excellent detail and superb coherence . . . the most successful combination of an electrostatic or ribbon wide range driver with a cone subwoofer that I have yet encountered." How do you improve on perfection? Maybe you can't.



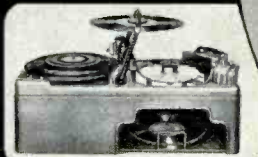
Lincoln

THE WORLD'S MOST VERSATILE RECORD CHANGER



FOR CUSTOM INSTALLATION

The Lincoln turns the record over



Record is placed on turntable . . .



First side is played . . .



Turntable inverts . . .



Second side is played

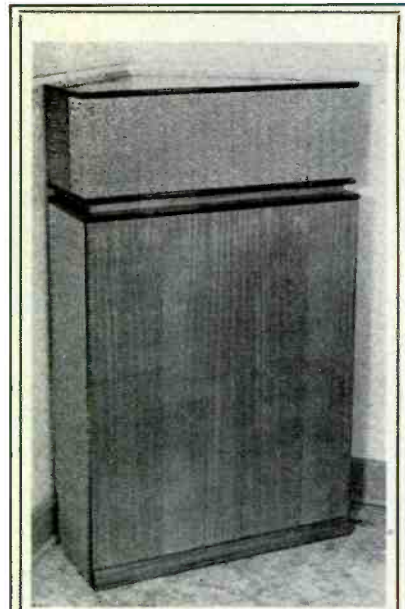
After second side has been played record is released to Receiver, and cycle automatically repeats. (When Changer is set for "Single Side" operation, it releases the record without playing the second side.)

PLAYS BOTH SIDES OF RECORDS . . . ALL SIZES . . . ALL SPEEDS . . . ON A CUSHION OF AIR

The Lincoln Record Changer not only plays both sides, or one side of records, as desired, but plays 33 1/3 r.p.m., 45 r.p.m., and 78 r.p.m. speeds; any size, 7", 10" and 12" intermixed. Changer can provide up to 2 hours of continuous music, and shuts off automatically.

Only one record is on the turntable at any one time, eliminating slippage which may damage records. Records with rough or chipped edges and warped records may be played as easily as records in perfect condition. Soft rubber suction cups handle the records. No metal (except needle) ever touches the records.

THE LINCOLN . . . can be easily installed in Capehart console model cabinet; if desired . . . Write for Brochure and Complete Information.



KLIPSCHORN—Closest approach to perfect sound reproduction at any price—Finest craftsmanship—consummately styled.

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Both offer quality consistent with the Klipsch reputation; both include radiation of clean fundamentals down to 30 cycles. Write or visit us.

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1951

1950

1950

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ROBUST, LIVE BASS
Acclaimed By Musicians, Engineers!

An entirely new experience in music and voice reproduction awaits you in this unique Kettle Drum Speaker . . . a Bozak exclusive! Truly, you'll be moved by the live, undistorted tone—the unparalleled listening ease at any level, achieved by this fine Bozak instrument. And you'll be amazed at the low price.

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1957

University's vision of the good, hi-fi enhanced, life, circa 1957—still mono, and not quite full color.

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UNIVERSITY SPEAKER SYSTEMS

AUDIO/MAY 1997
10€

ADCOM®

AURICLE

ADCOM GFA-5800 AMPLIFIER



was driving my reference Aesop's Studio Grands. I can't think of a better complement for an amplifier or one that does more to indicate that this is a product that deserves attention.

Part of the reason this amplifier sounds so good may be that much of its design was conceived by Nelson Pass, whose new Pass Laboratories' Aesop line has emerged as one of the best-sounding products in the hi-fi market. At the same time, Adcom has also used its long production runs to take advantage of economies of scale and to put a great deal into the product.

The GFA-5800's circuitry is very different from that of previous Adcom amplifiers. The power supply has been redesigned to prevent a rush of power to the transformer and capacitors at turn-on. It has completely separate main power supplies for each channel, which take power from a large toroid transformer but do not even share the same ground connection. It has 150 joules of energy storage for each channel, and the power supply ripple voltage is normally less than 10mV.

The front-end circuitry for each channel has its own regulated high-voltage supply, which eliminates interaction between the early gain stages and the output stages and also helps to reduce noise.

This amplifier's front-end operates at a higher voltage level than its output stages do, to reduce distortion and allow the front-end to drive the output stages to their supply rails, thus putting all available power to the load.

All audio elements use MCZ-FETs, and even the input transistors are power devices capable of delivering 2 amperes of current. Adcom believes that the high input impedance

amplifiers—“heat be” or a “breakthrough.” There are a number of excellent high-quality power amplifiers on the market, and some are quite affordable. Aesop's, Bryton, Hifon, McCormack Audio, and PS Audio all have very good products at good prices. I suspect, however, that the Adcom GFA-5800 may still be a “classic,” just as Adcom once changed the standards of the power amplifier market with the 555. It has introduced a new product that may similarly change the market again.

The Adcom GFA-5800 provides most of the detail and sweetness of a high-end tube amp with the power, delivery, control, extended tone, and fast upper treble of a high-end transistor amplifier. It is a very different and far better-sounding amplifier than any Adcom product I have heard to date—and Adcom's past products were pretty good. It is also a little difficult to believe that this amplifier is in the \$1,500 price range. In fact, I had two high-end loudspeaker manufacturers refuse to believe it until they saw for themselves that it really

FOR ONCE, AN AMP THAT CLAIMS TO COMBINE SWEETNESS WITH MUSCLE ACTUALLY DOES.

Company Address: 11 Elkins Rd., East Brunswick, N.J. 08816. For literature, circle No. 91

AUDIO/NOVEMBER 1994 91

of MCZ-FETs allows a very simple pass-through, and provides high thermal stability and reliable operation with very high output currents and voltages. Adcom also claims that the “characteristics of the input transistors, delivered at the minute of board in tube equipment.” I have heard these kind of statements many times for different devices and circuits, and I would have to suspect that it is not a full description of the GFA-5800's sound.

The results offer balanced operation, without the use of active inductors or capacitors, and common mode rejection is in excess of 40 dB. The gain gain of the GFA-5800 is very simple: it includes three stages versus five or more in most competing

models up to a stereo channel controlled by the 10-pin practice. The GFA-5800 will not exhibit any noticeable non-linearities, or else when the tubes are very warm, the sound listening to loud passages is even after processing. The GFA-5800 is rated at 250 watts per channel into 8 ohms and 300 watts into 4 ohms. IM distortion at full power is rated as less than 0.05%, and THD is less than 0.02% at 1 kHz and only 0.03% at 20 kHz. Power bandwidth is 3 Hz to 100 kHz, and transient response is 20 Hz and 100 kHz. There are both stereo and mono balanced inputs with gains of 20 and 30 dB, respectively. The input impedance is 20 kΩ, and the output impedance is 0.2 Ω. The Adcom sound will make

THIS IS THE KIND OF PRODUCT WHICH SHOWS THAT THE BEST OF THE HIGH END CAN BE TRULY AFFORDABLE.

All of this is packed into a relatively small chassis (7.8 x 17 x 13.5 inches), all 37 pounds, without any options, rack mount. The front panel has no features save for an on/off switch and the LED to indicate whether power is on, and is a neat and understated design with a switch to choose between stereo and mono. The Adcom GFA-5800 is an excellent amplifier, and with all the claims, it is a real contender in the current market. It is a real contender in the current market. It is a real contender in the current market.

though the amplifier weighs a fairly hefty 37 pounds, without any options, rack mount. The front panel has no features save for an on/off switch and the LED to indicate whether power is on, and is a neat and understated design with a switch to choose between stereo and mono. The Adcom GFA-5800 is an excellent amplifier, and with all the claims, it is a real contender in the current market. It is a real contender in the current market.

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production path. The same job could be done with a single IC, but the short signal paths, such as its own, including ground

standing. However, it is the ability to deliver

AUDIO/NOVEMBER 1994 92

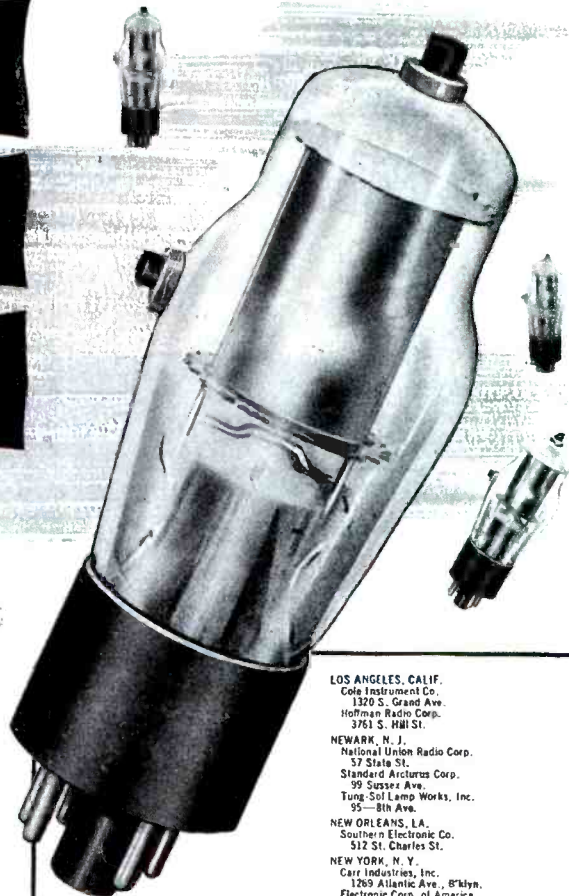
ADCOM
GFA-5800
AMPLIFIER
NOVEMBER 1994

In November 1994, *Audio's* Anthony Cordesman predicted the Adcom GFA-5800 would be a “classic.” It was a good bet since the Adcom 555 had previously changed the standards of the power amplifier market. Today we know he was right. Cordesman concluded that the GFA-5800 “does everything exceptionally well for its price, and its upper midrange and treble and overall musicality are hard to find in any amplifier not costing at least twice its price. This is the kind of product that shows the best of the high end can be made truly affordable.”



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This 1947 government ad illustrates the surplus-parts bonanza that demobilization brought to electronics manufacturers and hobbyists after the end of the War.

1947

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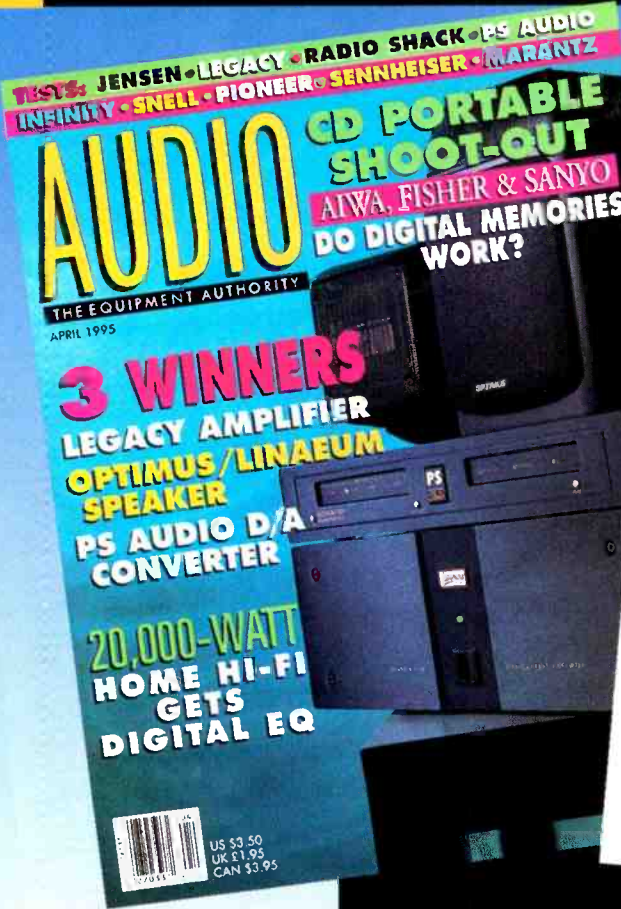


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AUDIO ENGINEERING SEPTEMBER, 1947



RadioShackSM



OPTIMUS PRO LX5 LOUDSPEAKER

APRIL 1995

Built to Rock "with a good combination of performance, size and looks" is how *Audio* reviewed RadioShack's Optimus PRO LX5 Speaker in April 1995. The LX5 continues in the strong tradition of RadioShack's products—products that have been putting music in our homes since 1954. Visit one of the 6,700+ RadioShack stores for all your audio/video needs.





IN STEREO, THE AVP1000 HAS A CLEAN SOUND AND A GREAT DEAL OF DYNAMIC ENERGY.

and high-end A/V units. Just when the digital signal processing circuitry that is most (this, not) at the lead listening levels used for movies and a few other produce some effects such as very low-level high-pitched whistles and static hiss. The changes resulting to the AVP1000 included a had very clean (but) the logic circuitry, and the "clean" version of Dolby Pro Logic provides added flexibility with systems using a subwoofer. Overall, the sonic differences between the AVP1000 and other Dolby Pro Logic units in reproducing Dolby-encoded material are remarkably consistent. I found the transparency and directional information provided by the AVP1000 to be typical of all A/V units that support Dolby Pro Logic.

The sound quality of the AVP1000 is proved that of many high-end stereo components. For two effects, broad and mid-range capabilities seem to alter some part of music—some of the information that from 1990 to 1995 to add processing means to get the best sound example, which seems to broadcast all grams with an extra special low-frequency, which sweeps sounds around the 300-Hz filter series, which sometimes great, sometimes subtle, effectively corrects through the use of a wide stereo microphone sound. Premium quality of like (110), Shure, and Cinema fail to properly reproduce the better soundtracks. Movies via preamp (the film, the film, and VHS) a different story. With these units you usually hear the true quality and sound-track, as the subtle soundtracks (movies) don't exist.

The original soundtracks can be heard of their own. If you want to hear some soundtracks that were as an afterthought, blowing in and soundtracks that were to hear the best and has been

tests for this kind of sound quality. Yet there are notable exceptions, and the AVP1000 does as good a job as any other Dolby Pro Logic unit I have heard in reproducing the lowest voices on *The Last of the Mohicans* and the low-level ambient effects in *Terminator 2 and James Bond*.

The B & K AVP1000 A/V tuner/preamp is a full featured, post-processing unit, offering good sound to the movies. Whether you have to sit back or, however, it likely to be a pleasure of how you rate its responsiveness, for

proach to controlling an A/V system that the computer, with a host of aerial processors that tailor the sound to a given source and application. For set-up users, it will give all of the features they have of VCRs and computers with conventional driver systems. The only way to find out which can give you the best of it is to test it: see the AVP1000, its price, however, that few other units offer significant alternatives to raise the small entertainment expenses. If you are considering, breaking away from the herd, you should give the AVP1000 a try.

AURICLE
ANTHONY H. CORDESMAN
B & K COMPONENTS
AVP1000
A/V TUNER/PREAMP



Most manufacturers' preamps follow a common pattern: Although the details of their features and controls may differ, they all use functionally straightforward devices found on stereo preamps and receivers, while adding extra buttons, switches, and lights to the front panel and the remote. This often creates the kind of complexity that invites maintenance confusion, or simply a press of the wrong button. The B & K Components AVP1000 A/V tuner/preamp breaks free from this pattern: It's a fully featured unit governed by an

put and outputs, and eight fully comparable A/V preamps. You can program each input and output for display on the front panel. There is also the most advanced remote control system, allowing you to send signals from one room to another.

The central feature of the B & K AVP1000, however, is its unique processor, which replaces most of the A/V unit's controls found on typical A/V units. Instead of sporting enough controls to drive the Enterprise up to Warp Four, the AVP1000 front panel is simple, with a three-, 16-character display, a single volume control, and six buttons that include "Menu," "Display," and the unit's basic programming controls.

The learning curve is the main method of programming and operating this preamp, enabling you to select virtually all of the features and adjustments at much the same way you enter commands on an IBM-style PC. With the remote, you can adjust volume, balance, bass, treble, and AV and tuner preset, surround modes, input switching for the equalizer/preprocessor loop, and filters. You can also enter custom codes, use the built-in test signal for channel balance, and set the level and the time delay of each speaker used in the surround modes. The

learning remote further enables you to use and match different audio and video features.

Let us give mention of programming, step-by-step, become interesting. I should explain that the AVP1000 doesn't require you to begin by reading through the first 100 pages of its (remote) manual. The built-in system is so intuitive that you can fully understand the unit and its operating system using only the labels on the rear panel.

THE AVP1000'S REMOTE ALLOWS YOU TO SELECT FEATURES THE SAME WAY YOU ENTER COMMANDS ON AN IBM-STYLE PC.

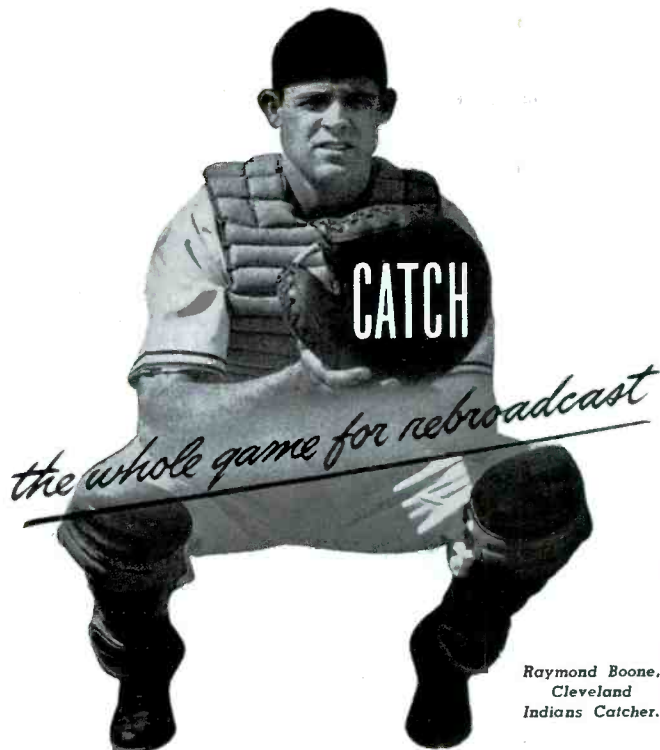
Company Address: 2100 Old Union Road, Buffalo, NY 14227. For literature, circle No. 99.

AUDIO/JUNE 1995 78

B & K
AVP1000
TUNER/PREAMP
 JUNE 1995

B & K broke away from the herd in June 1995, when *Audio* reviewed the AVP1000 A/V tuner/preamp. In keeping stride with its heritage of "high end A/V means high performance, not high price," the AVP1000 proved no exception. Today, B & K's AVP1030 is leading the way with the first Dolby Digital® (AC3) preamp tuner/processor powered by the Motorola® 56009 DSP processor.





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Three hour high fidelity recording is easy with the MAGNETONE*!

Broadcasting stations will find this magnetic recorder ideal for remote pickup and delayed broadcast work. Especially suited for conference recording, case history study, educational training, opera recording, dispatchers' monitoring, police radio monitoring and many other long period recording usages.

The "MAGNETONE" uses plated brass wire and makes permanent magnetic recordings of unsurpassed quality. Recordings may be "erased" and the wire reused any desired number of times. "Erasure" is automatic as a new

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Outstanding characteristics of the MODEL BK-303 "MAGNETONE" are its fast rewind, fast forward speed, and constant recording speed which permits any section of a recorded program to be spliced into any other section without impairing the faithful reproduction.

Available with High and Low Impedance Inputs and 500 Ohm Balanced-Line Output

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- Follows every recorded detail faithfully without damaging delicate record engravings.
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- A sapphire stylus lasts a 1000 plays longer—a diamond stylus forever!

1957

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Model H010 High Fidelity Amplifier and Model RXPX Remote Control—YOU LEAD THE ORCHESTRA—from your favorite easy chair—with complete remote control of function, selection, volume, tone and record equalization. Permits instant adjustment for maximum enjoyment of each selection on radio or phonograph. Handsome, compact remote control unit complements every decor.

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Brush is still catching the sound on wire in 1948. Also shown, the legendary Weathers tonearm (1957) and a remote-controlled amplifier from Bogen (1951).

1948

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NOW. All 3 CARTRIDGES in ONE ARM

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Fairchild boasts the ultimate in 1950 record-playing convenience with a tonearm that accommodates all disc types of the day with the twist of a knob.

1950

— SIMPLY TURN KNOB
select cartridge
Changes Automatically

miniature version of the Fairchild moving magnet cartridge permits this revolutionary advance. The design is amazingly simple and low priced. A new passage for the tonearm keeps total cost at a minimum. Write for details.

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Classé

AURICLE
ANTHONY H. CORDESMAN
**CLASSÉ AUDIO
CA-400 AMPLIFIER**



The sound of Classé Audio's CA-400 amp is such a major departure for the company that it almost seems as if this firm had suddenly decided to go "multicultural," combining the practicality and efficiency of the Anglo and with the power drive of the Canadian. Perhaps Classé's products have always been exceptional, but they have also been hot and hot and hot. The company's products are known for great detail and transparency, excellent overall timbre, and very good imaging, but they have not been state of the art in sheer dynamics, depth, or musical impact.

The CA-400, however, has a new level of dynamic excitement. There is

Company Address: 9114 Côte de L'Église Rd., Lachinc, Que. Canada H8T 1A1.
For literature, circle 56 on page 118.

than bipolar devices. The amplifier is coupled from input to

output. There is a switch to toggle between stereo and mono; another switch selects balanced or unbalanced input.

Classé Audio does not give exhaustively detailed specifications, but they do reveal that the CA-400 provides the power you'd expect from an amplifier that weighs in at 120 pounds. Its output is 400 watts stereo into 8 ohms and 400 watts into 4 ohms. Bridged for mono—and it sounds just as good in that mode as in stereo—it produces 1,500 watts into 8 ohms and 2,000 watts into 4 ohms. Its SN is specified as better than 100 dB sensitivity is rated at 1.0 V for input and output, output impedance is 20 ohms, and frequency response is rated as 10:1 dB from 20 Hz to 20 kHz.

The most striking thing about the CA-400's technology is that its dramatically changed sound character comes from simple the same Classé All circuit topology as in previous Classé power amplifiers. The CA-400 uses a very low impedance power supply that provides a much faster discharge than other Classé designs, such as the M-1000. The CA-400 amp uses a 4,500 VA transformer secondary 240V for the M-1000 (1000VA) and uses a Schottky bridge rectifier for Classé recovery.

While the M-1000 had two large 35,000 µF capacitors per channel in its power supply, the CA-400 uses two dozen 4,700 µF capacitors. As a result, the CA-400 has 132,000 µF per channel, versus 70,000 µF for the M-1000. Classé Audio believes that connecting a series of smaller capacitors directly as output devices provides a much faster discharge and reduces power supply inductance, and that this permits greater detail reproduction and greater detail.

The CA-400's basic circuit topology is the same as in previous Classé amps, but true differential amplifier circuits are used from input to output. The input section uses 1417Ts because Classé feels they are easier to drive and have more stable d.c. offset

Classé found this solution by up to 70%.

The protection circuitry is excellent. I used the CA-400 with a number of two- and three-way speakers, and inevitably more when hooking up complex systems. In every case, the Classé protection circuitry worked, and I simply turned the amplifier off and on, no service work. Nice!

The CA-400 preserves the best sonic virtues of Classé's previous amplifiers. It is remarkably neutral and objective, never emphasizing one aspect of sound, never oversteering. For example, it never gives up sweetness. Further, it does not trade depth for soundstage width or alter the upper octaves to make them more euphonic or to highlight added detail. The CA-400 adds a degree of life and energy to these virtues, with musical excitement resulting.

THE CA-400 DOES AN OUTSTANDING JOB OF REPRODUCING THE HARMONICS AND "AIR" OF MUSIC.

the best musical dynamics and transient response I have heard in any tube or Classé design.

The CA-400 preserves the natural, flat tone that Classé amplifiers have been famous for, while extending the deep bass and providing added resolution. It proves the character of the upper octaves and treble.

It has it all: state of the art, with the emotion and control to get the best of demanding speaker loads like 12 and out of high-performance drivers from VASIS or from Apogee's horns. It also can provide the dynamics I have previously associated with Jeff Rowland's design. If you really believe that like or that you can throw over an amplifier to drive a CA-400, and lower midrange are more dramatic than on the

DECEMBER 1995

CLASSÉ AUDIO CA-400 AMP DECEMBER 1995

Since Audio's Anthony Cordesman has used the Classé M-1000 amplifier as one of his reference amps, the expectations for the CA-400 he reviewed in December 1995, were incredibly high. The verdict—"the CA-400 is notably cleaner than the M-1000 and has an added degree of depth, providing more detailed imaging. The CA-400 has a new level of dynamic excellence, deep bass with power and a real ability to make music come alive. The CA-400 is one you can't afford to miss when auditioning the best around."





MARTIN LOGAN SL3 SPEAKER

JANUARY 1996

"Aaah, aaah, aaah!" was the sound coming from Ivan Berger's office upon reviewing the Martin Logan SL-3 speakers in January 1996. From the Monolith, to the SL3's down to the Aerius i's, Martin Logan's revolutionary products continue to draw similar responses, allowing you to touch space and feel an image like no other speaker. Martin Logan has shown the world just how exciting their electrostatic technology is. When you become disenchanted with the ordinary, you are invited to experience Martin Logan technology.



CIRCLE NO. 90 ON READER SERVICE CARD



1950



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It is possible to produce amplifiers that measure up to the most rigid requirements and tolerances of a "mechanical ear"... amplifiers that show perfect laboratory measurements, BUT may, despite their mechanical and technical perfection fall short of providing enjoyable "listening-quality."

When you buy a phonograph amplifier you buy one thing... listening quality. That elusive characteristic which, after all, is any amplifier's prime reason for being.

Newcomb amplifiers must not only measure up to the highest standards electrically... but in addition are subjected to critical "listening quality" tests by trained experts. That is why Newcomb amplifiers provide more real listening pleasure.



Insist upon hearing a Newcomb. Compare the listening quality of Model KXLP30 from the standpoint of enjoyment with that of any other amplifier. Your ear will readily hear the pure natural quality and true character of each deep bass note. Now, listen to the clear, undistorted, brilliant, high tones with their remarkable freedom from surface noise made possible by Newcomb's exclusive MAGIC RED KNOB. A comparison will convince you that Newcomb Sound is without question the closest you can get to "Live Music" quality.

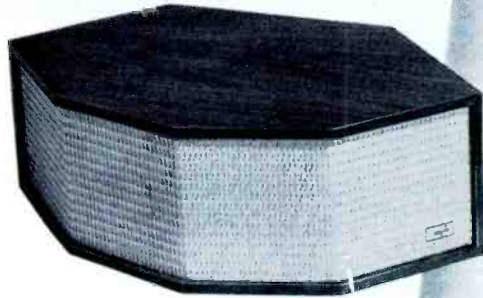
Newcomb Phonograph Amplifiers from \$59.50



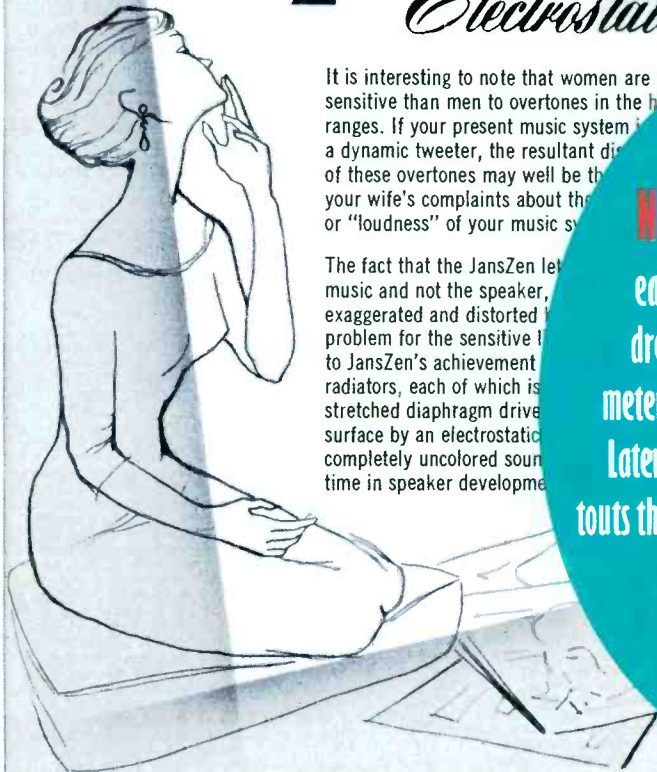
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hear the music
not the speaker...



JansZen *Electrostatic*



It is interesting to note that women are more sensitive than men to overtones in the high ranges. If your present music system has a dynamic tweeter, the resultant distortion of these overtones may well be the cause of your wife's complaints about the "harshness" or "loudness" of your music system.

The fact that the JansZen lets you hear the music and not the speaker, is not an exaggerated and distorted claim. It is a problem for the sensitive listener. It is to JansZen's achievement to have developed radiators, each of which is a stretched diaphragm driven by a completely uncolored sound surface by an electrostatic method. This is a completely uncolored sound surface by an electrostatic method. This is a completely uncolored sound surface by an electrostatic method.

Newcomb fires an early volley at the dreaded tin-eared meter reader (1950). Later (1957), JansZen touts the sonic purity of its electrostatic tweeters.

Write for literature and the name of your nearest dealer

PRODUCT OF NESHAMINY ELECTRONIC CORP., NESHAMINY, PA.

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1957

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In 1950, BIC was an importer of British hi-fi gear, including record changers from Garrard, amplifiers from Leak, and speakers from Wharfedale.

1950

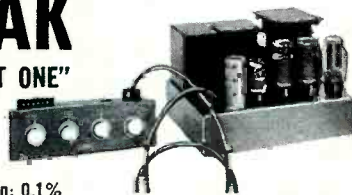
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A new model of Britain's best audio amplifier with compensated settings for all type recordings.

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BRYSTON



EQUIPMENT PROFILE
EDWARD J. FOSTER

BRYSTON 4B ST AMPLIFIER

It's been almost two years since a Bryston product crossed my bench. I had one (the BP 20 preamp, *Audio*, July 1994) was such a pleasure that I looked forward to getting my hands on the 4B ST power amplifier. Bryston's "ST" line of power amps strikes me as quite venerable: 220 watts per channel into 8 ohms in stereo, or 440 watts, bridged into 4 ohms in a similar amp, with an 8 ohm stereo rating of 120 watts per channel. The 4B ST has two amp modules but is designed for mono-phonic use; the two modules can be "bridged" to double the output voltage into relatively high impedance loads (3 to 8 ohms) or operated in parallel to double the current into relatively low impedance loads (1 to 3 ohms), interesting concept. The 4B ST is a four-channel amp that is stereo-compatible to the 4B ST-4 can be configured to drive four, three, or two speakers. All of these amps are available in DIN versions, which differ only in having 12-volt trigger inputs for remote turn-on; the 4B ST that I tested was the standard version.

Technically, Bryston seems to have done it all, with each amplifier module built around eight common output devices powered by separate positive and negative 45-volt supplies. There are two large toroidal power transformers, one for each channel, both unbalanced and balanced outputs are provided, the former via gold-plated RCA phono jacks and the latter through gold-plated connectors that can accept both XLR and 1/2-inch stereo phone plugs. All inputs sport fully discrete active buffers. A slide switch centered between the left-pair selects balanced or unbalanced input. The output terminals are gold-plated end-wire binding posts set on standard 3/4-inch centers and configured with wire holes large enough for heavy gauge wire. Another slide switch, between the RCA jacks and the end-wire terminals, selects bridged or stereo operation. In bridged mode, stereo operation is input is used, and the load is connected between the red output terminals. (The wiring details are clearly indicated on the back panel.) Between the output terminals and five holes is a toggle switch for lifting the signal-ground connections to the chassis. Lifting the grounds breaks the hum-pickup loop that might occur through a common power ground when you're using multiple amplifiers, yet it still permits the chassis to be grounded for safety. Good thinking.

The main panel is a straightforward solid handles near each end, a centrally located power button, and two multi-color LEDs above the power switch. The LEDs indicate normal operation (green), the approach of clipping in each channel (red and clip purple) and they also flash red momentarily on power-up and may glow red if signal is present in the supply voltage and/or when powering down; neither condition is cause for concern.

The 14-inch black-oxidized aluminum panel is drilled for rack mounting. When not rack-mounted, the 4B ST sits on feet that provide a 3/4-inch more than 1/2-inch of clearance above the supporting shell. Black anodized feet sink down, each side provide adequate cooling without a need fan. The chassis is designed so that you can't temporarily rest this hefty amp on its backside without having to disconnect the wiring. Nice thought!

Measurements
With continuous signal, the Bryston 4B ST ran warm (but not dangerously hot) during my bench tests but remained a good

Rated Output: Stereo, 220 watts per channel into 8 ohms or 400 watts per channel into 4 ohms; bridged, 440 watts into 4 ohms.
Dimensions: 19 in. W x 5 1/2 in. H x 15 1/2 in. D (48.3 cm x 13.9 cm x 39.4 cm).
Weight: 42 lbs. (19 kg).
Price: \$2,995 (DIN version, \$1,295).
Company Address: 29 Northfield St., Montpelier, VT 05602; 802/222-0339.
For literature, circle No. 91

AUDIO/FEBRUARY 1996
35

BRYSTON 4B ST AMPLIFIER

FEBRUARY 1996

Having reviewed the Bryston BP 20 preamplifier earlier, Edward J. Foster had high expectations for the 4B ST power amplifier when he reviewed it in February 1996. The 4B ST performed beautifully. Foster summed up his review saying "It's technically impressive, sonically superb, and a top value . . . Pair it with a BP 20 preamp, and you'll have a system to drool over."



CIRCLE NO. 71 ON READER SERVICE CARD

BRYSTON, LTD 677 NEAL DRIVE PETERBOROUGH, ONT K9J7Y4 PHONE (705) 742-5325 FAX (705) 742-0882

conrad-johnson It just sounds right.

The MF2300-A also uses laser-trimmed Varyer resistors in the critical input stage and feedback loop.

Low output impedance is also achieved by the use of MOS FETs—four pairs of them—as output drivers. This gives the MF2300-A a much higher damping factor than tube amplifiers.

The MF2300-A is definitely a music-lover's amplifier, designed to capture the fine details of a performance rather than excite your musical dynamics to the deepest possible bass. It is the kind of amplifier you appreciate best in listening to natural recordings. Amplifiers that sound more strident at first, particularly with heavily processed music that depends on sheer power for its impact, are likely to sound less

FEW AMPLIFIERS IN THIS PRICE RANGE COMMUNICATE OVERTONES AND DETAIL SO WELL.

radiating when you listen seriously and want music rather than drama.

The overall timbre is slightly soft, compared to some solid state units, and is similar to that of Conrad Johnson's tube amplifiers. The MF2300-A's highs do not sound esdled off, yet they are smooth and one reaching very well. The extended highs a flat response of the T160 CS-1 as a s of my reference loudspeakers and allow me to use the flat setting on my Apogee/Gardner/Johnson speakers. The MF2300 produced a wider timbre than B-N-W-2 which have less overall upper octave than the T160 and Apogee speakers.

The MF2300-A has good deep bass without the sheer power and excess of the KSR BSA-90A and Classic Audio-190, but I sometimes use for compact deep bass is closer to that of the Laborcines Alpha 11, with more detail on control and information and dynamic extension.

Mid bass and lower midrange good, without the looseness of many state amps. As a result, the MF2300 an excellent job of reproducing grand piano and deep male vo-

AUDIO/MARCH 1996 23



CONRAD JOHNSON MF2300-A AMPLIFIER

MARCH 1996

In March 1996, Conrad Johnson's MF-2300 amplifier continued a long string of exceptional reviews received from *Audio* over the past two decades. This particular review however, had a twist, the MF-2300 did not have tubes. *Audio*'s Anthony Cordesman said "few amplifiers in this price range communicate overtones and detail so well." This serves as testimony, that whether tube or solid state, all Conrad Johnson products share one important quality . . . they just sound right!



CIRCLE NO. 82 ON READER SERVICE CARD

CONRAD JOHNSON 2733 MERRILEE DRIVE FAIRFAX, VA 22031 (703) 698-3581 FAX 703) 560-5360

ACCLAIMED BY EXPERTS!

The H. H. Scott *Dynamic Noise Suppressor has been acclaimed by acknowledged experts the world around. Manufacturers of the finest records and the finest phonographs have joined music critics and leading broadcasters in enthusiastic endorsement of the performance of this major advance in the reproduction of fine recorded music.

Now you can have the full beauty and realism from your records. For the Type 210-A Amplifier with *Dynamic Noise Suppressor provides all the electronic equipment for *distortionless, low-noise-level* record playing in a *single compact unit*.

If you are a lover of fine music and want all the quality that was originally recorded on your records, you should have one of the Type 210-A Amplifiers. On sale now at leading radio parts and equipment distributors. Write for detailed specifications and list of distributors in your locality.

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HERMON SCOTT, INC.
HOSMER

"PACKAGED ENGINEERING"

Dept. AE-8

385 PUTNAM AVE. • CAMBRIDGE 39, MASS.



Price: \$460.00 list; \$276.00 net, tax included.
Immediate Delivery.

SAYS A MAKER OF FAMOUS RECORDS:

"Before this new invention all attempts at full sound frequency reproduction were handicapped by needle scratch at one end of the scale and by rumble at the other end, both of which are eliminated by the Scott system while permitting the full range and quality of musical reproduction."

—Sir Ernest Fisk, Managing Director of Electric and Musical Industries, Ltd., England

(This company owns the Gramophone Company, Ltd. (His Master's Voice), the Columbin Gramophone Company, Ltd., and other companies in the phonograph field. Trade names include His Master's Voice, Columbia, Marconiphone, Parlophone, Odeon, Pathe and Regal-Zonophone.)

From 1948,
H. H. Scott's first big
hit, the 210-A amp with
Dynamic Noise
Suppression, and
subscriptions to *Audio*,
then in its second year,
at \$3 for 12 issues.
1948

It's Tops!

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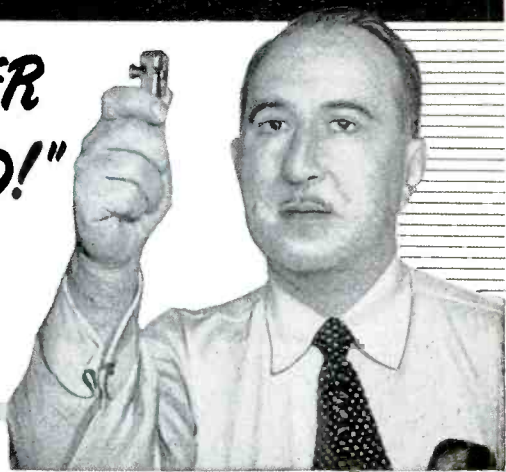
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**"OUTSELLS ALL OTHER
MAKES COMBINED!"**

Reports **ARNOLD DEUTSCHMANN**
Vice President, **RADIO SHACK Corporation**
Boston, Mass.



1951

GE makes an absolutely true claim in this 1951 advertisement. It dominated the high-performance cartridge market, until stereo gave more agile competitors an opening.

MORE customers ask us for G-E than for all other cartridge brands combined. In our business that's an important tip-off because people who come to us usually know exactly what they want in audio performance. They want what we stock the best. We handle every type of cartridge—and G-E Variable Reluctance cartridges—they all by at least 4 to 1! We are known the world over as a "quality" store for audio equipment. Radio Shack on Boston's Washington Street is typical of finer dealers everywhere in its

support of General Electric parts and components.

Every stylus in every G-E cartridge is double-damped to absorb virtually all mechanical noise. Diamond or synthetic sapphire tips are available for standard or microgroove records.

A Sales Point to Remember—Replace with a G-E stylus and you get the equivalent of a whole new pickup! Here's why:—General Electric's single-package stylus assembly contains stylus, cantilever, and damping blocks—the only parts of your pickup that are affected by time and use. No other cartridge gives you this advantage.



SPEAKER PERFORMANCE THAT SELLS—and stays sold! Lew Kornfeld and Arnold Deutschmann, Radio Shack experts, agree that G.E.'s 27 sizes of speakers bring quality sound within the range of every taste and budget.

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NEW BOOKLET!**



You can put your confidence in—

GENERAL  ELECTRIC

General Electric Company, Section 44111
Electronics Park, Syracuse, New York

Yes—send me new booklet with complete information on General Electric diamond stylus.

NAME
ADDRESS
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Classé

CLASSÉ AUDIO CP-60 PREAMP

MAY 1996

"The CP-60 stands out among today's preamps . . . its versatile features are likely to suit demanding audiophiles," concluded *Audio's* Anthony Cordesman, in the May 1996 issue. "Its sound is outstanding, and it looks as good as it sounds."

And I heard no subtractive or additive colorations when I switched from phono to line stage; something different is even the best hi-fi and equipment.

Nature is the name of the game in the high end, particularly with components as neutral as today's best preamps. Classé will depend greatly on how its characteristics interact with those of the other components in your system. With that in mind, I believe you will find the CP-60 optional enough to reinforce the strengths of most high-end systems. It may not please those who are looking for some magic combination or a "one sound," but it is likely to please even the most demanding audiophile in any system, the CP-60.

from speak response good, midrange. The energy and have still on solid state p but the CP-60 performance that of most is not like some. The CP-60's optional life will energy. I've pream on note from ma of near total when night electronic ha 60's low noise even excellent overall frequency transparency.

Some preamps have sensitive, more depth precision of imaging than ever, the Classé preamp re exactly what I expected in microstages on own and on DAT tapes where I was performance, and in areas which I have a great deal of short, I found the soundstage rather than euphonic. The CP-

ALV/MAY 1996 67

soundstage information at very low signal levels usually well and gave the sound stage naturally.

I experienced a few minor system extension problems with the CP-60. The phono input connection was awkward, making it more difficult to connect my turntable's ground wire than it should have been. You may have to experiment extensively with different ways of grounding your cartridge tone arm, or turntable to get the best results. My MC cartridges at extremely high gain settings. And unless you follow the instructions manual carefully, the CP-60 may throw you a curve by staying when you switch in and out of the surround process.

The CP-60 stands out even among today's preamps. It offers excellent phono performance, transparency, and dynamics. If you are looking for neutrality rather than some special coloration, you'll find Classé Audio's CP-60 to be a versatile, quality preamp. And its versatile features are likely to suit demanding audiophiles.

Unlike some other preamps, the CP-60 has front panel and remote-control layouts that are clear and easy to memorize. What's more, the selected inputs, the volume, and balance control potentiometers, and other status information are indicated in the front panel's LED display.

With buttons on the front panel or remote, you can select from two balanced inputs ("TRM1" and "TRM2") and from four unbalanced inputs ("RECT" through "REG7"). In addition to tape and surround loops. Other controls on the panel and the remote are for balance, polarity, muting, volume continuously adjustable, and gain (choice of 12 or 18 dB at the base stage). The volume and balance controls offer a wide range of settings and fine adjustments (80 steps for the volume control, 15 steps for balance). Since these controls' settings are shown in the LED display, you can easily replicate your favorites. I found the balance-control display particularly valuable in adjusting for the best imaging, soundstage width, and depth for favorite recordings.

The CP-60 uses the same basic circuitry as previous Classé preamplifiers. Its refinements were based on extended listening to the effects of new components, circuitry, and operating voltage adjustments.

A versatile phono preamp is available for an additional \$495. Classé says that in moving magnet mode it has 35 dB of gain and a signal-to-noise ratio greater than 85 dB. The moving coil mode, selected by jumpers, adds another 10 to 11 dB of gain (factory-set at 22 dB, but you can change resistors to alter it). Even so, it maintains almost the same SNR, leading to an automatically adjusted match to the moving coil cartridge.

The CP-60's phono preamp is centered by the phono stage I have heard in previous Classé products, rivaling the best outboard phono preamps. It delivered exceptional clarity, dynamic detail, and very low noise, even when I used moving coil cartridges having very low output.

ANTHONY 1996

AURICLE
ANTHONY H. CORDESMAN

CLASSÉ AUDIO
CP-60 PREAMPLIFIER



Because today's preamps are commonly so good, it can be tempting to write reviews that say "Here's another good one." Yet there are differences in features, responsiveness, phono stage performance, and some cases, but all the comments that mention the occasional preamp that makes the leap from very good to excellent.

Classé Audio's CP-60 makes that leap. It offers some unusual and useful features. Its optional phono stage should please the most demanding LP fan. Its sound is outstanding. And this \$5000 preamp's dimensions, available in black or silver, makes the first Classé preamp that looks as good as it sounds.

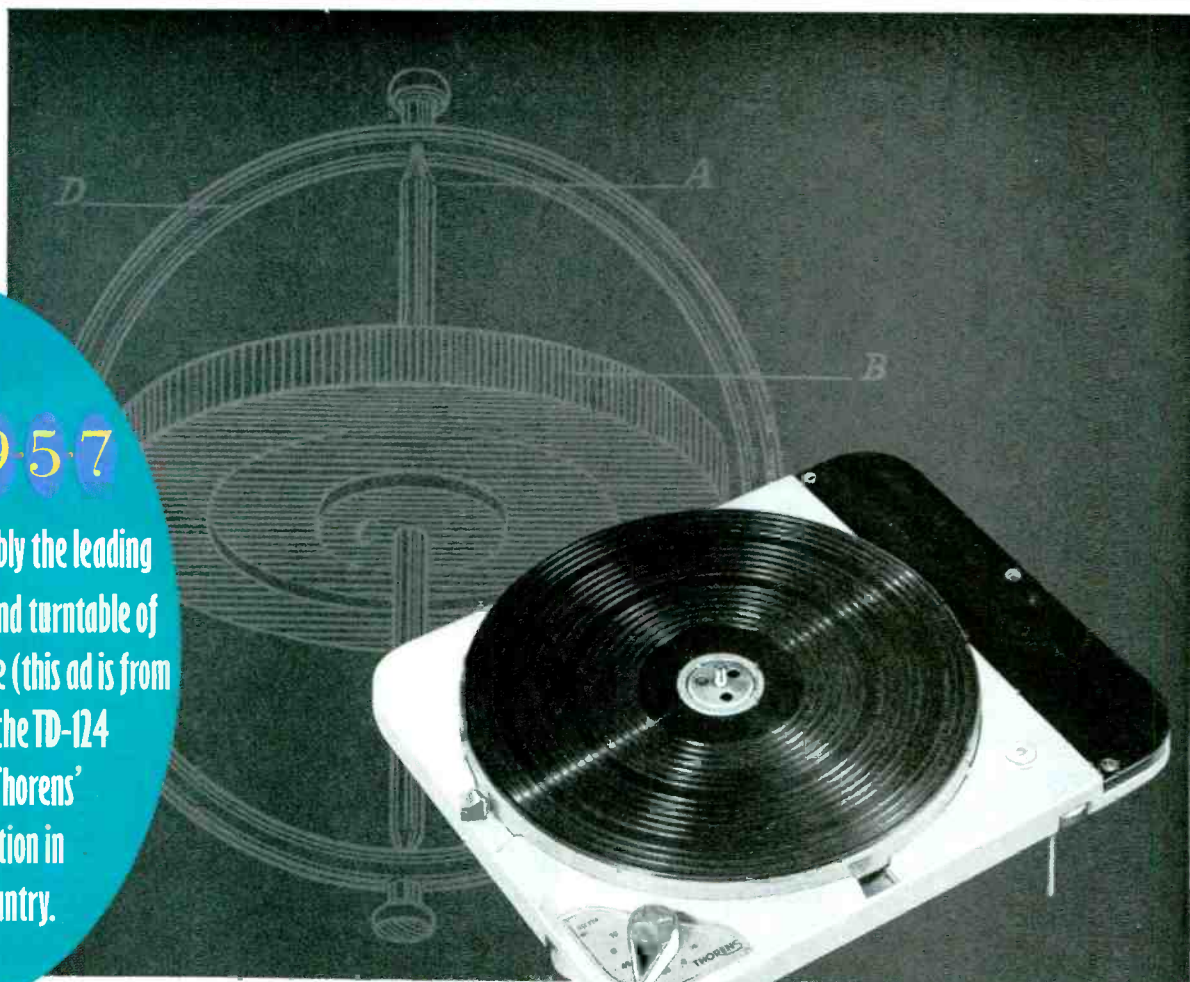
Classé Audio does not bother with any, or any, distortion. Starting with one, other high-end manufacturers the belief that measurable distortions have long been reduced to the point where "spaciousness" is meaningless. Frequency response is specified at 20 Hz to 20 kHz, 200 dB, with a bandwidth of 1 Hz to 150 kHz between 3-dB points at maximum output. Rated sensitivity is 120 millivolts for the line inputs, gain is 18 dB, and signal-to-noise ratio is 85 dB. The line stage's input impedance is just 20 kilohms and the output impedance is 1 ohm.

Company Address: 9414 Côte de L'Église Rd., Lachine, Québec, Canada H8T 1A3; 514-636-6384.
For literature, circle No. 94



1957

Arguably the leading high-end turntable of its time (this ad is from 1957), the TD-124 made Thorens' reputation in this country.



99.75 net

NEW 12" PRECISION TURNTABLE

OUTSTANDING FEATURES

- Four speeds, each with +3% speed adjustment. Built-in illuminated strobe disk for all speeds. Built-in level bubble and leveling screws.
- Precision 4-pole motor, extra-compliant belt-drive and idler system plus exclusive Thorens Roto-Drive principle, provide complete vibration isolation, absolutely constant speed.
- Provision for easily changing arms without leaving unsightly permanent marks—just replace low-cost arm mounting board, available for 12" or 16" arms in various finishes.
- Easy to mount, the TD-124 requires only 2 3/4" clearance below mounting board. Furnished with attached line cord, shielded cable and solder plate.

Gyro-like Roto-Drive gives new Thorens TD-124 absolute speed uniformity. Heavier than 16-inch turntables, yet it starts, stops in less than 2/3 turn!

How to get the heaviest possible turntable for smooth, absolutely quiet operation without sacrificing fast starts and stops.

That's the problem Thorens engineers faced when they set out to build the best four-speed, 12-inch, hi-fi turntable money can buy. You'll be amazed at the simplicity of their solution.

The new TD-124 really has two turntables in one: (1) a heavy 10-lb. rim-concentrated, cast-iron flywheel (outweighs 16" aluminum turntables) (2) a light aluminum cover, or turntable proper. An exclusive, Thorens-originated clutch couples or decouples the light aluminum table to the heavy flywheel for instant starts and stops. What's more, the Thorens double turntable system gives you the weight of a cast-iron table (3 times as heavy as aluminum) without danger of attracting any pickup magnet. And with this unique construction, your pickup gets magnetic shielding from motor or transformer hum fields by the iron turntable.

Ask your hi-fi dealer to show you the Thorens TD-124. Better yet, arrange to hear one of those critical, slow piano records on the TD-124. If you don't know who your dealer is, write Thorens Company, Dept. A127, New Hyde Park, N. Y. 79



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Lexicon

EQUIPMENT PROFILE
EDWARD J. FOSTER

LEXICON DC-1/THX A/V PREAMP/PROCESSOR



Lexicon's quarter-century history in digital audio doesn't seem long. Until you realize that in 1971 the CD hadn't even been launched and analog tape had more than a decade to live before being "challenged" by rapidly advancing technology.

How old I'm getting!

Lexicon and digital processing have been inseparably linked throughout the company's history, even back when ghidol was invented at the supposed "inventing" of the stereo tape. (Look, of course, at most everyone has some tape that digital audio's near perfect response, articulation, wide dynamic range, and low distortion enough to let us listen—uh, for the owner, not the listener—without those very same characteristics.)

The DC-1 is also available in two other versions. The DC-1/THX adds Lexicon's Home THX Cinema and Lexicon's Logic 7 elaborations of Pro Logic's coding. "Matrix Surround" mode has and treats center channel and side channel compression. As such, and true to Lexicon's reputation for high-end processing, all filter and equalization functions are performed digitally. At the top of the heap is the DC-1/THX, which includes all of the above plus Dolby Digital (Dolby) decoding (to which Home THX processing can be applied if desired) and a "late-stage" compression circuit, and a spectral dynamic control. The basic system of the DC-1 can be upgraded to the THX version, which can, in turn, be upgraded to the DC-1/THX version, via plug-in modules in both cases. And until the end of August, you can even upgrade in Lexicon's CP-Logic series processors for credit on a new DC-1/THX. (Credit in credit depends on the specific model and its condition but can range as high as \$2,000 for a CP-3 Plus, which is twice the price of the new Dolby Digital model.)

The Lexicon DC-1/THX provides all the features of a "mainstage" line-stage preamp: stereo and surround, adjustable digital sources, video switching, an adjustable preamplifier, and a dual-slope, optical preamplifier. The DC-1 also provides its own, fully digital surround capabilities. First among these is the company's highly regarded, patented super-resolution of Dolby Digital's 24-bit, 92.1 kHz sampling rate, but most of the other processing options are directed at enhancing the two-channel stereo source. "Parasound" and "ambience" are recording "made real," which is processed by "Parasound" and "ambience" for a wide range of recording, including studio and live recording. And there are four and seven channel modes: "Stereo," "Surround," and "THX." (See "Lexicon" and "THX" for more details.)

ADDENDUM 1996
23

AUDIO

THE EQUIPMENT AUTHORITY
MAY 1996

THE AMAZING
**SHRINKING
SUBWOOFER**

TESTED

LEXICON SURROUND
The Next Generation

PLATINUM'S
DYNAMIC
DUO SPEAKER

ALSO TESTED

PARASOUND PREAMP,
VAC AMP & PREAMP,
AND MORE

US \$3.50
UK £1.95
CAN \$3.95

Dimensions: 17 1/2 in. W x 3 1/2 in. H (44 cm x 9.2 cm) with rack-mounting brackets, 17 in. W x 3 1/2 in. H (44.3 cm x 8.9 cm).
Weight: 0.9 lb. (418 g).
Price: DC-1/THX, \$1,595; DC-1/THX, \$2,995; DC-1/THX, \$4,500.
Company Address: 100 Beaver M., Woburn, Mass. 02158; 617/736-0300.
lexicon@compuserve.com
For literature, circle No. 90.

LEXICON DC-1/THX A/V PREAMPLIFIER

MAY 1996

In 1971, Lexicon introduced audio recording professionals to the first digital audio signal processor. Twenty-five years later, in May 1996, Lexicon's DC-1/THX A/V preamplifier set a new standard. *Audio's* Ed Foster described the DC-1 as offering "surround that was the deepest and most realistic I've heard" and as being "outstanding" and "uncanny." With superb performance and options like THX®, Dolby Digital® and DTS®, the DC-1 is "in a class by itself." One audition and you'll agree with *Audio's* assessment "this . . . is . . . really . . . good!"

CIRCLE NO. 87 ON READER SERVICE CARD

LEXICON, INC. 3 OAK PARK BEDFORD, MA 01530 PHONE (617) 280-0300 FAX (617) 280-0490 www.lexicon.com

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PLATINUM

PLATINUM AUDIO LTD. DUO SPEAKER

MAY 1996

According to D.B. Keele Jr. (*Audio* May 1996), "Platinum Audio's Duos have superb looks and high performance that belies their small size . . . the sound was smooth and well balanced, clean bass matching that of some larger systems." As with all the speakers in the Listening Room Series, British designer Phil Jones has used state of the art technology to create the complexities of music in a small speaker format.

EQUIPMENT PROFILE D. B. KEELE, JR. PLATINUM AUDIO DUO SPEAKER



one, he built his own copy—fretless, because he didn't know how to determine fret placement. At 15, he played in several rock bands and was heavily influenced by James Brown and was heavily into contracting his own bass work. Later, after contracting his own "60s-stick" "high-end" audio system from old Western Electric James B. Lansing components, Jones started a company that rented public-address systems (using all his rental speaker designs) and went on to build and operate his own recording studio in the early '60s.

In 1967, Jones and a partner founded a speaker company Acoustic Energy (not to be confused with the Energy brand of speakers from Canada's Audio Products Inc.) speakers from Canada's Audio Products Inc. Jones subsequently moved to the Netherlands. He subsequently moved to the United States and worked for Boston Acoustics before starting Platinum Audio, Inc. in 1994.

The Duo is third down in Platinum Audio's Listening Room (LR) series of loudspeakers, priced from \$2,498 to \$5,995 per speaker. The Duo is relatively small and was designed to be placed on a stand. Among the design goals were high accuracy and reliability, high response, and a full range system in minimum size and cost. The Duo has two woofers and one tweeter. Designed and manufactured by Platinum Audio, the tweeter is attached vertically with the tweeter between the two woofers—let us call it a V-Apples configuration. Although you would think this is a two-way system, it can be considered a two-and-a-half-way. Both woofers operate in

Rated Frequency Response: 40 Hz to 20 kHz, ±2 dB.
Rated Sensitivity: 86 dB at 1 watt/1 meter.
Rated Impedance: 4 ohms, nominal.
Recommended Amplifier Power: 100 to 250 watts per channel.
Dimensions: 210 mm H x 80 mm W x 130 mm D (8.25 x 3.15 x 5.1 cm).
Weight: 200 lbs (90.7 kg) each.
Price: \$2,498 per pair, in semigloss ebony or rosewood; \$3,498 stand, semi-gloss per pair.
Company Address: 10 Commerce Park North, Unit 11, Bedford, N.H. 03110.
Phone: (603) 647-7396.
For literature, circle No. 92

Both woofers work together up to 250 Hz, above that the lower one rolls off.

What do Leo Fender, James Jamerson, and Jimi Hendrix have in common? They are all here in sound! They are all here in sound! They are all here in sound! They are all here in sound!

are the other road James Jamerson was known as "The Funky" and Jimi Hendrix was known as "The Space Man". The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market. The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market.

AUDIO/MAY 1996

THE SOUND WAS SMOOTH AND WELL BALANCED, WITH LOUD, CLEAN BASS MATCHING THAT OF SOME LARGER SYSTEMS.

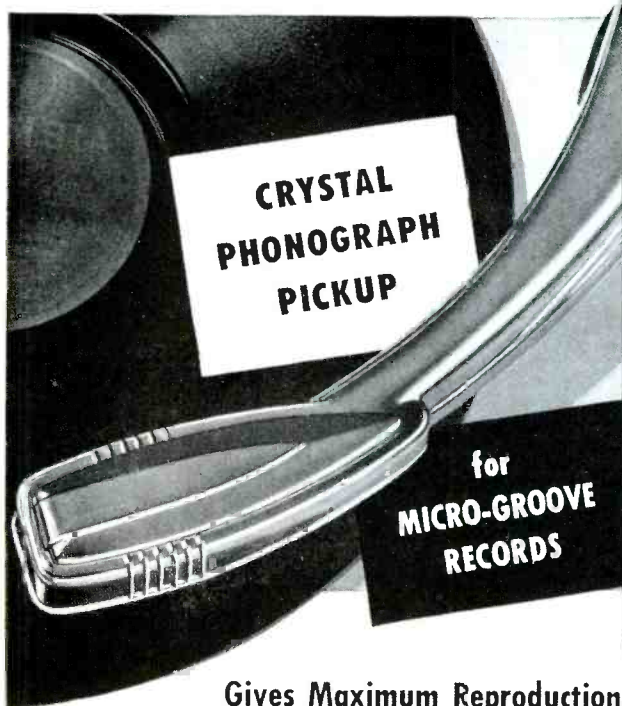
of 40 Hz and 4.5 kHz, with a peak response of 120 dB at 1 kHz. The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market. The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market.

I placed the Duo in my usual listening position and aimed it toward my listening position and aimed it toward my listening position. The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market.

On the Duo's rear panel are two flared ports and a bass baffle. The Duo's tweeter is a 1/2" V-Apples tweeter, which is a better tweeter than most tweeters in the market.



NEW SHURE "900M



Gives Maximum Reproduction of Micro-Groove Record Fidelity

The Shure "900MG" Pickup is an ideal instrument for tracking on the new micro-groove records. It tracks at 6 grams . . . uses a special offset osmium-tipped needle with a point radius of only .001" . . . and has an output of 1 volt! The Shure lever system has been adapted in the development of this new pickup—providing a high needle compliance. Listen to it—you will be thrilled with the results!

Model "900MG"

Code: RUZUZ

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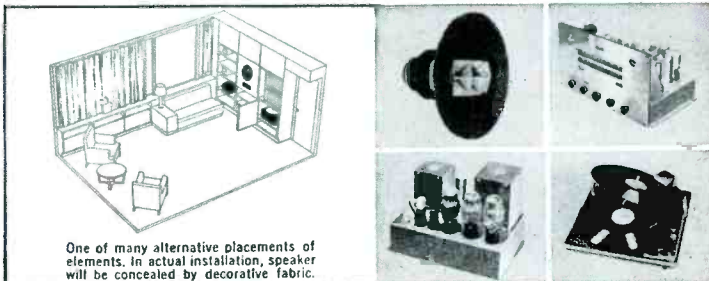
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home music system



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As an engineer with professional knowledge of the science of audio reproduction, you can appreciate more thoroughly than any layman the incredible life-like reproduction of voice and music of which this magnificent Altec Lansing Home Music System is capable. Added to the lifetime enjoyment which this system will provide is the pleasure of installing it yourself. Full instructions are included. This system transcends the inherent limitations of commercial radio-

phonographs, yet costs are favorable to this system. The system includes the famous Altec Lansing Duplex speaker, a special Altec Lansing amplifier, a newly designed TRF Altec Lansing tuner, and the Webster 70 changer. Built-in Altec Lansing Daylight Television can also be included.

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1948

From 1948: Shure before it developed the moving-magnet cartridge, and custom installation à la Altec Lansing.

the future of stereo


The problems of traditional two-channel stereo

by **FLOYD E. TOOLE**

The capture, storage, and reproduction of musical and other acoustical events has been an obsession of the audio industry for its entire existence. At first, it was amazing that any sound could be captured and reproduced. With the passage of time and advancing technology, we became fussier, demanding timbral accuracy, an absence of noise and distortion, realistic dynamic range and bandwidth, and so on. With stereo came some limited impressions of direction and space. Now we demand more—more realism, more dramatic effects, and more listeners to share the auditory experiences. This article will examine our progress in meeting these objectives. (Part II will look at binaural hearing and related issues.)

Floyd E. Toole is Corporate Vice President of Engineering for Harman International. He is a past president of the Audio Engineering Society and a Silver Medal Award winner. Prior to his move to the United States, he spent 25 years with the National Research Council of Canada as a scientist and psychoacoustician. His Ph.D. thesis dealt with stereo localization and binaural hearing.



A woman with long brown hair, wearing a black and leopard-print dress, is lying on a bright yellow background. She is surrounded by various audio equipment: a large black speaker, a smaller black speaker, a black subwoofer, and several vinyl records. A black bag is also visible. The scene is lit with bright, even light, creating a high-contrast, vibrant aesthetic.

and multichannel approaches to solving them

PART I

Photograph: Robert Lewis



EQUIPMENT PROFILE
D. B. KEELE, JR.

KEF REFERENCE SERIES MODEL FOUR SPEAKER

into the room from this cavity, through a large tapered port. The Model Four's interior is coated cavity has a loading system in stainless steel but has a vented rather than a sealed enclosure for each woofer and has larger, 10-inch, bass drivers.

A conventional bass-reflex vented enclosure normally has a single bass resonance in the center of the woofer's passband. By contrast, the InterPort design has an additional bass resonance at the low end of the

The Model Four is at the top of KEF's high-end Reference line, which comprises four models that range from \$6,400 down to \$1,600 per pair. All with magnets, shielding, it's also KEF's second most expensive speaker, exceeded in price only by the Model 10712 at \$7,500 per pair; the latter is part of KEF's Raymond Cooke Series, named in honor of the company's late founder. (I reviewed the original Model 107 in the February 1984 issue.)

The current Reference Series was conceived and developed by engineer Enrico Cecconi, who has been at KEF for more than 17 years. I saw the previous Reference Series, this line is based upon KEF's Uni-Q two-way coincident driver technology, which puts a very small dome tweeter at the apex of a wide-range cone. The precursor to the Model Four was the wonderfully configured Model 105's (Audio, June 1991). Like the 105's, the Model Four has a large, floor-standing tower as also a four-way system using six KEF bass drivers, two of which



<p>Rated Frequency Response: 25 Hz to 20 kHz, ±3 dB</p> <p>Rated Sensitivity: 92 dB at 1 meter, 2.85 watts per channel</p> <p>Rated Impedance: 4 ohms, nominal</p> <p>Recommended Amplifier Power: 50 to 300 watts per channel</p> <p>Dimensions: 47 1/2 x 11 1/2 x 11 1/2 in. W x 15 1/2 in. D (121.4 cm x 30 cm x 39 cm)</p> <p>Weight: 10 1/2 lbs (4.8 kg) each</p> <p>Price: \$5,200 to \$6,400 per pair, depending on finish, plus freight and handling charges. Address: 89 Doug Brown Way, Holliston, Mass. 01746-5091/29-5060.</p> <p>See literature, circle No. 91</p>	<p>are concealed inside, "back-mount" higher frequencies are handled by a single Uni-Q driver with a 1/8-inch cone and a 1-inch soft-dome tweeter.</p> <p>Although the Model Four looks similar to the 105's, it differs in two significant ways. First, the Model Four's Uni-Q driver is positioned between the two other mid-range drivers in a 10-degree configuration. The second difference is the woofer system. The 105's used two 8-inch woofers in separate, sealed enclosures that sat into a common "cavity cavity" bass-reflex</p>
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woofer's range. The two bass-tuning frequencies reduce cone motion and distortion over a wide range than a single-tuned design in group drivers.

The 105's had two woofers, one facing up in the top half of the cabinet and two other facing down in the bottom half. These woofers were connected solidly together by a force-canceling rod. In the Model Four, the rod is actually much thicker, is actually comprised of two laser-cut braided tubes of extruded aluminum that are connected by a threaded barbed rod. Since the original 105's "rod" split, they move in separate

Photo: Richard Coates

KEF



powerful low frequency output, whereas the Model Four in the top half of all speakers have better:

The dual listening tests were conducted one per test. The Model Four was placed on the test bench with the other speakers. I was the only person and the speaker was in the room. I was the only person and the speaker was in the room. I was the only person and the speaker was in the room.

WIDE BANDWIDTH, NEUTRALITY, BASS, DYNAMICS, COVERAGE, IMAGING—THESE KEFs HAVE IT ALL.

their specs, it covers magnetic shielding, speaker placement, room acoustics, placement of feet and spikes, speaker cables and connections, wiring and interconnects, speaker phasing, amplifier damping, and power handling. (I found it interesting, however, that most of the advice in such areas is directed in relation to the test and speaker than to speaker and speaker placement.) The

AUDIOJUNE, 1996

KEF REFERENCE SERIES MODEL FOUR SPEAKER

JUNE 1996

Just like *Audio Magazine*, KEF's Reference Series is a benchmark in its field. The top of the line Model Four has garnered worldwide praise, including a review in *Audio's* June 1996 issue, for its superb performance and innovative technology. From its patented Uni-Q® point source driver, to its dual InterPort Coupled Cavity bass system, the Model Four showcases KEF's ground breaking research and development. Check out the Reference Series and KEF's great new Q Series at your local KEF dealer, or contact us for further information.



In the beginning, there was monaural (it means, literally, one ear—we actually listen binaurally, through two ears, no matter how many channels are used). Everything we heard was stored in and reproduced from a single channel. In those early days of mono, listeners enthused, and critics applauded the technical accomplishments of Thomas Edison, Emile Berliner, and others as being the closest possible to reality. They were wrong, but clearly a revolution in home entertainment had taken place.

Monophonic reproduction conveys most of the musically important dimensions—melody, timbre, tempo, and reverberation—but no sense of spatial envelopment, of being there. In the 1930s, the essential principles by which the missing elements could be communicated were understood, but there were technical and cost limitations to what was practical. It is humbling to read the wisdom embodied in the Blumlein-EMI patent [1] applied for in 1931, which describes two-channel stereo techniques that would wait 25 years before being exposed to the public. Then there are the insights of the Bell Telephone Laboratories scientists, who, considering the reproduction of auditory perspective, concluded in 1934 [2] that there were two alternative reproduction methods that would work: binaural and multichannel.

By binaural, the Bell Labs scientists meant the technique of capturing a multidimensional sound field by using microphones at the ear locations in an artificial head (thereby encoding all of the directional cues in the left- and right-ear signals) and reproducing those signals through headphones. The listener's ears would then hear what the dummy head "heard," so that, in theory, perfect auditory perspective would be communicated.

Multichannel reproduction is more obvious, since each channel and its associated loudspeaker creates an independently localizable sound source, and interactions between them create even more. Inevitably, the question arose: How many channels are necessary? Bell Labs scientists concluded that a great many channels would be necessary to capture and reproduce the directional and spatial complexities of musical events. Being practical, they investigated the

possibilities of simplification and concluded that, while two channels could yield acceptable results, three channels (left, center, and right) would be a desirable minimum to establish the illusion of a stable front soundstage, especially for a group of listeners. It is important to note that there was no attempt to re-create a surrounding sense of envelopment.

By 1953, ideas were more developed, and in his paper "Basic Principles of Stereophonic Sound" [3], William Snow describes



Fig. 1—Because of the stereo-seat restriction, two-channel stereo is an antisocial system; only one listener at a time can hear it properly.

Mono reproduction conveys most of the musical y important dimensions but no sense of spatial envelopment, of being there.

a stereophonic system as one having two or more channels and speakers. He says, "The number of channels will depend upon the size of the stage and listening rooms, and the precision in localization required." Snow goes on to say that "for a use such as rendition of music in the home, where economy is required and accurate place-

ment of sources is not of great importance if the feeling of separation of sources is preserved, two-channel reproduction is of real importance."

Thus, two-channel reproduction was known to be a compromise—"good enough for the home," or words to that effect. So what did we end up with? Two channels! The choice had nothing to do with scientific ideals, but with technical realities: When stereo became commercially available, nobody knew how to store more than two channels in the groove of a record.

Around that same time, however, the film industry was highly motivated to do better, and several major movies were released with multichannel surround sound accompanying their panoramic images. These were discrete-channel soundtracks recorded on magnetic stripes added to the film.

Although these soundtracks were very successful artistically, the technology languished because of the high costs of production and duplication. The industry reverted to monophonic optical soundtracks, at least until the development of the "dual bilateral light valve." This device enabled each side of an optical soundtrack to be modulated independently, thus accommodating two channels. Once that barrier was surmounted, film soundtracks moved beyond two-channel stereo relatively quickly. And in the end, it was the film industry, not the audio industry or audiophiles, that drove the successful introduction of multichannel home sound reproduction. On the way, however, it learned much from the earlier missteps of others.

Multichannel Sound—First Try

The arrival of two-channel stereo in the '50s was a revolution, even though recording techniques being used at the time frequently resulted in hole-in-the-middle soundstages and exaggerated left/right effects. Conventional stereo is not blessed with an underlying encode/decode system or philosophy; it is merely a two-channel delivery mechanism. Over the years, microphone and mixing techniques have evolved, but the struggle to capture, store, and re-

Illustrations: Paragraphics

produce a realistic sense of direction and space from two channels and two speakers has been a mighty one. There has been no single satisfactory solution, as is evidenced by the diversity of microphone techniques, signal processors, loudspeaker designs, and “tweaks” that have come and gone, as well as those that survive.

What can one say about a system that accommodates speakers having directional characteristics ranging from omnidirectional through bidirectional in-phase (so-called bipole), bidirectional out-of-phase (dipole), and predominantly backward-firing, to forward-firing, with a variety of directivity characteristics within each of those broad categories? The nature of the direct and reflected sounds arriving at the listeners’ ears from these different designs runs the entire gamut of possibilities. This is not really a system at all; it is merely a foundation for individual experimentation. The history of two-channel stereo is littered with examples of efforts to generate a more engaging sense of envelopment and depth—some acoustical, some electronic, and some that appear to operate simply on faith. Remember the Hafler system [4] sold by Dynaco? And Carver’s Sonic Holography [5]? Nowadays we have SRS, Spatializer, and hosts of digital signal processors (DSPs) that offer dimensional embellishments. We can only conclude that, in a multichannel system, two channels are simply not enough.

Added to these fundamental problems is the inconvenience of the stereo seat, or “sweet spot.” Two-channel stereo is an essentially antisocial system; only one listener can hear it properly (Fig. 1). If one leans a little to the left or right, the featured artist flops into the left or right speaker and the soundstage distorts. Sit up straight, and the featured artist floats as a phantom image between the speakers, but the sound quality is altered because of the acoustical crosstalk. That is, the sound from each loudspeaker travels not just to the ear nearer to it, but to both ears. And when identical sounds radiate from both channels, as happens for a center image, there is a comb-fil-

**Bell Labs scientists
concluded in 1934 that
many channels would
be needed to simulate
the directional and
spatial complexities
of musical events.**



Fig. 2—Quadraphonic sound compounded the problems of stereo. The sweet spot was now constrained in the front-to-back direction as well as the left-to-right.

ter effect at each ear when the direct sound from the nearer loudspeaker combines with the slightly delayed sound from the opposite speaker. The dominant effect is a distortion of the amplitude and phase response of the center image’s sound. Ironically, no matter how perfect a loudspeaker may be in frequency and phase response, those properties will not be appreciated in the sound of the center image because of an intrinsic limitation of two-channel stereo.

You don’t believe me? Play some monophonic pink noise and move in and out of the stereo sweet spot. As you move from the left or right toward the center, you will experience phasiness, and as you approach the precise center location, the sound will get noticeably duller as destructive interference creates a dip at around 3 to 4 kHz. Fortunately, room reflections help to minimize

the annoyance of this effect in most home installations.

In fairness, it must be said that after more than 40 years of experimentation, the best two-channel stereo recordings reproduced over the right set of speakers in the right room can be very satisfying indeed. Sadly, only a fraction of our listening experiences fall into that category, so this is not a long-term solution.

Multichannel Sound—Second Try

In the ’70s, we broke the two-channel doldrums with a misadventure into four-channel sound called quadraphonics. The intention was laudable: to deliver an enriched sense of direction and space. The key to achieving this goal lay in the ability to store four channels of information in the existing two channels of a vinyl LP and then to recover them.

Two categories of systems were in use at the time, matrixed and discrete. The matrixed systems crammed four signals into the bandwidth normally used for two channels. Something had to give, and as a result, separation was not the same between all channels. In other words, information that was supposed to be in only one channel would appear in smaller quantities in some or all of the other channels. For the listener, the result of this channel leakage, or crosstalk, was confusion about where the sound was coming from. I well remember feeling as though I were inside a cello while listening to one of my quadraphonic LPs.

Various forms of signal-adaptive “steering” (a technique for routing signals in preferred directions) were devised to assist the directional illusions during the playback process. The alphabet soup is memorable: SQ from CBS, QS from Sansui, EV-4 from Electro-Voice, and others. Peter Scheiber, a musician with a technological bent, figures prominently as a pioneer in the matrix game, with his patented encoder and decoder ideas incorporated into many designs. The best matrix systems were remarkably good in creating the impression of four completely separate, or discrete, channels. However, matrix processing breaks down when there is a demand for several simultaneously occurring discrete images.



SONIC FRONTIERS

INCORPORATED



SONIC FRONTIERS POWER-3 MONO AMP

AUGUST 1996

"Ease," "dynamic power," "lack of irritation," and "musical believability" were among many descriptions given to Sonic Frontiers' Power-3 Mono Amp.

The distortion performance, measured back in August 1996, was among the best *Audio's* Bascom H. King had ever seen in tube power amplifiers, explaining why the Power-3's overall audition was

equally impressive. The Power-3 Mono Amp is just one of Sonic Frontiers' impressive lineup of preamps and amplifiers, designed for breaking the sound barrier.

EQUIPMENT PROFILE
BASCOM H. KING

SONIC FRONTIERS POWER-3 MONO AMP



I had hoped to get the more Power-3, the concept's top-of-the-line amplifier. I expected to get the Power-2 stereo amp. I got surprised and delighted when a pair of 120-watt Power-3s arrived on my doorstep. The 1996 pair was delivered (the 1995 model amp was not shipped).

The most Sonic Frontiers distinguishes the Power-3 is available with a black or gold face panel. The sub features on that panel are push-button switches and indicators. It has six "Standby" and "Power" buttons. The front panel has input transformers and 30-ohm impedances are in a secondary enclosure. It is a nice look of the Power-3, which also has a top panel. The amp's top panel is a solid metal, as is on this panel which is a solid metal unbalanced single-ended, balanced input, or unbalanced, unbalanced input. Balanced inputs can be fed in

through an XLR connector or a pair of RCA inputs. One of two RCA inputs also serves as the non-inverting unbalanced input; the other serves as the inverting unbalanced input. As with a preamp, the input selector switch on the Power-3 shorts all of its inputs, and activates the bias-setting circuitry for the output tubes.

The Power-3's audio circuitry is in a sturdy metal chassis extending forward from the transformer enclosure, and the tubes are slotted through the top of the chassis. Between the chassis and the transformer enclosure behind it is a small band, about 1/4 inch wide, that is used to help seal a number of heat sinks for power supply components that are just below the band. A slotted metal cage fits over the tubes, going

THE CIRCUIT COMBINES
FAMILIAR ELEMENTS
WITH NEW REFINEMENTS
TO PRODUCE
A UNIQUE DESIGN.

The amplifier's single low-shaper tone control is also built on the chassis with a rotary switch. The amplifier's bottom plate is slotted to allow cool air to flow.

Inside the Power-3 are two pre-boards. A triode-connected 6X4 tube chassis has all the tube sockets and most of the audio circuitry. The second board is finally divided to allow air to flow through the bottom plate to pass through the transformer enclosure behind the transformer enclosure holds power supply components. Unlike many tube amps that have pre-boards to match their chassis, the Power-3 has most of its components mounted to the underside of the board for easy access.

Rated Power Output: 120 watts into 8-ohm load.
Dimensions: 18 in. W x 9 in. H x 22 in. D (46 cm x 23 cm x 56 cm).
Weight: 100 lbs. (45 kg) each.
Price: \$6,995 per pair.
Company Address: 1790 Brighton Rd., Oakville, Ont., Canada L6H 5T4.
205429-3434.
For literature, circle No. 93

RECEIVED AUGUST 1996



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THE ORIGINAL BIPOLAR LOUDSPEAKER™

EQUIPMENT PROFILE

D. B. KEELE, JR.

MIRAGE MBS-2 SATELLITES, BPSS-210 SUBWOOFER, AND LFX-2 CROSSOVER

Mirage speakers are made by Audio Products International (API), which also makes Energy and Sound Dynamics speakers. The company manufactures its own drivers, crossovers, cabinets, and electronics.

Mirage is best known for bipolar loudspeakers which have identical sets of front and rear drivers that radiate in phase over the whole audio band. (This is different from dipolar loudspeakers, whose front and rear outputs are in opposite phase to one another.) In the case of my knowledge, Mirage introduced the bipolar concept back in 1967 with the M41 loudspeaker. Currently, Mirage offers 26 speaker systems, both bipolar and front-radiating, at prices from \$200 to \$6,000 per pair. The line includes

BOTH THE MIRAGE MBS-2 SATELLITES AND BPSS-210 SUBWOOFER ARE BIPOLAR DESIGNS.

stereo, home theater, and in-wall speakers, as well as electronic crossovers.

Both the MBS-2 satellites and the BPSS-210's Mirage's top satellites are bipolar systems and are included in Mirage's high-end home theater line. As I said them, bipolar means that the two sets of drivers are in phase with the Mirage LFX-2 electronic crossover, at a two-channel subwoofer satellite speaker system.

The MBS-2 bipolar speakers have very compact, sealed enclosures, each holding two 3 1/2-inch woofers and two 1-inch tweeter cone drivers. One woofer and tweeter are mounted in a vertical line on the

front of the enclosure, while the other set of drivers is similarly arranged on the back, and the two sets are connected in phase. However, the tweeter on the front of the enclosure is above the woofer, whereas the tweeter is below its woofer. When the MBS-2s are used as main-channel or stereo speakers, their fronts should face the listening area, when they're used for surround

speakers, they should be placed high on the side wall and facing sideways in the listening area (that is, with the drivers facing to the front and back of the room). With the mounting hardware supplied with the MBS-2, but I did a little tinkering with the speakers on stands.

A wall-mounted speaker gets more low-frequency assistance from room boundaries than a stand-mounted speaker away from the walls does. So the MBS-2's internal crossover has different settings for stand and wall mounting. With the wall-mount

setting, the speaker's bass output is determined by about 60 Hz to 200 Hz and the high-frequency response is raised slightly above about 10 kHz. The setting is selected by jumpers in the connection-terminal cutout at the bottom of the cabinet. The crossover contains nine components (two resistors, two inductors, and five capacitors), forming a first-order low-pass filter on the woofer

and a second-order high-pass on the tweeter. To protect the speaker against high-level bass signals, one or two of the crossover's capacitors (depending on the configuration) are in series with the speaker. Identical grilles are supplied for front and rear. The grilles are supplied for front smooth, low-diffraction surfaces when the grilles are in place, and the MBS-2 should be used with both grilles on.

The BPSS-210 powered subwoofer's cup 10-inch drivers have very high excursion. One driver is mounted at each end of a relatively large sealed enclosure. Since they operate in phase, they move in opposite directions, so their overall effect, but does keep the cabinet from "wobbling" around the room when delivering high-amplitude signals. The enclosure is said to be extremely rigid and to incorporate a system to decouple low-frequency vibration from the floor. Grilles consist of the sides and front of the cabinet, even though there are no drivers on the front.

The BPSS-210's built-in amplifier delivers 250 watts and uses servo feedback (from an accelerometer mounted in the center of each voice coil) to linearize the driver's motion. Mirage says the servo system has a wide bandwidth of 0 to 300 Hz. It is equalized with pole-zero cancellation techniques that are said to reduce distortion by a factor of 250 (about 48 dB). The amplifier has feedback internal error correction and circuits to prevent signal overload and driver excursion. It is a current-source (voltage source) design, which means it has a relatively high output impedance. The subwoofer turns on automatically when presented with a signal at its single, gold-plated, banana-style input jack. The input jacks, power and "stand-by/operate" switches, as well as a large fused heat sink, are on the amplifier's back panel at the rear of the enclosure. The subwoofer amp has built-in bandpass filtering, using a fourth-order Butterworth high-pass filter that is 4 dB down at 18 Hz and a second-order low-pass filter that is 4 dB down at 100 Hz.

The LFX-2 24Vdc electronic crossover is a two-channel unit for use in a stereo setup with one subwoofer or a stereo pair of subs. It's also available. The LFX-2 is versatile, with controls for selecting crossover frequencies between 50 and 100 Hz (in four one-third-octave steps) as well as "slope" con-

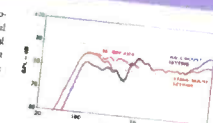


Fig. 1—On-axis frequency response of MBS-2 satellite.

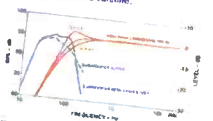


Fig. 2—Frequency responses of BPSS-210 subwoofer and LFX-2 crossover's high-pass filter.

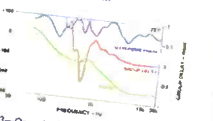


Fig. 3—On-axis phase response, group delay, and waveform phase of MBS-2.

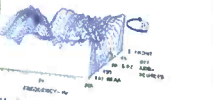
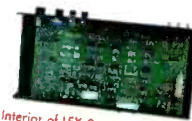


Fig. 4—Horizontal on-axis frequency response of MBS-2.



Interior of LFX-2 crossover.

SATELLITES
 Rated Frequency Response: 10 Hz to 20 kHz, ±3 dB
 Rated Sensitivity: 88 dB at 1 meter, 2.83 V rms applied
 Rated Impedance: 8 ohms, nominal
 Recommended Amplifier Power: 15 to 125 watts per channel
 Dimensions: 12 1/2 in. H x 7 1/2 in. W x 7 1/2 in. D (31.8 cm x 19.0 cm x 19.0 cm)
 Weight: 12 lbs. (5.5 kg) each
 Price: per pair; available in high-gloss black or white

SUBWOOFER
 Rated Frequency Response: 18 Hz to 100 Hz, ±3 dB
 Rated Input Sensitivity and Impedance: 50 mV, 47 kilohms
 Dimensions: 24 in. H x 18 in. W x 18 in. D (61 cm x 45.7 cm x 45.7 cm)
 Weight: 94 lbs. (42.7 kg) each
 Price: each; available in high-gloss black

ELECTRONIC CROSSOVER
 Crossover Frequencies: 50, 63, 80, and 100 Hz, switch selectable
 Filter Slopes: Low-pass, 24 dB/octave; High-pass, 12 dB/octave
 Rated Input Impedance: 100 kilohms
 Minimum Load Impedance: 10 kilohms
 Price:
 Company Address: c/o Audio Products International, 3641 McNicoll Ave., Scarborough, Ont., Canada M1X 1G5, (416) 521-1800
 For literature, circle No. 91

MIRAGE LOUDSPEAKERS MBS-2, BPSS-210, LFX-2 SEPTEMBER 1996

"Very wise choice," were D.B. Keele's closing words describing Mirage's MBS-2 satellite, BPSS-210 subwoofer and the LFX-2 crossover home theater system, in the September 1996 issue of *Audio*. In fact, those same words could be used to describe the entire line of Mirage products, the company that introduced the world to bipolar loudspeakers over a decade ago.



CIRCLE NO. 64 ON READER SERVICE CARD



to back using conventional techniques. The quadrasonic square array—of left and right, front and rear—created a more complex, but still antisocial, system (Fig. 2). The sweet spot now was constrained in the front-to-back direction as well as the left-to-right.

In addition, there was no center channel, a basic requirement if the stereo seat is to be eliminated. And placing the additional channels behind the listener is not the best arrangement for generating envelopment and a sense of spaciousness. Placement to the sides is better. Sounds arriving from the back are extremely rare in the standard repertoire of music, but the need for a credible spatial impression is common; sound from the sides is crucial to the generation of spatial impression. Ironically, the authors of a 1971 paper, "Subjective Assessment of Multichannel Reproduction" [6], demonstrated that listeners preferred surround speakers positioned to the sides over ones placed behind them, granting scores that were two to four times higher. It seems as though nobody with any influence read it.

Fortunately, much of the innovation that went into quadrasonics would live on in different forms.

Hollywood to the Rescue

Failure in one market was not enough to kill good ideas, and quad contributed two: multiple channels and adaptive matrixes. Dolby Laboratories was well connected to the real multichannel pioneers, the movie makers, in the application of its noise-reduction system to stereo optical soundtracks. Putting the pieces together, Dolby rearranged the quad channel configuration to one better suited to film use (Fig. 3): left, center, and right across the front, plus a single surround channel, which was used to drive numerous speakers arranged beside and behind the audience. All of this information was stored in two audio-bandwidth channels. With the appropriate adjustments to the encode matrix and to the steering algorithm in the active decoding matrix, Dolby devised the system that has become so familiar in quality films and theaters: Dolby Stereo, or, as it is known in home media, Dolby Surround.

Although they were not explicitly stated, this system was subject to some basic rules

Fig. 3—Dolby Stereo made multichannel sound a social experience. A center channel anchors dialog and eliminates the sweet spot, while the surround channels envelop the audience in music and sound effects.

Ultimately, there is no substitute for entirely separated channels. But getting four discrete channels into the grooves of a vinyl LP required that the recorded bandwidth be extended to about 50 kHz, which was quite a challenge. Nevertheless, it was accomplished in JVC's CD-4 system, and although this quadrasonic format did not survive, the technology necessary to achieve the wider bandwidth did have a lasting benefit on the quality of conventional two-channel LPs. Half-speed cutting processes, better pressings, and playback cartridges with wider bandwidth and reduced tracing and tracking distortions were to live on. Discrete multichannel tape recordings were available, but open-reel tape was a nuisance, to say the least, and high-quality packaged tape formats (such as cassettes) were not yet ready for high-fidelity multichannel sound.

Years passed, with the audio manufacturers unable to agree on a single standard.

The history of stereo is littered with examples of efforts to generate a more engaging sense of envelopment and depth.

Eventually, the whole thing dissolved into competitive squabbles. The industry lost a lot of money and credibility, and customers were justifiably disconcerted.

Although the failure of quadrasonics was regrettable, it has to be said that the system was not well founded psychoacoustically. Lacking an underlying encode/decode rationale, quad simply compounded the problems of two-channel stereo. There were even naive notions of panning images front

that have set a standard for multichannel sound: well-placed dialog in the center of the screen, music and sound effects across the front and in the surround channel. Reverberation and other ambient sounds are steered into the surround channel, as are sounds of aircraft passing overhead and the like. At times the audience can be enveloped in sound (as at a football game), or it can be transported to a giant reverberant cave or gymnasium, or it can be inside the confines of a car engaged in a dramatic chase, or it can be treated to an intimately whispered conversation between lovers, where the impression is that of being embarrassingly close. To fully realize such a range of spatial environments requires a flexible multichannel system, controlled-directivity speakers, and a degree of control over the acoustics of the playback environment. When it is done well, it may not be perfect, but it is remarkably entertaining—and it is not antisocial! The basic format of a front soundstage with enveloping ambience is also the basis for most of our real-life musical experiences, so audiences were immediately comfortable.

It is significant that the characteristics of the encoding and decoding matrixes and the spectral, directional, and temporal properties of the speakers and room (the theater, in this case) all are integral to the functioning of these systems. Fortunately, the film industry acknowledges the need for standardization and so from the outset tried to ensure that sound dubbing stages, where film soundtracks are assembled, would resemble theaters, where audiences are to enjoy the results. Although the industry standards provided a foundation, there were still inconsistencies. This left a need, and an opportunity, for Lucasfilm to establish its THX program to certify the audio performance of movie theaters, so that audiences would have an even greater assurance of quality.

Multichannel Sound—Third Try

With the popularity of watching movies at home on TV, it wasn't long before Dolby Surround made its way there. Adapting it to

the smaller environment required some changes, but nothing very radical (Fig. 4). Reducing the number of surround speakers to two ensured greater consumer acceptance, and recommending placement of these speakers to the sides of the listeners ensured that they would be most effective in creating the required illusions of space and envelopment. Delaying the sound to the surround speakers brought the precedence effect to bear to ensure that, even in a small room, the ambiguously localized sur-

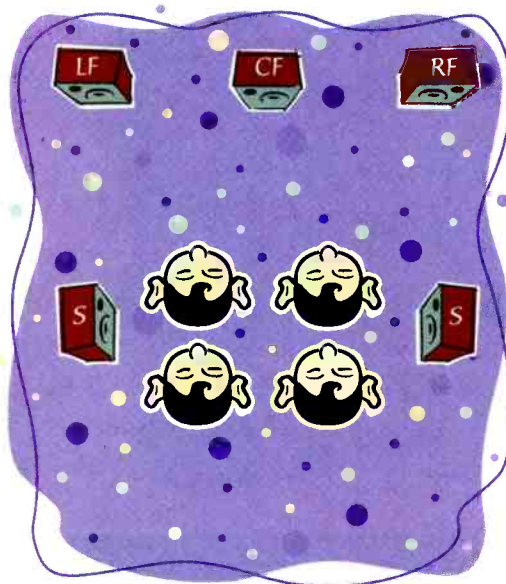


Fig. 4—Dolby Surround in the home reduced the number of surround speakers to two, ensuring consumer acceptance, and called for placement to the sides of the listener, creating a proper illusion of space and envelopment.

round sounds would be perceptually separated from those in the front channels.

At the outset, a simple fixed-matrix version of the decoding system was available in entry-level consumer systems. The fixed-matrix systems exhibited so much crosstalk among the channels (separation was as little as 3 dB) that listeners were surrounded by sound most of the time, even when it was inappropriate.

Fosgate and Shure HTS brought the first active-matrix decoders to the home theater market, albeit at premium prices. Low-cost integrated-circuit chips eventually brought active-matrix Dolby Pro Logic decoding to the masses, and home entertainment entered a new era. Admittedly, it was audio for movies, but it was multichannel audio nev-

ertheless, and many of us began to appreciate some of the dimensions that were missing from our directionally and spatially deprived two-channel stereo lives.

Dolby Surround was designed for movie soundtracks reproduced in large theaters, and in that role it performs very well indeed. However, once audiophiles get a taste of something attractive, they want more. In this case, the “more” they wanted was realistic multichannel music reproduction in their homes.

Playing conventional stereo recordings through a Dolby Pro Logic decoder was a logical experiment, and most of us have done it. The results are spotty: Some recordings work well, and others don't. A basic problem is that material mixed without a center channel in mind, when played through a conventional matrix decoder, yields center-channel signals that are perceived to be louder than they should be. The problem lies in the translation from large movie theaters to listening at shorter distances in smaller rooms. The high-frequency rolloff in the surround channel is also noticeable, and the active-matrix steering is sometimes caught messing with the music. Recordings made specifically for Dolby Surround are better, but even they have failed to establish a large following in the music recording industry. None of this is surprising, but all of it means that we have not yet arrived at a general-purpose multichannel solution.

THX Embellishments

In a natural succession to its THX program for certifying movie theater sound systems, Lucasfilm established a licensing scheme for certain features intended to enhance, or in certain ways ensure, the performance of home theater systems based on Dolby Pro Logic decoders. Home THX, as it is called, added features to a basic Pro Logic processor and to the speakers used in home theater systems, and it set some minimum performance standards for the electronics and speakers. At a time when the market was being inundated with “cheap and cheerful” add-on center-channel and surround speakers and amplifiers, THX made a clear statement that that would not do; all channels had to meet the same standard.

CARVER

AUDIO

THE EQUIPMENT AUTHORITY
 SEPTEMBER 1996

INSIDE THE STUDIO

HOW HIT RECORDS ARE MADE

TESTED

POWER STEERING 5-CHANNEL AMP FROM CARVER

SONANCE MUSIC & MOVIES SUBWOOFER

ALSO TESTED

Polk SRT System, Mirage Speakers, Meridian AC-3 Surround Processor



US \$395
 UK £229
 CAN \$495

CARVER AV-705X FIVE CHANNEL AMPLIFIER

SEPTEMBER 1996

In his 1996 review of our AV-705 5-channel amplifier, *Audio's* Edward J. Foster noted that "the benefits of Power Steering in a home theater product are so obvious, it's surprising the idea didn't surface sooner. But it always takes someone to be first, and the Carver people seem to have a knack for not missing the forest for the trees . . . I expect it comes from living in the Northwest woods; all that fresh air must encourage Carver engineers to take a fresh look at problems." Actually, it's that *and* the coffee here in Seattle that have helped make Carver the horsepower of choice for fine audio systems for nearly two decades.

EQUIPMENT PROFILE
 EDWARD J. FOSTER

CARVER AV-705X FIVE-CHANNEL AMPLIFIER



Mild power never shoves power away—by which I mean those of the 100 watt per channel all—come increase in its five-channel format, and for a simple reason: Most people who buy a receiver these days expect the powered service on their system for a week or so. It's not that they want to drive it. If you want more than 100 watts per channel in a single channel, you can be a pro. It's pretty difficult to shove for 200 watts of power into a box that isn't too hot. Carver's AV-705X is a five-channel amplifier that does it. Leave it to Carver Corporation.

In some ways, it's a neat trick. The AV-705X is a five-channel amplifier that does it. Leave it to Carver Corporation.

Therefore, most channel power shoves away with some channels. In the dynamic system, it's possible to have a signal that both channels will be required to deliver equal power simultaneously. For example, the relative power demands of the various channels in a Dolby Pro Logic system are very unlikely to be the same at any given time, in part because the decoder separates the signal into channels with predominant energy and sends a substantial portion of the signal to the other channels. But the two channels never simultaneously.

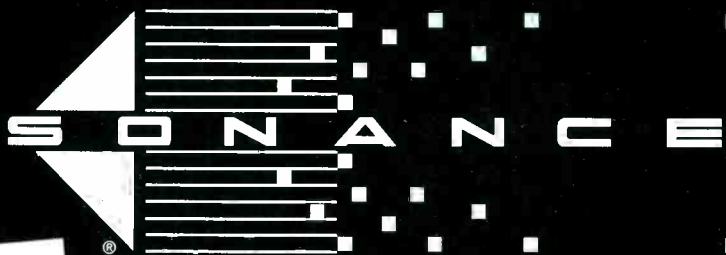
Power Steering takes advantage of this fact by adapting to signal conditions in effect, diverting power from channels that don't need it to the channel or channels that do. It's not that the latter no longer substantially all five channels drive equally. In other words, the AV-705X doesn't have a knob for rate the only knob (it's a knob) to decrease 125 watts per channel to 100 watts per channel. The power supply and output stage are actually designed to deliver 200 watts into a single channel. It's kind of neat, isn't it? Dynamic because it's not static. Dynamic because it's not static. It's not that the AV-705X will deliver up to 200 watts into any one channel all day and all night if you wish it to.

POWER STEERING DIVERTS POWER FROM CHANNELS THAT DON'T NEED IT AT THE MOMENT TO ONES THAT DO.

Rated Power Output into 8 Ohms, 20 Hz to 20 kHz, with 0.05% THD: Stereo mode, 100 watts/channel; five-channel mode, 125 watts/channel. Dimensions, with Handles and Feet: 50 1/2" H x 19 1/2" W x 13 1/4" D (14.6 cm x 49.3 cm x 33.5 cm). Weight: 42 lbs. (19.1 kg). Price: \$1,199. Company: Address: P.O. Box 1237, Lynnwood, Wash. 98046-1237. 206/775-1202. <http://www.carver.com>. See literature, circle No. 93.

AUDIO/SEPTEMBER 1996





EQUIPMENT PROFILE
EDWARD M. LONG
**SONANCE DL1200
POWERED
SUBWOOFER**



The Sonance DL1200 Dual Level powered subwoofer gets its name from its ability to switch between two output levels—a subcutant, but not an over-powerful or bassy level for most basic listening, and a more thunderous bass level for black-box movies. The two levels are independently set by a pair of level controls, which share a central



The rear panel holds the usual jacks and heat sink, plus the unique DualLevel controls and terminals.

AUDIO/SEPTEMBER 1996

which provides acoustical loading for the passive radiator and allows a path for the lower frequencies. The passive radiator is similar to the 12-inch driver, but without a spider and voice coil; it consists of a thick paper cone with a rubber surround, built on a metal baffle within the frame. The frame enables the passive radiator to be replaced easily, if that ever necessary (manufacturers that save money by omitting the metal frame and attaching the surround directly to the enclosure make replacement very difficult).

The DL1200 enclosure is finished in black, wood-grain vinyl with a removable black cloth grille. The internal power amp is rated at 200 watts maximum output, but since it draws only 18 watts of AC power when there's no signal input, it can be left on continuously. There is a moderately loud pop when the amplifier is switched on or off. As Sonance suggests that you plug the DL1200 into an unswitched output on your receiver or directly to an AC outlet, the DL1200's amplifier is mounted directly to the large metal plate on the rear of the case and has its own internal enclosure to separate it from the air-tight main enclosure. Post-type loudspeaker input terminals on the plate accept speaker-level signals from your amplifier or receiver and feed them to the DL1200 amplifier. This pass-through is also sent through first-order

Rated Frequency Response: 25 to 140 Hz, -5 dB
Crossover: Low-pass, 40 to 150 Hz, 9 dB variable; high-pass, 125 Hz at 6 dB
Infrared Filter: 20 Hz, 18 dB/octave
Power Capability: 18 watts at idle
Dimensions: 21 in. H x 20 in. W x 20 in. D (53.3 cm x 50.8 cm x 50.8 cm)
Weight: 40 lbs. (17.7 kg)
Price: \$999
Company: Sonance, 961 Calle Negocio, San Clemente, Cal. 92673; (800) 582-7777.
For literature: circle No. 92

I GOT EXCELLENT SOUND AND A VERY SMOOTH CROSSOVER WHEN I USED THE DL1200S WITH SMALL SATELLITES.

...while the filter's adjustable high-frequency rolloff approaches the specified 18 dB per octave rate at the lower settings and is steeper for the 150-Hz setting. The 9-dB setting is the best when using the DL1200 with loudspeakers that operate should work well with small satellites that operate down to about 100 Hz. The DL1200's output is down only a bit at 18 Hz, which is very good.

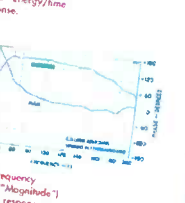
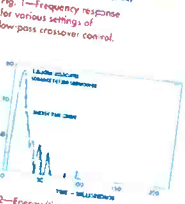
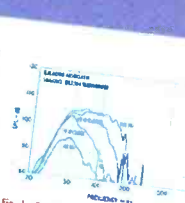
Figure 2 is the energy-time response of the DL1200 with its low-pass filter set at 150 Hz; the test signal's energy is in the normal signal delay caused by the minimum 1-meter distance from the speaker gives a signal delay of 7 to 8 microseconds for

etc. without distortion. If you don't need this high-pass feature, you can use either the speaker-level inputs or a pair of gold-plated phono input jacks that accept the subwoofer output from a preamplifier or the surround processor. When the line inputs are used, no signal will be present at the DL1200's speaker output terminals. The DL1200 amplifier has a soft limiter circuit that increases the subwoofer's dynamic range for maintaining steady levels when driven to sustained high levels. The owner's manual is very good; it includes diagrams, specifications, and all the information you need to connect the subwoofer to a variety of audio/video systems. Sonance also provides a full-free phone number in case you run into difficulties.

Measurements
Figure 1 shows the output of the Sonance DL1200 subwoofer for different settings of its low-pass filter (shown). The sub's natural roll-off rate of about 24 dB per octave, characteristic of a half-reflex or passive radiator

system, while the filter's adjustable high-frequency rolloff approaches the specified 18 dB per octave rate at the lower settings and is steeper for the 150-Hz setting. The 9-dB setting is the best when using the DL1200 with loudspeakers that operate should work well with small satellites that operate down to about 100 Hz. The DL1200's output is down only a bit at 18 Hz, which is very good.

Figure 2 is the energy-time response of the DL1200 with its low-pass filter set at 150 Hz; the test signal's energy is in the normal signal delay caused by the minimum 1-meter distance from the speaker gives a signal delay of 7 to 8 microseconds for



**SONANCE DL1200
POWERED SUBWOOFER**

SEPTEMBER 1996

Sonance is the pioneer and leader in "Architectural Audio," with the world's most complete line of high-fidelity in-wall speakers. Their new line of powered subwoofers set new standards in their class. In September 1996, *Audio* published a review of the DL1200. Edward M. Long concluded, "It is well engineered, well built, and offers excellent value." Today there are three DualLevel subwoofers in Sonance's mix of high quality products that go beyond your musical expectations.



CIRCLE NO. 106 ON READER SERVICE CARD

Tomlinson Holman deserves credit for assembling this amalgam of existing and novel features into what has become a benchmark for consumer home theater.

The Home THX features relevant to this discussion are:

1. High- and low-pass filters to approximate a proper crossover between a subwoofer and satellite speakers. (Elaborate systems did this anyway, but the THX crossover brought an important feature to the mass market.)

2. Electronic decorrelation between the left and right surround channels. Reducing the number of surround speakers to two and putting them in a small room eliminates much of the acoustical decorrelation (randomization of the sounds arriving at the listeners' left and right ears) that the many speakers at the sides and rear of a large movie theater accomplish automatically. Substituting electronic decorrelation is a good idea that was, to my knowledge, first introduced in the Shure HTS systems.

3. Timbre-matching of the surround channel to the left, center, and right (front) channels. In my view, this is a dubious feature. Sounds arriving from the sides, or even from random incidences, cannot and should not match the timbre of sounds arriving from the front. It is not natural—the complex shape of the external ears ensures that. However, it is a relatively minor matter in the larger scheme.

4. Re-equalization of the soundtrack to adjust for excessive treble that is usually built into film soundtracks to achieve correct tonal balance in large theaters. A single correction curve was chosen. This is a useful feature, but it should be an adjustable tone control because soundtracks vary in treble balance.

5. The Home THX loudspeaker standard requires some control of the vertical dispersion from the left, center, and right (front) units and a bidirectional out-of-phase configuration (an approximation of a dipole) for the surrounds. The purpose of the former is to reduce the strength of floor- and ceiling-reflected sounds, and the purpose of the latter is to increase the proportion of reflected sound that is generated by the two

surround speakers, thereby compensating somewhat for the fact that there are only two of them. Both of these are good ideas, but some of the implementations have created a belief that somehow they are incompatible with the objectives of good music reproduction. While there have been some less than worthy examples of home theater speakers, one can easily say the same about conventional "music" speakers. In principle, there should be no reason to differentiate between them. Good design is good design.

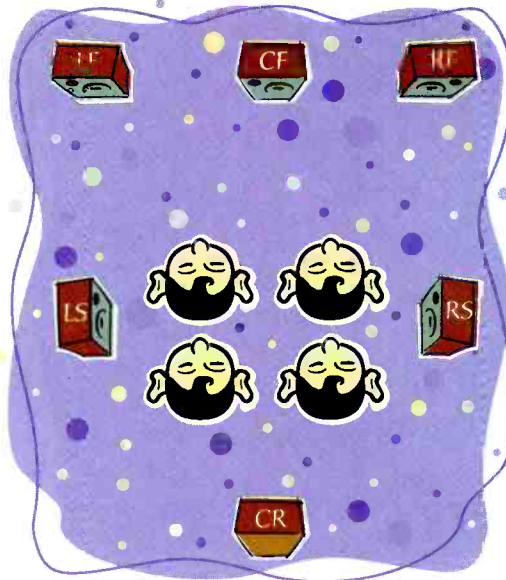


Fig. 5—Jim Fosgate's novel 6-Axis approach to Dolby Surround decoding adds left/right distinction to the surround channels and provides for an optional sixth channel behind the listeners.

**With Dolby Surround,
many of us began
to appreciate some of
the dimensions that
were missing from our
spatially deprived,
two-channel lives.**

Matrix Mania

Recognizing an opportunity to improve on a good thing, inventors have had a field day manipulating the parameters of the standard surround matrixes, with delays and with steering algorithms, all in an attempt to finesse the multichannel decoders

to be more impressive when playing movies, more compatible with stereo music, or both. In addition to varying the five-channel, five-speaker theme, the more adventurous designers have augmented the surround system with additional speakers behind the listeners. Most provide for full-bandwidth surround or rear channels. Purists frown on such meddling, especially for film soundtracks, but lots of people, me included, find rewards in the artistry of several of the alternatives.

There have been many of these matrix-system variations. Some are decode-only, relying on Dolby Surround and regular stereo-encoded material for source material. Others are encode/decode systems that have some degree of compatibility with existing systems. All provide multichannel playback of two-channel program material that at least some listeners find attractive at least some of the time. In addition to stand-alone products like Circle Surround, there are proprietary algorithms built into surround processors from numerous companies, such as Proceed and Meridian.

The two systems described below are both long-term survivors and distinguish themselves by having evolved to the point that they include optional features and channels. And they are approaches I am particularly familiar with from my work with the companies at Harman where they were developed.

A veteran of the quadraphonic wars, Jim Fosgate found ways to decode Dolby Surround soundtracks in a manner that many people found preferable to more conventional means (Fig. 5). Part of the improvement had to do with the responsiveness of the steering logic, and part of it had to do with providing some amount of left and right distinction in the full-bandwidth surround channel. Since there is no such left/right separation in the encoded program, the art has been to judge how much, and when, left and right *front* information should be directed to the surrounds, with what spectral modifications (if any), and with what delay.

Fosgate practiced his art well and over the years has produced several positively re-

ceived designs optimized for films and for different kinds of music, all in the analog domain. An interesting feature was the provision for separately powering the forward- and rear-firing drivers of the surround “dipoles” to generate more directional and spatial enrichment. His designs can be found in products bearing his own name as well as the Harman Kardon and now Citation brands. Fosgate’s latest effort is called 6-Axis, because in addition to the basic five steered channels, it provides for an optional sixth, behind the listener, to complete the surround effect.

Working independently, and in the digital domain, David Griesinger has done similar things to move beyond the basic Pro Logic process. He is probably best known in professional audio, as the author of the reverberation algorithms used in the Lexicon products found in most recording studios. Griesinger is driven by an intense interest in the physics and psychoacoustics of concert hall acoustics and has been a significant contributor to that area of science, so it is no surprise that his efforts in surround sound decoding and multichannel synthesis are based on his years of studying, synthesizing, and electronically enhancing the acoustics of concert halls. Accentuating the desirable aspects of complex multidimensional sound fields while avoiding undesirable artifacts is the essence of both endeavors.

The result is a suite of film- and music-playback algorithms embodied in Lexicon digital surround processors. Griesinger’s current effort is called Logic-7, since it provides for two additional channels and speakers behind the listener (Fig. 6). Using a sophisticated detection and steering process, these extra channels and rear speakers are supplied with strongly uncorrelated sounds—such as reverberation, applause, and crowd sounds—or with sounds that are strongly directed to move from front to surround or vice versa. Thus, the listeners (yes, these are still very much social systems) are treated to a truly enveloping sense of ambience and to occasional sounds that sweep dramatically forward or backward, even with appropriate left or

**Ironically, it was
the film industry,
not the audio industry,
that fueled
the success
of multichannel sound
in the home.**

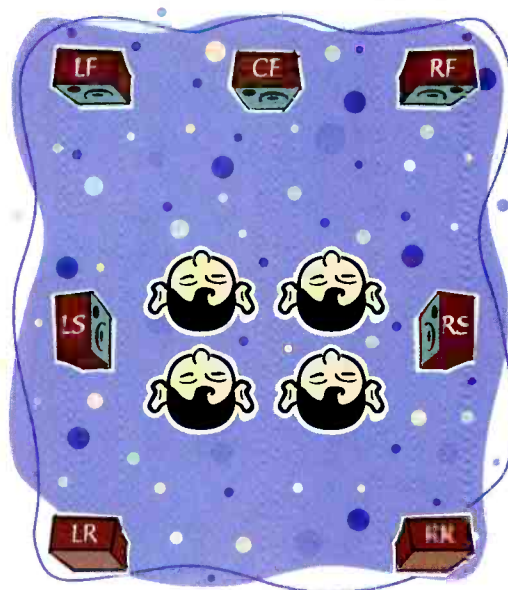


Fig. 6—In his Logic-7 implementation of Dolby Surround, David Griesinger of Lexicon adds two extra rear channels that are supplied with uncorrelated sounds or sounds that are steered to provide better front-to-back or back-to-front movement.

right biases. An important focus in the continuing development of Logic-7 is the quest for compatibility in multichannel reproduction of film soundtracks and music as well as between two-channel and multichannel reproduction of stereo music mixed for two channels.

Digital Discrete

The few samples of discrete multichannel recordings from the quadrasonic era were sufficient to generate a lasting desire, if not an outright lust, to develop a viable format that did not suffer from leakage, or crosstalk, among the channels. Today we are experiencing a version of that dream in the form of Dolby Digital, also referred to as AC-3. This system was designed for sound-

tracks and is widely used in that capacity for motion pictures. A consumer version is now available on laserdiscs and DVD, and other carriers, including HDTV, will follow. Following the basic geometry of the existing multichannel system, Dolby Digital (Fig. 7) incorporates five main channels, including separate left and right surround channels. All channels are completely discrete and full-bandwidth, offering multichannel producers enormous flexibility. A sixth channel is used for occasional, very powerful low-frequency sound effects and is inherently bandwidth-limited. Thus we end up with the 5.1-channel appellation. In home systems, the LFE (low-frequency effects) channel normally is blended with low frequencies from the five main channels and routed to a subwoofer that handles all the deep bass.

In Europe, the MPEG-2 audio standard provides for multichannel audio that can be either five or seven channels. In the seven-channel mode, the additional channels are interpolated between the center and left and center and right front channels. It is difficult to imagine this configuration becoming popular for home applications, however. A better use of the bandwidth might have been to add some truly rear channels, as in some of the aforementioned enhanced matrix schemes. In any event, MPEG-encoded **surround** will be the standard for future DVD releases in Europe, with Dolby Digital an option.

Digital Theater Systems’ DTS and Sony’s SDDS systems have established presences in the professional domain, as the multichannel formats for numerous feature films. On the consumer side, DTS-encoded soundtracks are available on some laserdiscs and may be included on some DVD releases as a supplement to the standard Dolby Digital soundtrack. DTS has also been promoting its system for music, with a small but growing catalog of multichannel CD releases.

All of these discrete systems are really transparent transport media; none of them incorporates or is based on an underlying method for encoding and decoding spatial information. All of the matrix systems discussed up to now put serious constraints on the creative process and, indeed, were a part

EQUIPMENT PROFILE
DANIEL KUMIN

LEXICON 412 FOUR-CHANNEL AMPLIFIER



in a sheet-metal, 30-ply 1/2-inch-thick metal front panel sculpted. The front panel presents not a polished, too-power-soft and four-center-located 135dB-per-channel THX THX-1135, but the overall appearance of a solid, well-built, and well-engineered piece of equipment. The overall appearance of the Lexicon 412 is that of a well-engineered piece of equipment. The overall appearance of the Lexicon 412 is that of a well-engineered piece of equipment.

The Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output. Each channel has two high-level inputs and two low-level inputs. Each channel is equipped with a clip-on, spring-back cover for protection. The Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output. Each channel has two high-level inputs and two low-level inputs. Each channel is equipped with a clip-on, spring-back cover for protection.

Since the Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output, it is a well-engineered piece of equipment. The Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output. Each channel has two high-level inputs and two low-level inputs. Each channel is equipped with a clip-on, spring-back cover for protection.

For a review of the Lexicon 412, see the Lexicon 412 review in the December 1996 issue of *Audio* magazine. The Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output. Each channel has two high-level inputs and two low-level inputs. Each channel is equipped with a clip-on, spring-back cover for protection.

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Rated Power: 100W x 4 channels, 120W x 2 channels, 200W x 1 channel. THX THX-1135. Dimensions: 17 1/2" x 17 1/2" x 1 1/2". Weight: 11 lbs. Price: \$2,995. Lexicon Audio, 3 Oak Park Drive, Bedford, MA 01530. Phone: (617) 280-0300. Fax: (617) 280-0490. Website: www.lexicon.com.

Lexicon Audio, 3 Oak Park Drive, Bedford, MA 01530. Phone: (617) 280-0300. Fax: (617) 280-0490. Website: www.lexicon.com. The Lexicon 412 is a four-channel amplifier with four channels of 100-watt-per-channel output. Each channel has two high-level inputs and two low-level inputs. Each channel is equipped with a clip-on, spring-back cover for protection.

ADVERTISED IN AUDIO 1996
70

Lexicon

LEXICON 412 FOUR CHANNEL POWER AMPLIFIER

DECEMBER 1996

"The Lexicon 412's performance can be summed up quickly and easily: plays loud, sounds clean, stays quiet." Sounds like a perfect set of parameters to judge any amp by! The 412's "outstanding performance and truly professional build quality" are shared with the rest of the NT series amplifiers, which feature THX® and safety certifications, are available in variety of input and output configurations. Here's a recipe for amplifier sonic nirvana "the 412 power amplifier performed impressively, like the proverbial straight wire with gain—but in this case, four of them!"



CIRCLE NO. 88 ON READER SERVICE CARD

Boston Acoustics

**BOSTON ACOUSTICS
VR2000
SUBWOOFER**
JANUARY 1997

One of the most admired speaker companies in the world, Boston Acoustics, provided Audio's D.B. Keele Jr. their VR2000 300-watt 12-inch subwoofer. Reviewed in January 1997, "[The Boston VR2000] . . . is one of the highest-performing subwoofers I have reviewed and, at \$1,200, is a very good value." Ready for AC-3® and THX® certified, the VR2000 is just one of the many fine home and car stereo speakers Boston Acoustics manufactures.

EQUIPMENT PROFILE
D. B. KEELE, JR.

BOSTON ACOUSTICS VR2000 POWERED SUBWOOFER



Have THX and most Dolby Digital systems should be connected to the VR2000's fixed-level input jack, which bypasses the subwoofer's controls. Mono and Stereo Two Laps systems may be connected to the jack on the variable left and right level handling ports (which accept up to accept double banana plugs). When its variable inputs are used, the VR2000's volume control and crossover-frequency control (adjustable from 40 to 100 Hz) are active.

The publicly-revealed and power switches are active for all inputs. The factory matches the VR2000's polarity to that of most systems' other speakers. The latter includes a "bass" position that turns the subwoofer on when there's a signal and turns it off if there has been none for 10 or 15 minutes.

The VR2000's cabinet is made from 18-gauge, medium-density fiberboard and has extensive internal bracing to minimize vibration. An additional large center brace contacts the rear of the 12-inch driver through rubber bumpers. It solidly connects the woofer to the cabinet's rear, which secures the bracing of the front and rear panels. The woofer's stamped frame holds a large ceramic magnet 19 inches in diameter and 1/2 inch thick; an additional field flux ring (19 inches in diameter and 1/2 inch thick) is attached to its rear. The resultant assembly is magnetically shielded for operation near TVs or computer displays. The rear panel also contains two large port tubes, 3 inches in diameter and 15 inches long, which are flared on both ends to minimize noise from air turbulence.

The power amplifier's components are on a 4 x 4-inch printed-circuit board mounted to the back of the heat sink. The

heat sink, as well as a fan up the cabinet, through overcast vents to cool it.

In its five-line protected processing (1 kHz) Two Laps system and several modes of operation on the VR are among 15 two-band speaker. The VR2000's driver is a 12-inch (1200 Hz) with frame the driver's edge of the frame, but allowing it to go in by. The driver is like being on a cabinet of brackets, provided by four more than 30 screws plus a separate



**ON TERMINATOR 2
THE VR2000 DELIVERED
CLEAN, LOUD,
GUT-THUMPING BASS.**

Self are such. The VR2000 has a wide range of control and on-terminator mode. The VR2000 has a wide range of control and on-terminator mode. The VR2000 has a wide range of control and on-terminator mode.

On the other hand, limited print run. The Boston VR2000 is a more and higher level. The Boston VR2000 is a more and higher level. The Boston VR2000 is a more and higher level.

As on the back-panel of pink noise, the VR2000's 20 and 25 Hz output was initial off and distorted.

The VR2000's 20 and 25 Hz output was initial off and distorted. The VR2000's 20 and 25 Hz output was initial off and distorted.

charges by 6-11 dB from here to burst. When the VR2000 played this same signal at high levels, its built-in limiter made all the VR2000's behavior, perceived the VR2000's behavior, perceived the VR2000's behavior.

Boston Acoustics' loudspeakers featuring Audio's Award-Winning Terminator 2 (October 1996) follow up well over 100 pages. The listing compares more than 40 models, including in-wall, ceiling, and multiple-speaker systems. The VR2000 is Boston Acoustics' most powerful subwoofer. It contains a built-in 300-watt amplifier driving a large 12-inch woofer mounted in a large, heavy-duty cabinet. The VR2000 is a 12-inch subwoofer with a 300-watt amplifier and controls for THX.

BOSTON ACOUSTICS' VR2000 SUBWOOFER MEETS THE STRINGENT REQUIREMENTS FOR HOME THX.

The speaker panel's controls and components enable the VR2000 to be used in stereo or home theater setups, including those with Dolby Digital (AC-3) decoders. A THX logo indicates that this subwoofer meets Acoustics' stringent specifications for bandwidth, acoustic output, and distortion and that it is the required subwoofer for THX.

<p>Rated Frequency Response: 20 to 100 Hz, 85 dB</p> <p>Impedance: Low-pass, 3 dB point variable from 40 to 100 Hz, 24 dB/octave roll-off; low-level high-pass, 3 dB at 100 Hz, 12 dB/octave roll-off</p> <p>Dimensions: 18 in. x 11 in. x 14 in. (W x H x D) (includes 15.7 in. x 5.5 in. x 15.7 in. port tubes)</p> <p>Weight: 55 lbs. (25.5 kg) each</p> <p>Model: S1200 each</p> <p>Company Address: 300 Jubilee Dr., Peabody, Mass. 01960-5887/530-5000. (See literature, circle 10-99)</p>

AL 1997/JANUARY 1997



of that process. Discrete systems have no such limitations. In fact, recording engineers have had to learn new techniques, and need new production tools, to re-create some of the illusions with which we have become familiar in the matrix systems. In short, we have entered a new realm of multichannel entertainment, wherein what we hear will be almost entirely the result of individual creative artistry in the recording process and its interaction with the particulars of the playback systems. And since there are no standards whatsoever, we can expect considerable variety in the results, including some examples of extremely bad taste. Be prepared.

As multichannel transport media, however, these systems are potentially wonderful. They can store audio data encoded in forms designed to entertain large audiences (such as conventional film soundtracks) or audio data intended to reconstruct a three-dimensional sound field (such as the elaborate forms of Ambisonics) or for formats yet to be invented. They represent a freedom that we have never had before.

All of these systems are scalable—that is, they can be designed to fit into different channel or storage capacities. There are two ways to achieve this, and both are used.

Lossless data compression makes use of redundancy and signal variability to fit information into less storage space and then recover it, perfectly, during playback. Perceptual encoding, on the other hand, achieves data reduction by taking advantage of both simultaneous and temporal masking in our hearing systems. It is well known that loud sounds prevent us from hearing weaker sounds. If we know the rules governing this phenomenon, we can simply eliminate—or at least encode more simply—those small sounds that are normally masked. Either way, we can attempt to store the same *perceived* sound in less space. The more aggressive the data reduction, the more likely that listeners will be aware that the signal has been modified—that something has been edited out.

High-end paranoia would have it that perceptual coding is intrinsically flawed. But having participated in comparative listening tests of Dolby Digital, DTS, and

MPEG-2, I can state categorically that among those systems, at least, the differences are not obvious. Even in the fairly aggressively data-reduced material I've heard, audible effects were quite infrequent and limited to certain kinds of sounds only. And the effects were not always describable as better or worse; sometimes they could be identified only as different. Naturally, it is possible to go too far, and in the most extreme examples of data reduction, things start sounding pretty bad. Needless to say,

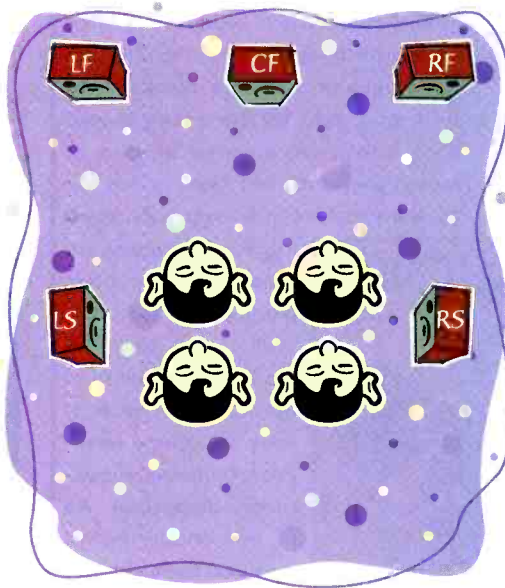


Fig. 7—Dolby Digital (AC-3) uses five discrete full-bandwidth channels, including separate stereo surround channels, and a sixth low-frequency effects channel, usually handled by a subwoofer.

**It is entirely feasible
to have the player
read a code at
the head of a program
and configure itself
to perform
the correct decoding.**

there is no reason to encumber our audio futures with systems that are annoying to listen to. However, I was frankly amazed at just how durable our auditory processes are and concluded that perceptual coding, *if applied in moderation*, is not a fatal flaw—in fact, it may not be detected at all.

In retrospect, perhaps one should not be totally surprised by this. After all, we have lived for many years with vinyl LP records that performed “data expansion,” adding information to the music in the form of crosstalk, noise, and distortions of every imaginable kind. It is mainly because of those very same masking phenomena exploited in data reduction that those distortions were perceptually attenuated and we were able to derive a great deal of pleasure from our LP records.

Fortunately, in the digital domain, all things tend to become possible at lower prices and higher speeds. With the end of this trend not yet in sight, it may be that the need for data reduction in critical applications will simply disappear eventually.

Too Much of a Good Thing?

Those of us who remember the quadraphonics debacle get a little queasy when we see what is going on presently. Could this wonderful progression to digital, discrete multichannel sound be stalled or stymied by a lack of agreement? Possibly, is one answer. No, is the one I prefer to believe. The reason is that now we are operating in the digital domain, and things are fundamentally different.

Personal computers have become general-purpose platforms on which we can run many programs: word processors, games, and so on. The day is fast coming when audio playback devices can have that kind of flexibility. It is entirely feasible to have the playback device read a code at the head of a program and configure itself to do the appropriate kind of decoding. We are not there yet, but the technology is available, and many of us believe that is the way things can, and should, go.

Digital, discrete multichannel storage capability should not carry with it any restriction as to the kind of signals that are stored. In a two-channel matrix system, that was not the case; the encoding was part of the storage process. Now it should be possible to envisage a six- or (pick any number) channel system that could store three two-channel programs (stereo, binaural, or Dolby Surround, for example), or a four-chan-

THE AMBISONICS ALTERNATIVE

There are two parts to the Ambisonics premise. The first is that, with the appropriate design of microphone, it would be possible to capture (record) the three-dimensional sound field existing at a point. The second part is that, with the appropriate electronic processing, it should be possible to reconstruct a facsimile of that sound field at a specified point within a square or circular arrangement of four or more speakers. Therefore, this system distinguishes itself from all others in that it is based on a specific encode/decode rationale.

Several names are associated with the technology. Duane Cooper first patented the basic idea for this form of surround sound [7]. Patents were also granted to Peter Fellgett and Michael Gerzon, who were working simultaneously and independently in England. Peter Craven contributed to the microphone design, and aided by some government sponsorship, the United Kingdom group commercialized the Ambisonics recording and reproduction system [8, 9].

Ambisonics is an enticing idea, and the spatial algebra tells us that it should work. And it does, up to a point. Ambisonics has enthusiastic supporters, but it remains a niche player in surround sound. Most people know little or nothing about it, although there are some Ambisonics-encoded recordings [9].

The scarcity of playback decoders is a clear problem. However, there are other considerations that may be significant. Ambisonics requires special recordings and playback ap-

paratus. It is incompatible with other multichannel systems (although it need not be). And it ends up entertaining a single listener. Mind you, that listener can be well entertained.

I have heard the system several times in different places (including a precise setup in an anechoic chamber), and I will admit that with large, spacious classical works it creates an attractively enveloping illusion for a listener with the discipline to find and stay in the small sweet spot. It tolerates a certain amount of moving around, but leaning too far forward results in a front bias, lean-



Audio's July 1972 cover photo illustrates the antisocial nature of quadrasonic sound: It could be enjoyed by only one person.

ing too far backward creates a rear bias, leaning too far left—well, you get the idea. Big, spacious reverberant recordings are more tolerant of listener movement, of course. All of this should be no surprise for a system in which the mathematical solution applies only at a point in space, and then only if the setup is absolutely precise in its geometry and the speakers are closely

matched in both their amplitude and phase responses.

In fairness, there are numerous ways to encode and store the Ambisonics signals and other ways to process the signals into forms suitable for reproduction from different numbers of speakers in different setups. All of these I have not heard. Ambisonics may yet play a role in our audio lives. Certainly having multiple, discrete digital channels within which to store data can only be an advantage for it. As it has been demonstrated, however, there seems to be a lot of paraphernalia for just one listener. F.E.T.

nel version of Ambisonics and a two-channel program, or a 5.1-channel discrete program, or . . .

Suffice it to say that, because technology is changing, it is now not so necessary to establish hard universal standards. We could have several formats, each optimized for different applications, ranging from uncompromised professional and high-end audio formats to those that have been adjusted in various ways to fit the cost and bandwidth limitations of portable, broadcast, or network distribution media. In the short term, there will likely be some angst, but in the long term, it is my sense that these are technical problems that will find appropriate and affordable solutions. Place your bets now. A

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www.aber.ac.uk/~dgv/3daudio.htm

CAMBRIDGE SOUNDWORKS®

CAMBRIDGE SOUNDWORKS TOWER SPEAKER

JANUARY 1997

AURICLE
DANIEL KUMIN
**CAMBRIDGE
SOUNDWORKS
TOWER SPEAKER**



signing interesting speaker systems that show Henry Kloss has a lot on his mind. So it was unexpected when Cambridge SoundWorks brought out a line of totally unconventional-looking three-driving tower type loudspeakers, of which the dual-woofer Tower is the subject here.

Despite the Tower line's departure from Henry Kloss's tradition of doing the untraditional, these speakers were, in fact, somewhat conventional—except for him, since designing them, Kloss has now retired from the company. He now works a few days per week as a consultant on new products but also turns his considerable talents to matters not necessarily related to hi-fi.

The Cambridge Tower looks a lot like many other speakers in the popular format: waist high, slim, and deep (about 18 x 9½ x 14 inches). The Tower is a top-to-bottom design. It has a 2.5-inch polypropylene cone tweeter and a 1-inch silk dome tweeter. The bottom section has a 6.5-inch polypropylene cone woofer and a 6.5-inch polypropylene cone woofer with a tweeter with a 1-inch dome of treated cloth. On the finished look, give it another clean, multi-tone pair of 6.5-inch tweeters plus a strongly flared port about 20 inches in diameter.

The Towers I received were finished on free water in water, finely red-stained walnut veneer (black is also available). They were supplied with black knit grilles that covered about three-quarters of the front panel and about one-quarter of the rear. The overall effect was quite handsome and understated, though the gold-finished metal logo strikes struck me as a bit too prominent. The Tower's cabinetry was of decent quality, solid and well finished, but the detail work, while fine, was not quite comparable to the best examples of mid-market loudspeakers. The cabinet's construction was solid.

Company Address: 311 Needham St., Newton, MA 02459
Tel: (617) 552-1000
Fax: (617) 552-1001
www.cambridgeaudio.com



Cambridge SoundWorks Tower has six drivers, the four visible here and two more on the back.

As soon as I fired the Towers up, it was evident that they threw a big output, the tenable thanks to their bipolar output. The Towers' soundstage was noticeably deep.

THE SOUNDSTAGE OF THE TOWERS WAS STABLE, DEEP, AND RICHLY THREE-DIMENSIONAL.

With Henry Kloss and his most recent company, Cambridge SoundWorks, have a reputation for doing the unexpected. Kloss, a longtime audio pioneer, developed (among other things) the first compact and portable phono preamp that could be considered hi-fi, the first truly hi-fi table radio, and the basic video processor—not to mention decades worth of audiophile speaker designs. Cambridge SoundWorks has done such well in these things, its marketing products factory direct and then opening a thousand chain of retail factory outlets, producing a portable speaker system whose carrying case doubles as the bass, but when the system is setup and set up, and the location—not to mention decades worth of audiophile speaker designs. Cambridge SoundWorks has done such well in these things, its marketing products factory direct and then opening a thousand chain of retail factory outlets, producing a portable speaker system whose carrying case doubles as the bass, but when the system is setup and set up, and the location—not to mention decades worth of audiophile speaker designs. Cambridge SoundWorks has done such well in these things, its marketing products factory direct and then opening a thousand chain of retail factory outlets, producing a portable speaker system whose carrying case doubles as the bass, but when the system is setup and set up, and the location—not to mention decades worth of audiophile speaker designs.

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CIRCLE NO. 75 ON READER SERVICE CARD

Designed by Audio Hall of Fame member Henry Kloss, the Cambridge SoundWorks Tower was reviewed in *Audio's* January 1997 issue. The flagship of the Tower series, this three way bipolar, was found "to have a sound stage that was stable, deep and richly three dimensional, unfettered solid bass to below 30HZ . . . an uncommon value." Complimenting the Towers is the Center Stage center channel and The Surround® dipole radiator speakers, forming a critically acclaimed theater sound system.



EDWARD J. FOSTER

SONY DVP-S7000 DVD PLAYER



One doesn't get the opportunity to observe the introduction of a really new type of audio/video component often. Such occurrences are more rare than, say, a lunar eclipse—and at least you can count on the eclipse taking place on schedule. The launches of new consumer electronics products seldom do, and many crash before they clear the pad. It is unlikely that DVD will fail no matter how companies may mess up its marketing, which makes it all the more interesting to study how different manufacturers launch their merchandising missiles.

Sony has chosen to follow the traditional route: Introduce an upscale, relatively full-featured DVD player for early adopters and then, presumably later on, follow with more economical everyman versions. That said, I'm rather surprised that the DVP-S7000, priced at \$1,000, costs as little as it does.

The DVP-S7000 plays 5-inch DVDs, Video CDs, and audio CDs (including 3-inch audio CDs), recognizes each for what it is, and decodes accordingly. DVP-S7000s sold in the United States play only Region 1 DVDs (and those labeled for all regions). They will deliver NTSC-compatible video in composite form on an RCA jack, in Y/C (luminance/color) form on an S-video connector, and in component-video form on three RCA jacks (one for luminance and the

others for the R-Y and B-Y color-difference signals). Component video delivers video information in its purest form, but it's usable only with monitors and projectors having the necessary inputs.

Audio outputs are present in both analog and digital form, the latter via an optical (Toslink) socket and a coaxial (phono) jack. The form of digital audio is determined by the disc, i.e., 16-bit linear PCM when playing CDs and normally a Dolby Digital (AC-3) bitstream when playing DVDs. However, using the setup menu, you can command the player to produce a two-track PCM signal when playing a Dolby Digital source. This enables you to feed digital signals to non-AC-3 components without the

**RESOLUTION
IS OUTSTANDING,
FAR BETTER THAN TAPE
AND FAR BETTER
EVEN THAN LASERDISC.**

“strange sound. . . affecting your ears or causing the speakers to be damaged,” as the otherwise better-than-average manual puts it. An analog stereo version of the digital audio is fed to two pairs of line-level RCA jacks. As befits the DVP-S7000's upscale image, all audio and video jacks (except the Toslink, of course) are gold-plated. An “S-link” mini-phone jack serves to tie the player to compatible Sony components for system control.

Considering the technical complexity of DVD, one could hardly imagine a player with a less intimidating appearance than the Sony DVP-S7000. At the upper left, from top to bottom, are an “On/Standby” LED, a power switch, a remote sensor, a headphone level control, and a gold-plated headphone jack. At the upper right is an “Open/Close” button, which lowers (or

Dimensions: 17 in. W x 4 $\frac{3}{8}$ in. H x 15 $\frac{5}{8}$ in. D. (43 cm x 11.1 cm x 39.5 cm).

Weight: 15 lbs., 7 oz. (7 kg).

Price: \$1,000.

Company Address: Sony Dr., Park Ridge, N.J. 07656; 201/930-1000.

For literature, circle No. 90

NAD

AURICLE
COREY GREENBERG

NAD 512 CD PLAYER AND 314 INTEGRATED AMP



ARC is well liked by many audiophiles, but I had to find good luck with this particular preamp. Its frequency response, converted quality to the midrange, and its exacting timing in the system sounded to the music like a clear change.

I can remember precisely when the change occurred. I used the ARCA for a month, and then I swapped the preamp for the new one up, and within a few minutes of warm-up and more music. The speakers sounded like legitimate high-end speakers, and even my sensitive ears could hear the mystery preamp. So what was the mystery preamp you ask? Oh, only so I lied. It was, in fact, a preamp I used the budget section of a fine mid-range NAD integrated amp. Core's ARC can go as far as you want, even to the point of being as good as the ARCA. (You'll have to try it to believe it.)

When you put them together, the NAD 314 and 512 make the ultimate affordable audiophile system. Specially, you have to check out the NAD 512 CD player. It's a CD player that's not only a great CD player, but it's also a great CD player. It's a CD player that's not only a great CD player, but it's also a great CD player. It's a CD player that's not only a great CD player, but it's also a great CD player.

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

When you put them together, the NAD 314 and 512 make the ultimate affordable audiophile system. Specially, you have to check out the NAD 512 CD player. It's a CD player that's not only a great CD player, but it's also a great CD player. It's a CD player that's not only a great CD player, but it's also a great CD player.

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Company Address: c/o KH America, 89 Doug Brown Way, Holliston, MA 01746, 508/429-3600, fax, 508/429-3699. For location, click No. 97

MIDWINTER 1997

WHEN PUT TOGETHER, THE NAD 314 AND 512 MAKE THE ULTIMATE AFFORDABLE AUDIOPHILE SYSTEM.

NAD 314 AMP AND 512 CD PLAYER

FEBRUARY 1997

Twenty-five years ago, NAD created a new class of audio product designed to deliver affordable high end performance. Today, NAD continues that tradition with innovative products like the 314 Integrated Amplifier and 512 CD Player, reviewed just three issues ago. Audio's Corey Greenberg claimed "when put together the NAD 314 and 512 make the ultimate affordable audiophile system."

Find out about all the NAD audio and home theater components at your local NAD retailer, or contact us for a copy of the brand new NAD full line catalog.



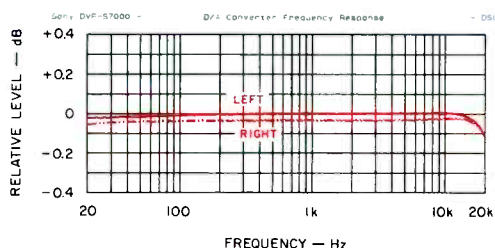


Fig. 1—Frequency response.

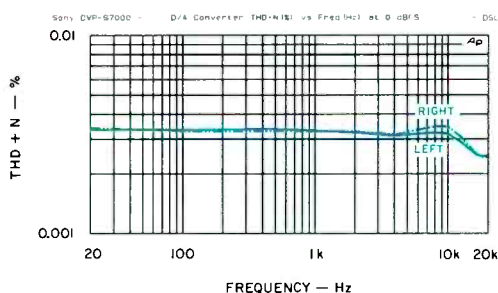


Fig. 2—THD + N vs. frequency.

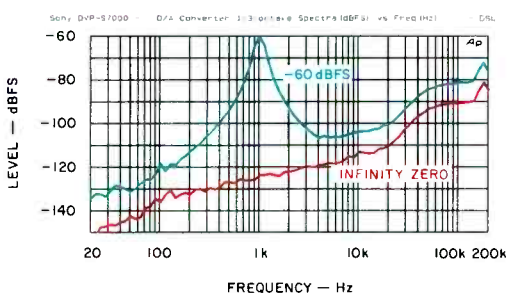


Fig. 3—Noise spectra.

raises) the front panel and extends the disc tray. A “Panel Up/Down” bar separately raises and lowers the front panel to expose the subpanel controls. On the front of the movable panel are three tiny buttons for play, pause, and stop. Behind it, the subpanel controls include “PREV/Next” chapter-skip buttons, another to activate “DNR” (a three-level digital noise-reduction system), a four-key array to move the cursor through on-screen menus, and “Title,” “DVD Menu,” “Return,” and “Enter” buttons to elicit and control these menus.

As usual, the remote provides a more complete complement of controls than the front panel, but here, too, Sony has attempted to minimize the intimidation factor. The RMT-D100A remote supplied with the

DVP-S7000 is rather wide and may be a bit uncomfortable for people with small hands, but the panel’s extra width permits more generous spacing between the numerous buttons, which helps people with large fingers.

The dedicated remote will control a Sony TV as well as the DVD player. There are separate power buttons for each, TV volume and channel-selection up/down pads, and a “TV/Video” key to toggle between the sources. The major transport controls for play, pause, stop, chapter-skip, and “double-speed” playback, as well as high-speed scan in both directions, are on the remote’s main panel. Here, too, are pads that provide a simple, direct way to change soundtracks, subtitles, and viewing angles—“Audio Change,” “Angle Change,” “Sub-Title Change,” and “Sub-Title On/Off”—when playing DVDs that support such niceties. If the disc doesn’t, you’re informed of the fact by an on-screen message if you should request, for example, a change in subtitle language when there isn’t another. Other buttons—“Display,” “Title,” “DVD Menu,” “Menu,” “Return,” “Enter,” and the four-key cursor array—call up and control the on-screen menus and other displays.

The functions of most keys are self-evident, but one deserves explanation. The “Display” key toggles through three on-screen exhibits. A simple one merely gives the current title and chapter numbers and the current chapter’s playing time. A more complete one tells you not only what you have chosen but also how many titles, chapters, subtitle languages, audio languages, and viewing angles are on the disc as well as the current audio mode and other information. Last is a bar graph that indicates the current video bit rate.

Lifting a flip-up cover on the remote reveals a subpanel with additional functions. There is a 10-key numeric pad with “Clear,” “Enter,” and “Search Mode” keys that enable direct access to titles, chapters, tracks, index points, and so forth by their identifying numbers. You also can enter parental-

control codes with the keypad, activate “DNR,” and engage a slow- or step-motion mode in either direction via other subpanel controls. In general, what you can do depends on the type of disc being played—DVD, CD, or Video CD—and, in the case of the DVD, the features that are supported by the disc itself.

The “Menu” button accesses four on-screen setup menus: “Play Mode,” “Video Control,” “Custom Set Up,” and “Initial Set Up.” “Play Mode” enables repeat playback of tracks, chapters, titles, or the entire disc (depending on disc format); randomized playback (“Shuffle”); playback of specific titles, chapters, or tracks (depending on the format); or repeat play of designated portions of a title, chapter, or track (“A-B Repeat”).

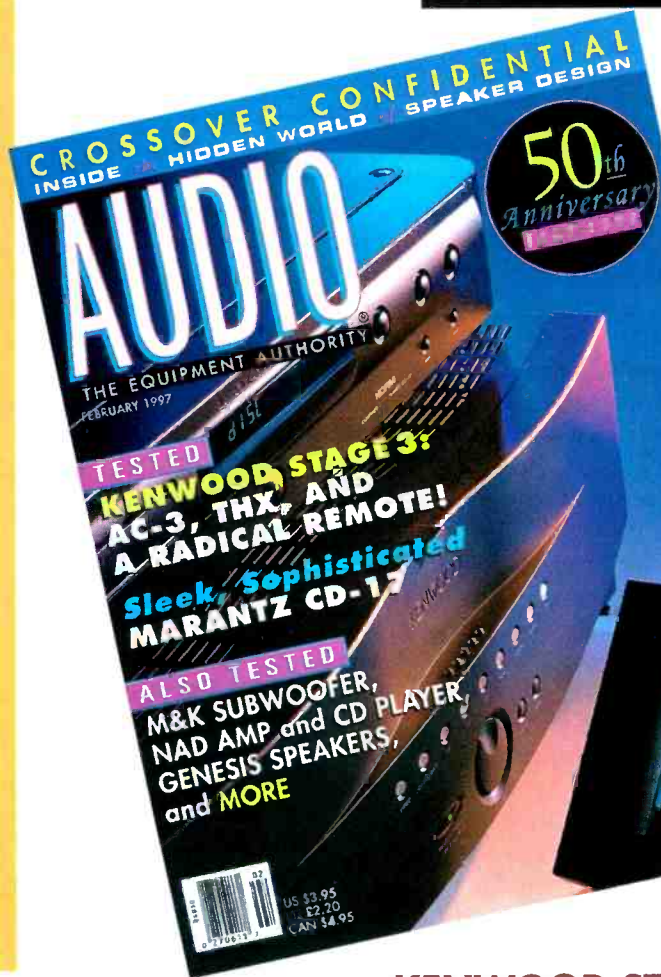
The “Video Control” menu facilitates adjustment of “Picture” (contrast), “Brightness” (black level), “Color” (saturation), and “Sharpness” and the storage of three custom combinations (“Memory Set”). The player comes with three factory presets: one optimized for viewing in a well-lit room, one for viewing in a darkened room, and “Standard,” which returns all controls to zero.

The “Custom Setup” menu provides control of a variety of functions. “Auto Play” activates timer playback and brings

**THE GRAY SCALE
PROVED PERFECTLY LINEAR
OVER THE FULL
10-STEP RANGE.**

up two demonstration modes. “Dimmer” brightens, darkens, or entirely kills the front-panel display. “Audio DRC” compresses the dynamic range for late-night listening to CDs or to DVDs with PCM stereo sound. “Audio ATT” raises and lowers the analog audio output level at the line-out jacks. “L/R/Stereo” yields left-channel only, right-channel only, or stereo at the analog outputs for audio CDs and at the digital output for Video CDs. “Background” lets you choose the menu background color (either blue or black) on the TV screen. “CD Background” turns the background picture

KENWOOD



EQUIPMENT PROFILE
EDWARD J. FOSTER

KENWOOD KC-Z1 A/V TUNER/PREAMP

Nothing tickles a jaded reviewer's fancy like an original product one that points in a new direction and seems certain to be imitated. The Kenwood Stage 3 Controller (in such a remote preamp because it's certainly not a Dolby Pro Logic IIH Home Cinema processor, so it holds these functions too. And you could call it a Dolby Digital AC-3) preamp because it's that in itself—both inputs built for the straight digital signal. You get two sources with an SPD out for the hi-res digital AC-3 outputs from incoming pieces.

But what makes the KC-Z1 innovative is the TouchPanel control which is 2 inches thick, just under 3 inches high, and has a single side centered on a 3.5 x 3.5 inch square LCD touch screen. When the controller is placed to the KC-Z1, it becomes the system control panel, communicating with the KC-Z1 via five metal contacts that also keep the remote unchanged. When you remove the TouchPanel, the KC-Z1 reverts to its normal functions.

The TouchPanel displays the KC-Z1's operating status, and that status from the TouchPanel is also a front panel LCD setting and



...selecting a source, setting, and tuning the KC-Z1 on and off. In fact, there are two control switches: "Source Power" (which lets you toggle the KC-Z1 on and off) and "Main Power" (which lets you toggle the KC-Z1 on and off). The "Main Power" is the same as the "Source Power" and is controlled by the KC-Z1's remote control. The "Source Power" is controlled by the KC-Z1's remote control. The "Main Power" is controlled by the KC-Z1's remote control. The "Source Power" is controlled by the KC-Z1's remote control. The "Main Power" is controlled by the KC-Z1's remote control.

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

Dimensions: 17 1/2" x 10 1/2" x 2 1/2" (444 x 267 x 64 mm)
Weight: 2.7 lbs. (12.2 kg)
Price: \$8,800
Company Address: 2201 East Dyer
Long Beach, CA 90801
800-536-5663
<http://www.kenwoodusa.com>
For literature, circle No. 90

KENWOOD STAGE 3 HOME THEATER CONTROLLER (KC-Z1)

FEBRUARY 1997

Kenwood's award-winning Stage 3 Home Theater Controller (KC-Z1), is a tuner/preamp that has turned a lot of heads. Ed Foster's review in February 1997 claimed the Stage 3 "looked ready for anything" with "sounds that were great in Pro Logic but spectacular in Dolby Digital." With the industry's most innovative remote, Kenwood's TouchPanel controller, the Stage 3 is "complete and flexible, a component to be reckoned with."



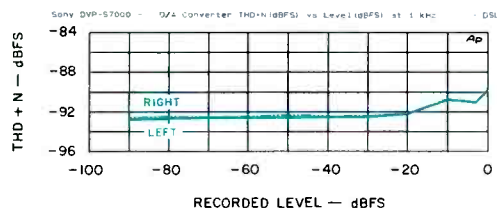


Fig. 4—THD + N vs. signal level.

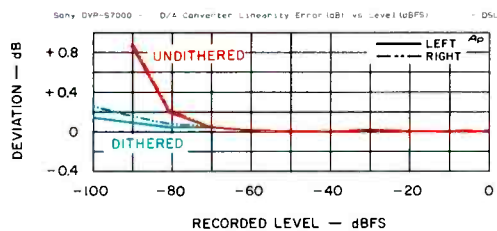


Fig. 5—Linearity error vs. signal level.

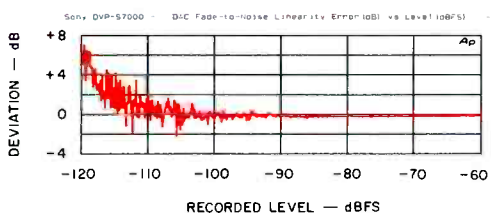


Fig. 6—Fade-to-noise test.

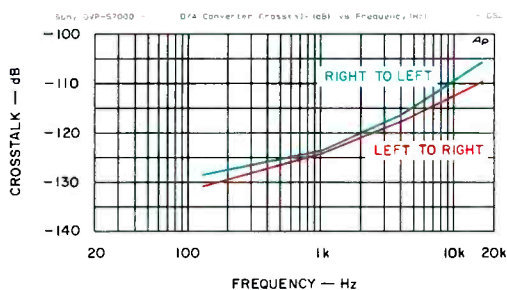


Fig. 7—Channel crosstalk vs. frequency.



(a stylized disc on a blue background) on and off when you're playing a CD.

Basic settings are made with the "Initial Setup" submenus. These let you tell the system the "TV Type" (4:3 or 16:9), the "Video Aspect Ratio" to use when displaying a widescreen picture on a normal TV (letterboxed or panned-and-scanned), and the "DVD Menu Language" and "OSD Language." The Sony DVP-S7000 provides a choice of English or French OSDs (on-screen displays) and nine DVD menu languages by name: English, Japanese, Chinese, Spanish, French, Italian, German, Portuguese, and Dutch. Many other languages can be selected by entering appropriate code numbers.

Other modes determined in the "Initial Setup" menu are "Downmix" ("Surround/Normal"), "DVD Digital Out" (PCM/AC-3), "Video CD Color System" (fixed at NTSC for U.S. players), "Video CD Digital Out," and "Parental Control." "DVD Digital Out" is set to PCM when digital audio signals from the DVP-S7000 are fed to a component that does not decode Dolby Digital; this prevents the DVP-S7000 from delivering an AC-3 bitstream when playing a DVD so that the connected D/A converter is not confused by an unknown format. AC-3 is chosen when the player is connected to a Dolby Digital decoder, because such decoders can automatically distinguish an AC-3 bitstream from a PCM bitstream. "Downmix" determines what comes out of the analog line-out jacks (and the digital outputs when "DVD Digital Out" is set to PCM) when playing a DVD with a Dolby Digital soundtrack. "Video CD Digital Out" toggles the digital audio outputs on or off when playing a Video CD.

A final note: Although the Sony DVP-S7000 seems capable of supporting every DVD feature imaginable, the disc itself determines what features are available. No player on earth can produce recognizable

Chinese from a disc that isn't recorded with a Chinese soundtrack!

Measurements

Sony supplied a preliminary version of a DVD test disc with the DVP-S7000, so I was able to make a few video measurements. But because I had no information about the location of test segments on the disc, testing became a sort of guessing game: "Hmm! Obviously that's a multiburst. I wonder what the frequencies are." Some of the video test signals were obvious, however, and Sony confirmed that I had properly identified most of the disc's levels and frequencies, so I have reasonable confidence that my measurements are accurate as far as they go.

To say that the DVP-S7000's measured video performance was excellent is an understatement. No other video product I have tested—laserdisc player, S-VHS tape deck, Hi8 camcorder, broadcast tuner, or whatever—has approached the dead-on accuracy of DVD through the DVP-S7000. Luminance response, a measure of horizontal resolution, was absolutely flat to the color-burst frequency (3.58 MHz) and down by a mere 0.2 dB at 4.2 MHz, the highest frequency in the multiburst group I used. I can't even be sure that the tiny 0.2-dB droop I detected at 4.2 MHz was caused by the player; it may have resulted from a

FREQUENCY RESPONSE IS REMARKABLY FLAT, AND THERE'S NO SIGN OF FILTER RIPPLE IN THE UPPER RANGE.

response rolloff in my waveform monitor. On the luminance sweep track (which, as it turns out, extends to 5.5 MHz), the DVP-S7000's response was within +0, -2 dB over the full range, and once again, some of the rolloff may have been due to the waveform monitor.

Chroma level was 1.7 dB high, which is unusual because most of the video components I have tested have delivered chroma levels that are a bit lower than standard. Either way, it's not of much significance because any decent monitor will automatical-

B.I.C. America™

THE V-604 DID NOT WIMP OUT ON HARD-DRIVING POP/ROCK.

Measured from the side (with a mirror image reflection of what you would hear in a normal listening environment), the point-to-point response was flat to about 120 Hz and about 2 dB lower at 80 Hz. The increase in deep bass output with one port closed ranged from 0.5 dB at 32 Hz to 5 dB at 20 Hz.

The V-604's grille causes significant response aberrations above 1 kHz (see Fig. 5). Large peaks and dips including a particularly big dip of about 9 dB at 8.6 kHz. Averaged about 200 Hz to 1 kHz (ignoring equalizer phase), the average measured response level, assuming an unobstructed listening position, is 22.5 dB significantly below BIC's 90-dB rating. The depressed response between 300 Hz and 3.5 kHz and between 800 Hz and 3.5 kHz are not as much as the low sensitivity response. Even with three ports closed, the sensitivity would rise to 80 or 82 dB.

I had four samples of the V-604 to work with. Three of these samples worked quite closely, their responses fitting a +4dB envelope between 200 Hz to 20 kHz. However, the fourth sample was just so well matched, at least above 9 kHz. It matched at least 2 dB higher than the others at 10 kHz, 5 dB at 12 kHz, and 8 dB at 20 kHz.

Figure 2 shows the V-604's phase and group delay responses, referenced to the tweeter's axial tone. The phase curve is very well with rising frequency in the range from 150 Hz to 1.5 kHz. The phase aberrations are the most serious in the on-axis response and would be reduced if speakers were arranged by about the axis response were smoother. Between 1 and 30 Hz, the phase decreased by about 200°. When averaged from 3 to 4 kHz, the group delay curve indicates a relative lag of about 0.14 milliseconds with the tweeter delayed behind the tweeter. The waveform phase (usually the absolute value of the wrapped waveform phase) variations are strongly between 0° and 180°, indicating that waveforms were not received in any

frequency range. For waveforms to be perceived (either upright or inverted), the wave form must rise near 0° or 180° over some phase range. There are no significant frequency ranges that are conventionally developed speaker drivers that have the V-604 as shown in Fig. 5. The curve of the V-604 is the graph in the hand of cover at the rear of the front in its response, the 180° curve in the front in the response taken on the rear driver axis. The response taken on the rear driver axis, though the response is a bit rough

from England and Japan to the United States. In the 1960s BIC handled such well known brands as Wharfedale, Gerrard, and Janssen. In the 1970s it began producing components and speakers under its own name, including the first half-inch record changer, a two speed cassette deck, and speakers using the patented Minuteman design.

Underwritten by the company itself in 1982, new owners revived it as BIC America in 1984, and it is doing very well as a household name in many homes as well as in wall speakers and multi-speaker packages for home theaters. The front-firing speakers range in price from \$130 per pair for the Model A, to up to \$1,200 per pair for the Model B. These standing speakers are available for stereo and home theater.

The V-604 is the larger of two bipolar floor-standing tower speakers that have

EQUIPMENT PROFILE

D. B. KEELE, JR.

BIC AMERICA VENTURI V-604 SPEAKER



THE REAR-FIRING DRIVERS ADDED AN ENVELOPING SPACIOUSNESS AND DEPTH.

Venturi come. Both are two-way designs with bass and mid drivers that operate in phase with each other. The V-604 has 6-inch woofers and 1/2-inch dome tweeters, one each on the front and on the rear, with the tweeters located above the woofers. The V-604 has two ports, each 3 inches in diameter and 18 inches long, mounted one

to each side of the front baffle. The main driver is a 6-inch woofer. The main driver is a 6-inch woofer. The main driver is a 6-inch woofer. The main driver is a 6-inch woofer.

If you were all caught in the middle, you probably remember BIC's heavy presence on the audio market. These days, physical (Gervase Rattier) is a 72-year-old man who first observed that when air (or any other fluid) is forced through a constriction, its velocity increases and its pressure decreases. The Venturi effect is a common phenomenon in those days. The same effect originally stood for BIC Industries Corporation, an American company that imported components

from England and Japan to the United States. In the 1960s BIC handled such well known brands as Wharfedale, Gerrard, and Janssen. In the 1970s it began producing components and speakers under its own name, including the first half-inch record changer, a two speed cassette deck, and speakers using the patented Minuteman design.

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The V-604 is the larger of two bipolar floor-standing tower speakers that have

B.I.C AMERICA VENTURI™ V604 SPEAKER

MARCH 1997

"Good looks . . . extended bass response . . . solid . . ." was how *Audio* described the V604 Bipolar Speaker. For a full copy of this latest review (among dozens more by the industry) on B.I.C's audio and home theater speaker systems, ask your authorized dealer. Or contact B.I.C America for the one nearest you. B.I.C . . . bringing you quality audio and home theater components for over thirty years.

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ly correct reasonable errors in chroma level. Luminance level was right on the mark, and the gray scale proved perfectly linear over the full 10-step range. Chroma phase accuracy—a measure of hue, or tint, accuracy—was perfect (most unusual!), and there was no measurable chroma differential phase or gain error (which cause shifts in hue and color saturation with differences in scene brightness).

In sum, the DVP-S7000 is the most nearly perfect video product I've had on my bench. However, it's only fair to point out that I didn't have the test disc for previous DVD player reviews and that these measurements are based on steady-state test patterns and are not necessarily indicative of a player's capability to handle full-motion video. Nevertheless, a DVD player that can't handle steady-state patterns sure won't handle motion any better, so consider these test parameters a necessary (if not sufficient) condition of excellence.

And, indeed, the DVP-S7000 is excellent at handling full-motion video. Whether that's a result of Sony's use of 10-bit video digital-to-analog converters (versus its competitors' 8- and 9-bit DACs) or its own MPEG-2 video decoder, and whether we can expect this level of performance from DVD players in general, are open questions. As I said, this is the first DVD player to get a full technical workout on my bench. Suffice it to say that 10-bit video DACs can't hurt!

Although there were also audio test signals on the preliminary DVD test disc, a Sony spokesman couldn't identify their function, so I couldn't use them. Accordingly, I reverted to my trusty CBS CD-1 test disc to evaluate the DVP-S7000's internal DACs. In a word, they're superb and bear an unmistakable resemblance to those in the Sony CDP-XA7ES, my reference CD player. Not surprisingly, the DVP-S7000 also uses Sony's Current Pulse conversion technology.

Frequency response (Fig. 1) is remarkably flat, and there's absolutely no sign of filter ripple in the upper range. There's plenty of output, and the channels are very well balanced. The D/A converter's THD + N versus frequency at 0 dBFS (Fig. 2) is exceptional. Note how flat the curve is and how the distortion does not peak above 5 kHz, as it does in many other players. (In

this curve, as in many of the others, I've expanded the vertical scale to show the test results more clearly.) Many converters produce THD + N an order of magnitude (10 times) higher than the DVP-S7000's; if I



THE DVP-S7000 SOUNDS ALMOST AS GOOD PLAYING CDs AS MY PRICIER SONY CDP-XA7ES.

plotted theirs on the scale I've used here, the distortion levels would be off the top of the graph!

The shape of the curve in Fig. 2—in particular, its smoothness in the high-frequency region—indicates an absence of cross-

modulation between the signal and the converter clock and testifies to excellent digital filtering. (The DVP-S7000 uses what Sony calls a Full Feed Forward digital filter, with internal calculations carried out to 45-bit precision.)

The noise spectra in Fig. 3 (left and right channels were essentially the same, so only the left channel is shown) suggest that Sony's Current Pulse converter is a highly oversampled, low-bit, noise-shaped system that redistributes quantization noise into the inaudible range. Note the extremely low lie of the infinity-zero noise curve in the audible range (between 20 Hz and 20 kHz) and the rise in noise energy in the ultrasonic region, the hallmark of noise shaping. Also note the absence of power-line-related components, a mark of careful circuit layout and grounding. Not surprisingly, A-weighted signal-to-noise ratio clocked in at a whopping 106.2 dB!

Also in Fig. 3, note the parallelism between the two curves in the high-frequency region. Often, the presence of a signal markedly alters the spectrum, because the D/A converter is doing some real conversion rather than resting at digital zero. Not

MEASURED DATA

PCM AUDIO

Output Level: Line, 2.3 V at 0 dBFS; headphone, 4.34 V, maximum.

Channel Balance: ±0.015 dB.

Output Impedance: Line, 120 ohms; headphone, 105 ohms.

Maximum Headphone Power: 600-ohm loads, 27.1 mW; 50-ohm loads, 39.4 mW at 1% THD.

Frequency Response: 20 Hz to 20 kHz, +0, -0.11 dB.

THD + N: At 0 dBFS, less than 0.0035%, 20 Hz to 20 kHz; at 1 kHz, below -89.5 dBFS from 0 to -90 dBFS and below -92.2 dBFS from -30 to -90 dBFS.

Maximum Linearity Error: Undithered recording, 0.92 dB from 0 to -90 dBFS; dithered recording, 0.24 dB from 0 to -100 dBFS.

A-Weighted Noise: -106.2 dB dBFS for infinity-zero recording.

Quantization Noise: -90.4 dBFS.

Dynamic Range: Unweighted, 92.8 dB; A-weighted, 96.4 dB.

Channel Separation: Greater than 105.7 dB, 125 Hz to 16 kHz.

DVD VIDEO

Luminance Frequency Response: -0.2 dB at 4.2 MHz; +0, -2 dB to beyond 5 MHz.

Luminance Level: No measurable error.

Chroma Level: +1.7 dB.

Gray-Scale Linearity: No measurable error.

Chroma Phase Accuracy: No measurable error.

Chroma Differential Gain: No measurable error.

Chroma Differential Phase: No measurable error.

California Audio Labs



CALIFORNIA AUDIO LABS CL-5 CD CHANGER

MARCH 1997

In March of 1997, California Audio Labs CL-5 graced the cover of *Audio*. Daniel Kumin described the CL-5 as "... more than competitive with many another player or changer in its price range." "A very well made, good performing, fine sounding changer." California Audio Labs ... manufacturing high performance, high value digital audio for the discriminating music lover for over a decade.



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here, however. These benefits also show up in dynamic range (see "Measured Data"). Even on an unweighted basis, the Sony converter clocked in at an excellent 92.8 dB. On an A-weighted basis, dynamic range was 96.4 dB. Quantization noise likewise was excellent.

Sony's converters also are exceptionally linear, as can be seen in the tests of THD + N versus signal level (Fig. 4), linearity error versus level (Fig. 5), and fade-to-noise (Fig. 6). On dithered recordings (and most are, purposely or accidentally), Sony's converters are as close to perfect as one can imagine converters to be.

Channel crosstalk is plotted in Fig. 7. (Do note the vertical scale!) Although channel separation in excess of 105 dB certainly isn't necessary for good listening, it does underscore the exceptional care Sony has taken in laying out the circuitry and in building the product. For that reason alone, the separation is worthy of mention.

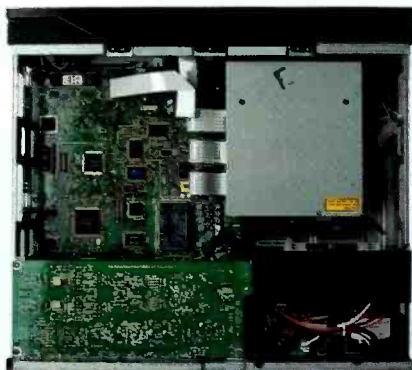
Should you wish to listen to CDs or DVDs on headphones, you'll find plenty of drive level into both professional and consumer 'phones. And the low source impedance at the Sony's line outputs ensures that you'll have no difficulty driving other equipment, either.

Use and Listening Tests

When I used the DVP-S7000 in my listening room and later in my home theater, my reaction was the same: "Wow!" In the listening room (using the player's internal D/A converters), CDs sounded almost as good as on my Sony CDP-XA7ES CD player, which sells for three times as much. The DVP-S7000 is certainly not as convenient to use (programming is rather awkward), but sonically it's great. And unlike some other DVD players, this one plays CD-Rs, by virtue of its Dual Discrete optical pickup. But that's not what the DVP-S7000 is all about.

The DVP-S7000 is the first DVD player I've used that produced reasonably clean and reliable pictures in pause (freeze-frame), double-speed play, and frame-by-frame slow motion (in both directions). That ability alone—Sony calls it Smooth Scan—probably explains some of the added cost for this player, since it requires "an ultra fast 32-bit RISC microprocessor" to smooth out the effects. Just to review for a

moment why special effects modes are a particular problem for DVD players, remember that the majority of the video frames recorded on DVD are not complete; they are predicted from what came before or what follows. Therefore, the player has to have extra smarts to pick the fully encoded "I" frames to use for special effects, rather than just using whatever frame happens to be there the instant you press "Pause" or



**OF ALL THE
VIDEO PRODUCTS I'VE
TESTED, THE DVP-S7000
IS THE MOST NEARLY
PERFECT.**

some timed frame-advance decides to snatch a new frame.

However, man does not live by special effects alone. In normal-motion video, the DVP-S7000 produced clean, sharp pictures that were remarkably noise-free. Colors were vivid, accurate, and free of the blotchies that videophiles have been forced to accept from tape and even laserdiscs. Resolution was outstanding—far better than from tape and, on well-encoded DVDs, far better even than from laserdisc. I was aware of what appeared to be pixelization (a sort of mosaic pattern) on one DVD, but I'm reasonably sure that was caused by poor encoding and had nothing to do with the DVP-S7000. (The encoding will make or break this format, so I do hope the industry gets its act together on that.)

I did not spot any motion artifacts on the (admittedly limited) collection of DVDs I

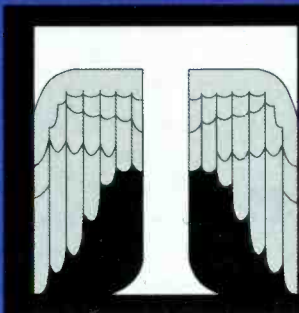
watched. Yes, there could be a slight smearing on occasion, but this can arise from motion picture film shot with a relatively slow shutter speed. Suffice it to say that, when I saw smearing on a freeze frame, I could never be sure whether it was on the original film frame or not.

I very much liked Sony's on-screen menus and displays, especially the one that shows what features are supported by the disc. It's nice to know when you're spinning your wheels asking for a subtitle language that just ain't there. And the bit-rate display is intriguing to the technically curious. I find it difficult to believe that the 0-to-10 megabit-per-second scale is linearly calibrated (as Sony told me it was), because the indicator was above the midpoint more often than below and DVD is designed for typical average rates below 5 megabits per second. Still, the display does give you a general idea of what type of scenes demand more from the DVD format than others, and before long you start criticizing the encoding. ("Hey, that scene didn't seem so difficult; why are you using so many bits, dummy?")

By now, I've acquired a few DVDs that support at least two languages for more than a few frames and several that have subtitles in a number of languages. The DVP-S7000 understood all of these discs' language provisions flawlessly. It also had no difficulty handling the multiple-angle scenes that I had at my disposal, but software that can be used to properly demonstrate the disc-encoded pan-and-scan function is notable by its absence.

I'm not sure I really need digital noise reduction (DNR) on a DVD player; DVD video shouldn't be noisy, and I was hard-pressed to see any effect. Sony's "Video Controls"—picture, brightness, color, and sharpness—offer five adjustment levels either side of "0." With the exception of "Sharpness," I found the steps rather broad; I'd rather use the controls on my TV monitor if I have to touch up the picture (which I didn't).

For features, convenience, and performance, the Sony DVP-S7000 is a major step above everyman models and in my opinion is well worth the extra bucks it costs. Put it this way: Of the DVD players I've used so far, this is the one I'd want to have in my home theater. A



Digital Done Right Theta Digital

THETA DIGITAL SURROUND PROCESSOR CASABLANCA

APRIL 1997

In 1989, Theta Digital changed history. Casablanca is changing history again . . .

Audio, September 1989: Anthony Cordesman introduced a new kind of component, Theta Digital's separate D to A converter. He exclaimed, ". . . I found for the first time that the CD could equal or surpass the analog record . . ."

"Corey Greenberg, in Audio's April 1997 issue, greets Theta Digital's Casablanca, which invents a new category of audio/video component: "Casablanca is the cleanest, best-sounding surround processor I have heard."



AURICLE
COREY GREENBERG

THETA DIGITAL CASABLANCA SURROUND PREAMP



When Theta Digital's Neil Jensen told me once that a year ago that he was thinking about introducing

around soundtracks processing? He would that new Theta be another of the outfall processors that either even basic Dolby Pro Logic processor avoid similar to Dolby Pro Logic but with more extended high-frequency response in the wide-band channel and what sounds like a wide-band stereo-matrix there as well. "Dolby Pro Logic" itself, revealed and published in the DSP realm by Theta, "Stereo" which is analog-digital, two-channel D/A conversion for listening to CDs via a digital transport, and "Matrix" which for some strange reason combines the left and right channels into one and sends it to both the left and right speakers. Why it does that, I have no idea, because it would sound much better and more coherent if the stereo signal were sent to just the center speaker; off-center listeners would have the apparent image jump over to whichever main speaker they are sitting closer to, for one thing. And then, of course, there are the optional surround modes, Dolby Digital and DTS. (I'd love to see other manufacturers offer their own processing cards for the Casablanca, like an Audible Illusions phase stage at a Pioneer karaoke board. Karaoke on digital surround would be a burning point for us audiophiles who are trying to keep this from us!)

Here's another great thing about the Casablanca: This thing is a breeze to set up. Two buttons, "Mode" and "Setup," and an up/down/lighting quartet of cursor controls are on the front panel and displayed on the remote.

"Mode" and "Setup" get you into options menus, and the cursor controls get you where you want to go. As Theta puts it, "The same button that gets you into a menu gets you back out too."

Sounds simple, but believe me, this one thing makes all the difference in the world. Without on-screen menus or even reading the manual, I had the Casablanca dialed in and ready to rumble in no time flat. Theta really scores here for designing a surround preamp that's so uncomplicated and yet remains so easy to set up and operate.

So how'd it sound? Given my strong liking for Theta's two-channel D/A converters over the years, I exposed the Casablanca to such. And looking at the circuit flow charts and feature set, I immediately could tell that Theta had paid full attention to those little areas in which some competitors coast ap-

(DAC) or DTS, to not just fight timing. And most high-end surround processors, that do decade-by-decade, but avoid overly wide steps in the channel level-calibration scheme, skipping on the number of inputs because the designer's got no idea how many sources can pile up in a home theater, failing to include proper base management and subwoofer crossover, or adding on-screen menus only for the convenience video output, not the S-video D to A out.

At first glance, the Theta Casablanca looks like the biggest, beefiest surround preamp you've ever seen. This thing's huge. At 19 inches wide x 16 inches deep x 7 1/2 inches high, and weighing in at a healthy 43 pounds, it's even bigger than Theta's Data III laserdisc/CD transport, which was the biggest slab in my equipment rack before the Casablanca arrived. Why? It's so big because under the hood, it has a multiple over-rated power supplies, its design is more akin to that of a personal computer than a hi-fi component. Instead of everything mounted on the same circuit board, the Casablanca is basically a mainframe and power supply on a chassis, with a series of modules that accept Theta's various circuit cards, each handling a different task, just as a PC has slots for internal modems, video cards, sound cards, and so forth; the Casablanca has card slots for digital input, analog audio, video, Dolby Digital/Pro Logic, DTS,

short. Theta must have taken notes about the weaknesses of earlier processors, because it has provided every one of them. But more important, Theta improved its legendary DSP and D/A conversion and then being a simple, as-digital-as-possible program on the menu, providing the multi-gang-controlled amplifier, digital-domain volume controls, and other identify compromised approaches to multichannel level control found in other processors. The result is surround sound that's never heard before, even from such standard bearers as the Meridian 565 and the Citation 7.8. The Theta Digital Casablanca is the cleanest, most solid and best-sounding surround processor I have heard.

As you might expect from any best-sounding vinyl, the Casablanca has amazing bass. Not just tight and powerful bass but full, detailed, multi-dimensional bass. The lines of which I don't hear from the Citation or the Meridian 565. One source of all sorts were measured by the Casablanca, revealing more complexity and texture than I'd previously noticed. From something as simple as the opening bass line at the start of Apocalypse Now, when the chapter flies across the screen and the Doors kick off "The End" suddenly sounded like a real electric bass being played by a real guy's finger.

(This passage isn't that clear on the original record and since didn't gain fidelity when Friends Ford Coppola's technician dialed it onto the soundtracks, it retains the right and left channels.) It had all the actual upper-midrange character and color of an old Ampex tube bass amp.

The Casablanca also has the other processors in there dynamic impact. The Citation is very, very good in this respect, while the Meridian's smoother gentler character seems to run to its ultimate limit. But the Theta is the champ here, by a long shot. It's no wonder that as of now, we compare the \$4,500 processor (the price of the configuration I reviewed) can sound more groovy and immediate than one from half its price, but the Meridian 565 AG-30001 comes in right in Theta's

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

AUDIO/APRIL 1997
62

D. B. KEELE, JR.

JAMO CONCERT 8 AND CONCERT CENTER SPEAKERS



Jamo (pronounced yah-mo), a 30-year-old Danish company, is currently the largest loudspeaker manufacturer in Europe. The company offers more than 61 different speakers in the United States, including models for high-end audio, home theater, and architectural acoustics. Jamo's products are distinguished by sleek and sometimes unusual Danish design. Two of its most arresting speakers, the Atmosphere (for wall-mounting) and the Converta (which can be wall-mounted or suspended from a cable) have built-in halogen lights.

This review is primarily of Jamo's new, high-end Concert 8 speakers, together with

the Concert Center speaker designed for use with them in home theater systems. But Jamo also supplied a pair of Surround One dipoles from its Home THX line, to flesh out the system. (I used a subwoofer I had on hand, although Jamo has a line of those, too.) The Concert 8 is a compact, two-way model with a 6½-inch vented woofer and a 1-inch dome tweeter. Designed for horizontal placement on top of a TV set, the Concert Center is a three-way system with two 6½-inch woofers, a 1½-inch dome mid-range, and a 1-inch dome tweeter. The Surround One (\$998 per pair) has a 4-inch woofer and a 1-inch dome tweeter on its front and an identical array on its back, plus

**JAMO'S SLEEK
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a third 4-inch woofer (which operates only below 200 Hz) on the side that faces the listening area.

The speakers in Jamo's Concert series boast many high-end features. These include voice coils wound from pure silver wire, Jamo-manufactured internal cabling of premium oxygen-free copper, 24-karat gold-plated terminals, individually matched components, solid-copper phase plugs, neodymium magnets, die-cast magnesium frames, and exotic wood veneers. The Concert 8 is the smaller and less expensive of the two main speakers in the Concert line. The Concert 11 (\$3,600 per pair) differs only in having a large, floor-standing cabinet and a second 6½-inch driver (a different design optimized for low-bass reproduction) that crosses over at 150 Hz.

The Concert 8 and Concert Center have several unusual construction features in

CONCERT 8

Rated Frequency Range: 38 Hz to 22 kHz.

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

Rated Impedance: 4 ohms, nominal.

Rated Power Handling: Long-term, 120 watts; short-term, 170 watts.

Dimensions: 15 in. H x 9½ in. W x 12¼ in. D (38 cm x 24.5 cm x 31 cm).

Weight: 24.9 lbs. (11.3 kg) each.

Price: \$2,400 per pair; available in swietenia mahogany or cherry wood.

CONCERT CENTER

Rated Frequency Range: 65 Hz to 20 kHz.

Rated Sensitivity: 91 dB at 1 meter, 2.83 V rms applied.

Rated Impedance: 4 ohms, nominal.

Rated Power Handling: Long-term, 110 watts; short-term, 150 watts.

Dimensions: 8¼ in. H x 22 in. W x 11¼ in. D (21 cm x 56 cm x 28.7 cm).

Weight: 23.8 lbs. (10.8 kg) each.

Price: \$800 each; available in swietenia mahogany or cherry wood.

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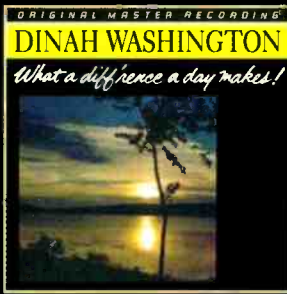
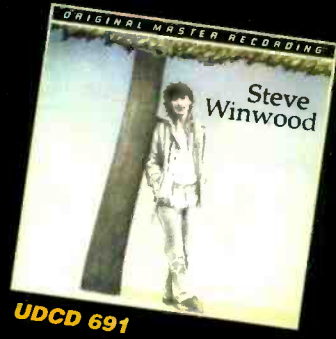
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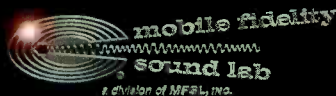


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common. The most important is the composition of their front baffles, which are made from quartz sand mixed with a resonance-deadening binding agent and covered front and rear by cast shells of a synthetic material. Jamo says this patented Non-Coloration Compound structure is extremely rigid and inert. The speakers' medium-density fiberboard grille frames are thin, to keep the drivers close to the grille cloth. And their cabinets are manufactured from 1-inch-thick medium-density fiberboard, reinforced with braces and lined with honeycomb-patterned acoustic foam to maximize damping.

**THE CONCERT 8'S
BASS RESPONSE
IS COMMENDABLE
FOR A SPEAKER
OF ITS SIZE.**

To minimize diffraction, the drivers of the Concert 8 and Concert Center are recessed into their front panels and the corners of the baffles and enclosures are rounded. The recess surrounding the Concert Center's midrange driver is especially deep, forming a horn-like sound director. One effect of this structure is to improve the driver's response at the low end of its range. Others are to restrict its coverage to the listening area and minimize wall reflections (both standard design goals for center speakers).

The Concert 8's port tube, 6 inches long and 2½ inches in diameter, is flared at each end and exits near the top of the rear panel. The woofer has a very rigid but light die-cast magnesium diaphragm with a rubber surround. Its most interesting feature is the solid-copper phase plug in the center of the cone. The plug takes the place of a dustcap but is attached to the driver's center pole so that, unlike a dustcap, it does not move with the cone. It is said to reduce distortion caused by cone breakup and eddy currents and to improve cooling by increasing heat transfer from the voice coil. The phase plug is also said to smooth the driver's upper-midrange response. The Concert 8's tweeter has a coated cloth diaphragm and is ferrofluid-cooled.

The Concert Center is an aperiodic design—essentially, a box with a highly resistive vent formed by narrow rear-panel slots whose total area is roughly 20% that of the woofers' diaphragms. This enables the use of relatively large drivers in a small cabinet. The woofer diaphragms are of glass fiber, and the magnets are shielded to allow placement directly on or below a TV. Although the Concert Center's tweeter is different from the Concert 8's, it also has a coated cloth diaphragm and ferrofluid cooling; both it and the dome midrange have high-energy neodymium magnets.

The crossovers for the Concert series speakers were designed to smooth their power response and to ensure that the drivers are essentially in phase through the crossover range, which improves vertical coverage and minimizes lobing error. The Concert 8's crossover contains three air-core inductors, four capacitors, and three resistors, hooked up as a second-order low-pass filter (with impedance compensation) and a third-order high-pass. The crossover is mounted to the input-connection panel, directly behind the woofer. Bi-wiring and biamping are supported via large, heavy-duty, gold-plated binding posts on about 1⅜-inch centers. Straps are provided for normal, single-wire operation.

The Concert Center's crossover has a third-order low-pass filter for the woofer, a second-order band-pass for the midrange, and a third-order high-pass for the tweeter. These filters are implemented with four inductors (one iron-core, the rest air-core), four capacitors, and two resistors. The Concert Center's input connections are identical to the Concert 8's.

Measurements

Figure 1 shows the on-axis anechoic frequency response of the Concert 8, with and without its grille, and of the Concert Center (lowered 10 dB for clarity). The

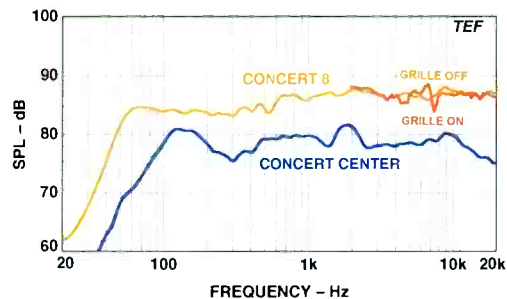


Fig. 1—On-axis frequency response of Concert Center (lowered 10 dB for clarity) and Concert 8.

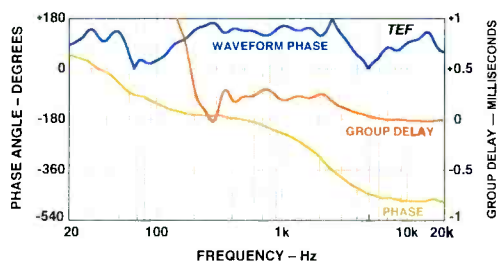


Fig. 2—On-axis phase response, group delay, and waveform phase of Concert 8.

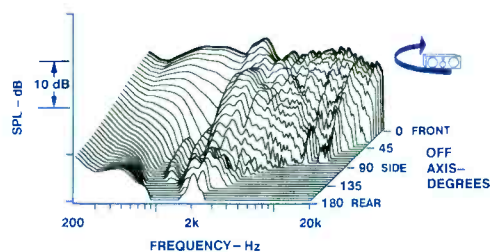


Fig. 3—Horizontal off-axis frequency responses of Concert Center.

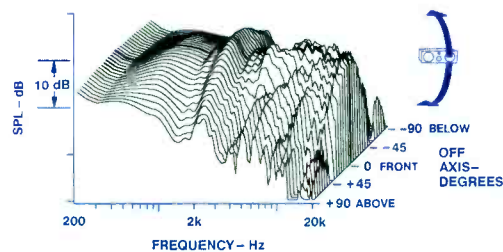


Fig. 4—Vertical off-axis frequency responses of Concert Center.

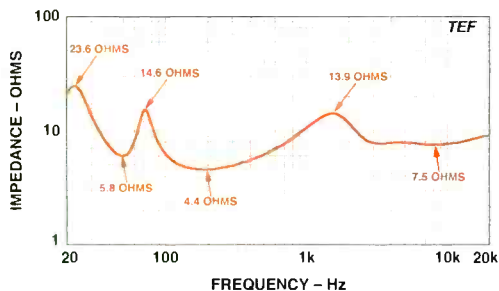


Fig. 5—Impedance magnitude of Concert 8.

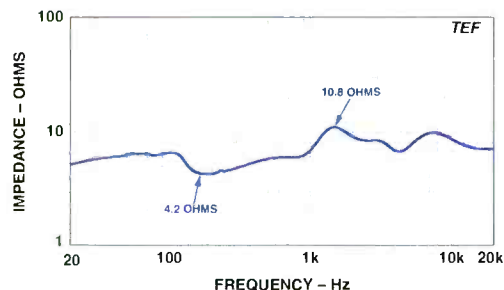


Fig. 6—Impedance magnitude of Concert Center.

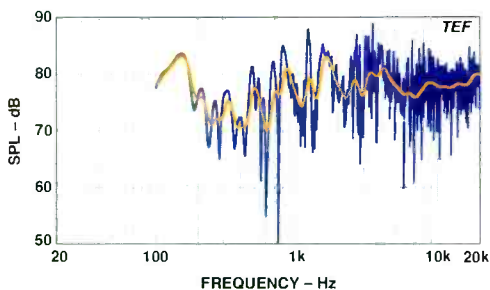


Fig. 7—Three-meter room response of Concert 8.

measurements were taken in a large anechoic chamber at a height halfway between the Concert 8's woofer and tweeter and halfway between the Concert Center's midrange and tweeter. The response below 200 Hz has been corrected according to near-field measurements.

Without the grille, the Concert 8's response is commendably smooth and extended but shelves down about 3 dB below 600 Hz. The overall curve fits a moderately tight, 4.8-dB, window between 54 Hz and 20 kHz. The low-frequency response is flat and extended, about 3 dB lower at 48 Hz than at 200 Hz and down another 3 dB at 43 Hz; that's very good for a speaker of the

Concert 8's size. The grille has only minimal effect on the response; the major deviations are only about ± 2.5 dB in the narrow range between 6 and 8 kHz. The right and left speakers matched reasonably well, within ± 0.5 dB of each other below 4 kHz and within ± 1.5 dB at higher frequencies. Averaged from 250 Hz to 4 kHz, the Concert 8's sensitivity measured 86 dB, 4 dB below Jamo's rating.

The Concert Center's on-axis response is not as smooth and flat as the Concert 8's, occupying a wider, 6.5-dB, window between 82 Hz and 20 kHz. Averaged from 250 Hz to 4 kHz, the Concert Center's sensitivity measured 88.8 dB, 2.2 dB below Jamo's spec.

Figure 2 shows the Concert 8's phase and group-delay responses, referenced to its tweeter's arrival time. The phase curve is well behaved but rotates 240° between 1 and 10 kHz. When averaged between 700 Hz and 2 kHz, the group-delay curve indicates that middle frequencies are delayed about 0.25 millisecond relative to the tweeter range. The curve for waveform phase is not at or near 0° or $\pm 180^\circ$ over any frequency band, which indicates that waveshapes will not be preserved. But this is normal behavior for all but the very few speakers designed specifically to maintain waveform phase.

The Concert 8's horizontal and vertical on- and off-axis responses were very well behaved. Horizontally, the response was quite broad and even, with extended off-axis coverage to above 16 kHz. Vertically, the response was very uniform from on-axis to 15° above and was essentially flat through the crossover region. At 15° below axis, a moderate, octave-wide dip developed between 2 and 4 kHz.

The Concert Center's horizontal off-axis response is shown in Fig. 3. (The bold curve at the rear of the graph is the on-axis response.) Like most center-channel designs, this speaker has significantly greater directivity (narrower coverage) than speakers designed for stereo music listening, primarily because of the wide spacing between the

woofers, which operate together below 1.1 kHz. The most significant anomaly is an abrupt widening of the response just above the lower, 1.1-kHz, crossover, where the wavelengths are too great for the horn recess to control their directivity. The high-frequency coverage, on the other hand, is quite even and extended.

The Concert Center's vertical off-axis response is shown in Fig. 4. (The bold curve in the center of the graph is the on-axis response.) Note that the coverage is quite broad below 3 kHz, as compared to the horizontal off-axis radiation seen in Fig. 3. At



The Jamo Concert 8's woofer phase plug is its most striking feature.

RECESSED DRIVERS AND ROUNDED CORNERS IN THE CONCERT SERIES SPEAKERS MINIMIZE DIFFRACTION.

higher frequencies, in the tweeter's range, the vertical and horizontal coverages are essentially the same and quite well behaved.

Figure 5 shows the Concert 8's impedance magnitude versus frequency. There are no surprises here. The two peaks below 100 Hz are the hallmarks of a vented enclosure; the 5.8-ohm dip between them indicates the speaker's tuning frequency, 50 Hz. Because the Concert 8's minimum impedance is 4.4 ohms and its maximum is 23.6 ohms, the overall impedance variation is a moderately high 5.4 to 1 (23.6 divided by 4.4). So, for example, if you want to keep cable-drop effects from causing response variations greater than 0.1 dB, cable series resistance should be limited to about 0.063 ohm or



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The port tube of the Concert 8 is flared to reduce wind noise.

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WERE ALL QUITE SOLID
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less. For a typical run of about 10 feet, 12-gauge (or larger), low-inductance cable would suffice.

The Concert Center's impedance magnitude is shown in Fig. 6. The variation is significantly less than for the Concert 8—a relatively low 2.6 to 1 (10.8 ohms divided by 4.2 ohms). The impedance is also uncharacteristically flat below 100 Hz, varying only from 5 to 6.3 ohms, because of the speaker's aperiodic enclosure design.

The Concert 8's raw and smoothed 3-meter room responses (Fig. 7) were taken in my listening room, rather than my home theater, for comparison with the room responses I've measured for other speakers. The Jamo was in the right-channel stereo position; the test microphone was at ear height (36 inches), at my listening position on the sofa. If you exclude the peak at 1.6 kHz, the smoothed curve fits a tight, 6.5-dB, window from 650 Hz to 20 kHz. Overall, the smoothed curve fits a looser, 13-dB, window, including all peaks and dips.

Figure 8 shows the Concert 8's G_1 (49-Hz) harmonic distortion, with input power ranging from 0.05 to 50 watts. The second harmonic reaches only a low 7.7%, while the third rises to just 2%. Higher harmonics are 0.8% or lower. Interestingly, the third harmonic did not decrease at lower levels but remained in the 1% to 2% range. The low distortion at G_1 is because its frequen-

cy, 49 Hz, coincides almost exactly with the Concert 8's tuning frequency of 50 Hz.

The E_1 (41.2-Hz) tone I usually use for this test is significantly below the Concert 8's tuning frequency and thus caused excessive distortion. With 50 watts input, the second-harmonic distortion at this frequency reached nearly 100%; the third harmonic was 17%.

Distortion for A_2 (110 Hz), well above the Concert 8's tuning frequency, rose to only 8.6% second harmonic and 4.5% third, with higher harmonics below 1.4%. The A_4 (440-Hz) harmonic distortion was very low, 0.4% or less.

The Concert Center's 50-watt harmonic distortion at G_1 (49 Hz) rose to 6.3% second, a high 46% third, and 8.2% fourth, with higher harmonics less than 1%. Raising the test frequency one-third octave, to 63 Hz, reduced the harmonic distortion readings to the more reasonable levels of 3.4% second, 12.6% third, and 2% fourth.

The Concert 8's cabinet is quite solid: A high-level sine-wave sweep caused minimal vibration except at about 340 Hz, where the side walls vibrated noticeably. The woofer overloaded quite gracefully and exhibited a maximum excursion of about 0.5 inch, peak to peak. Significant dynamic distortion was evident just below the 50-Hz box resonance and above 80 Hz, where the cone displaced outward. A healthy reduction in excursion occurred at the speaker's resonance. Some chuffing was evident from the ports.

The Concert Center also has a very solid cabinet, although I noticed some side-wall vibration at about 230 Hz. I heard significant buzzing and chuffing from the ports between 60 and 80 Hz at high input levels with test signals. The woofers' maximum excursion was about 0.3 inch, peak to peak.

I measured only the Concert 8's short-term peak power input and output (Fig. 9). The peak input power starts low, 8 watts at 20 Hz, and then rises very rapidly to 400 watts at 50 Hz, the speaker's tuning frequency. After a slight fall to 230 watts at 70 Hz, the power handling rises quickly to the speaker's maximum of 7.2 kilowatts above 600 Hz. Between 80 and 160 Hz, the woofer

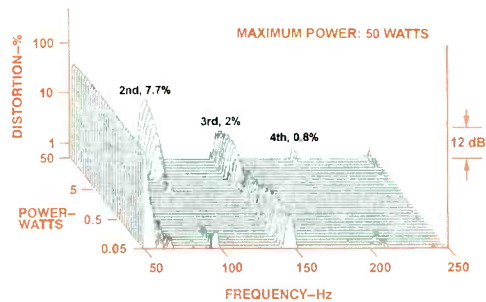


Fig. 8—Harmonic distortion for G_1 (49 Hz) of Concert 8.

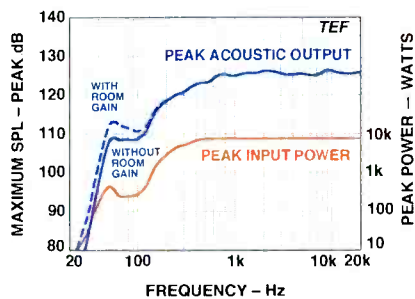


Fig. 9—Maximum peak input power and sound output, Concert 8.

exhibited significant dynamic offset, with the cone moving outward.

With room gain included, the Concert 8's peak acoustic output starts at an unusably low 78 dB at 20 Hz, rises very rapidly (passing through 100 dB at 42 Hz and 110 dB at 46 Hz), and reaches a healthy peak of 113 dB at 55 Hz. After a slight decrease to 110.5 dB (at 100 Hz), the output sound pressure level rises rapidly up to about 125 dB above 600 Hz, passing through 120 dB at 250 Hz.

Use and Listening Tests

The Concert 8s, which came to me in the mahogany finish, looked gorgeous and seemed very substantial and well built. They looked even more distinctive without their grilles, thanks to the shiny machined-copper phase plug in the center of each woofer's light-colored cone. Every detail, from the screws in the tweeter flanges to the terminals on the rear, contributed to their elegance.

Naturally, I was quite curious to find out if the Concert 8s sounded as good as they looked. I was not disappointed. Played as stereo music speakers, they stood out from

the pack of other small bookshelf systems, possessing a smooth, extended response that competed very well with the output from much larger systems. I was particularly impressed with the quality and quantity of the bass, which was exceptional considering the Concert 8's size. They weren't bass-shy, as many small speakers are.

The Concert Center clearly is cut from the same cloth as the Concert 8, though it did not look quite as distinctive, particularly without its grille. Both use the same gold-plated terminals, whose large, 1/4-inch holes can take wires of jumper-cable size. The terminals are not spaced on the standard 3/4-inch centers that would enable them to accept double-banana plugs, but I discovered that you can wedge such plugs securely between the terminals' shafts. (European safety rules forbid 3/4-inch terminal spacing, as that's too close to the spacing of many European AC power plugs and sockets.)

At 122 pages, Jamo's instruction manual for the Concert series speakers looks impressively thick—until you realize its information is repeated in eight different languages (English, Danish, Dutch, German, French, Swedish, Spanish, and Chinese!); it would make a good Rosetta Stone for language reference. The 18-page English section is well written, informative, and very thorough—one of the best manuals I've seen. (The Surround Ones' 64-page multilingual manual—of which 10 pages are in English—was also quite detailed and helpful.)

I first listened to the Concert 8s as standard stereo speakers. I placed them as Jamo's manual suggests, allowing a minimum of 12 inches to the wall behind them and at least 30 to 40 inches to the side walls, and toeing them in toward my listening position. I was immediately impressed with the Concert 8's smooth and balanced sound, extended broad-coverage high-frequency response, and even bass response, which made it sound like a significantly larger system. Small speakers often make you want to turn up the bass because the speaker sounds rather anemic on its own. This was not the case with the Concert 8s, which sounded well balanced.

The Concert 8s sounded as smooth as the B&W 801 Matrix Series 3 speakers I use for comparisons but had a slightly elevated high end that made them sound crisper and

more open. Only on program material with high levels of low bass did the B&Ws beat the Jamos. The Concert 8s and the B&Ws had essentially equal sensitivity. The Concert 8s reproduced female vocals quite faithfully, with no harshness and only a slight emphasis on sibilants when compared to the B&Ws. Their imaging and soundstaging could not be faulted.

On pink noise, the Concert 8's upper-midrange balance did not change significantly when I stood up, which is very good. On third-octave, band-limited pink noise, the Concert 8s exhibited strong output from 50 Hz up, with quite usable output down to 40 Hz. When the speakers were driven hard, dynamic offset caused significant outward cone displacement in the 40-, 80-, and 100-Hz bands, accompanied by a sudden increase in second-harmonic distortion. And at levels that caused large cone excursions, I heard some chuffing sounds from air moving around the copper phase plugs.

After my initial stereo music listening, I transferred the Concert 8s to my home theater and set them up with the Concert Center and the Surround Ones. The Concert 8s



**I WAS VERY SATISFIED
WITH THE JAMOS,
BOTH FOR STEREO MUSIC
AND HOME THEATER USE.**

were placed 20 inches to either side of a 52-inch rear-projection TV, and the Concert Center was centered on top of it. The Surround Ones were mounted to the sides of my chair, somewhat above ear level. The subwoofer was the Boston Acoustics VR-2000 that I reviewed in the January issue. Aside from the speakers and a Sony VCR, all the audio/video equipment in this system was Pioneer Elite.

The Jamo speakers were installed in my home theater long enough for me to become familiar with their capabilities on a wide variety of material. The Concert Center performed flawlessly on most, reproducing both male and female voices intelligibly and realistically. Compared with the KEF Model 200C center-channel speaker I normally use, the Concert Center did exhibit some slight upper-midrange tonal differences, primarily when I listened to network anchorwomen. On male voices, it sounded fairly dry and analytical, with no chestiness or tubbiness; Jamo's aperiodic design seems to have paid off well here.

The Concert 8s also performed strongly in their home theater role. On soundtracks with dynamic sound effects (such as *Top Gun's* jet fighters), the Concert 8s, Concert Center, and Surround Ones rose to the occasion, reproducing them loudly and cleanly. The Surround Ones did everything they were supposed to do, creating a properly diffuse surround sound field that contributed greatly to the realism of soundtracks.

Music CDs also sounded very good through the Jamo home theater setup. I am still surprised at the large increase in realism often provided by playing music recordings through a Dolby Pro Logic decoder in a good home theater system. Live concert recordings, especially those with audience sounds and clapping, are tremendously enhanced. Having soloists actually come out of the center also improves the presentation greatly.

I am very satisfied with these Jamo speakers, both for stereo music and home theater use. I was particularly impressed with the Concert 8s' wide, smooth response and well-balanced sound, coupled with impressive bass output for their size. The bass was solid and strong when called for, without boominess, and the Jamos competed very well with my reference systems over the rest of the audio range. The Concert Center and Surround Ones were equally adept at bringing out all the best qualities of movie soundtracks. The Concert speakers also boast first-rate looks and construction, suitable for display in any home entertainment system. If you desire speakers with a true high-end pedigree and features suited for both stereo and home theater reproduction, you need look no farther than the Jamo Concert 8 and Concert Center. **A**

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CARVER A-760x AMPLIFIER



Is it a contradiction to speak of a design as both innovative and traditional? In this case, I would say not. The roots of Carver's A-760x Magnified Current THX stereo power amplifier hark back to the past while the product itself looks forward to the future. The most obvious ties to the past are the twin, round analog "power" meters, which are calibrated in decibels and watts. They are the only decoration on an otherwise stark front panel and, as on Carver's previous upscale power amps, add an air of technical seriousness that belies their limited usefulness. Although I'd usually poo-hoo such meters, I must admit that Carver is quite frank about their strengths and weaknesses in its excellent owner's manual. After describing their calibration and ballistics (average-reading with fixed overshoot), it concludes that "the best way to tell whether the amplifier is overloading is simply to listen." I concur—but the warm glow of the meters does remind me of a simpler time.

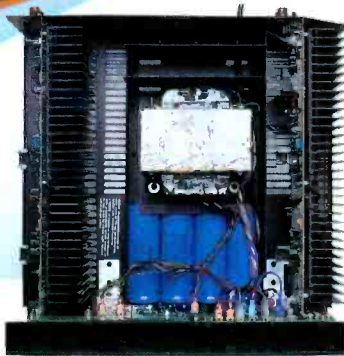
The only controls on the front panel are a heavy-duty power rocker and two buttons for the meters. One of these controls the meter illumination; the other changes the meter range by a factor of 10, so that 0 dB corresponds to 38 watts with "Range" depressed and to 380 watts with the button released. The scale extends to +3 dB (78 or 780 watts) to leave room for overshoot. All power readings are calibrated assuming 8-ohm loads, however; the meters themselves read output voltage, not power directly.

The back panel is equally simple: one pair of binding posts per channel, gold-plated RCA input jacks for each, and separate left and right finger-adjusted controls to vary voltage gain. (When the controls are advanced fully, the A-760x adheres to Lucasfilm's Home THX specifications.) There's also a switch to bridge the two channels into one for mono operation, which almost quadruples the power avail-

able into a single 8-ohm load. In bridged monophonic operation, the left-channel RCA jack is used as the input and the two red binding posts serve as the output, with left-channel red being "positive."

The A-760x's binding posts accept bare wire and standard banana plugs but are spaced 1 inch apart instead of $\frac{3}{4}$ inch, so they can't be used with dual-banana connectors. The manual says this is done "to comply with international safety standards" and has been Carver's practice for some years now. Compatibility with international requirements being the concern, it's a little strange to find the A-760x equipped with a fixed two-wire line cord for the United States rather than a detachable IEC power cord.

In design and construction, the A-760x shares the tradition of the well-respected AV-705x. Signal paths have been kept as short as possible to minimize the impact of electromagnetic interference and the "cu-



mulative reactance in the critical signal conductors," and the amplifier is assembled from modules, which reduces manufacturing cost without impairing quality. In fact, one can make a strong argument that modularity improves quality, since circuitry can be tested initially on a subassembly basis and accepted or reject-

ed at that level. In the A-760x (as in the AV-705x), input and output connectors are

Rated Power: Stereo, 380 watts per channel into 8 ohms, 600 watts per channel into 4 ohms; bridged, 1,200 watts into 8 ohms.

Distortion: THD, less than 0.08%; SMPTE IM, less than 0.03%; CCIF IM, less than 0.01%.

Dimensions: With handles, 19 in. W x 5 $\frac{3}{4}$ in. H x 18 $\frac{3}{4}$ in. D (48.3 cm x 14.6 cm x 47.8 cm); without handles, 17 in. W x 17 $\frac{3}{4}$ in. D (43.2 cm x 45.2 cm).

Weight: 39 lbs. (17.7 kg).

Price: \$1,299.

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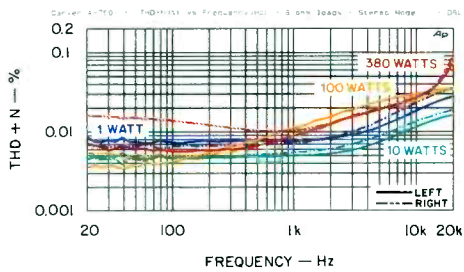


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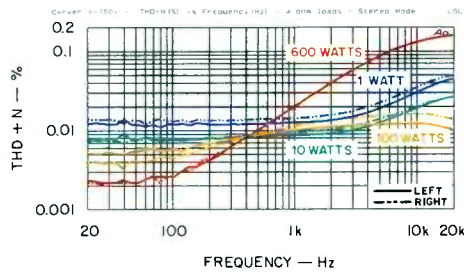
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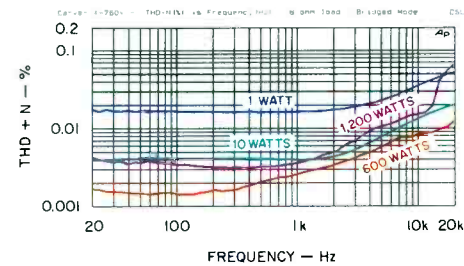
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A



B



C

Fig. 1—THD + N vs. frequency at four output levels in stereo mode into 8 ohms (A), in stereo mode into 4 ohms (B), and in bridged mode into 8 ohms (C).

mounted directly on the circuit board and simply poke through holes in the back panel, so an entire amplifier channel can be plugged into a test jig and evaluated prior to installation in the chassis.

Of exceptional importance, to my way of thinking, is Carver's Total Direct Coupling (TDC) output topology. It does away with the series inductor that's usually interposed between the output transistors and the loudspeaker, to "protect" the output stage from a wayward load. Such output inductors are really nothing but crutches that enable an amplifier of limited open-loop bandwidth to use a lot of overall feedback to reduce distortion and still remain stable when driving a reactive load. The downside of using an output inductor is that the output impedance rises with frequency, which can result in audible response aberrations when driving real loudspeakers.

Excuse my soapbox; I've been on this kick for some time because I think the bad rap that's been given to global feedback results at least in part from the side effects of using output inductors—not to the feedback per se—and I was glad when Lucasfilm picked up the cudgel and limited the permissible high-frequency output impedance of THX-certified amplifiers. (Unfortunately, many of them don't meet the requirement on my test bench, but that's another story.)

There's no secret regarding what's needed to design an amplifier that doesn't require an output inductor. It's just good engineering: using very fast transistors to ensure a wide open-loop bandwidth (I'm told that of the A-760x extends to beyond 20 kHz), using local feedback to control distortion within the loop, and limiting the amount of global feedback to an amount adequate to lower output impedance and keep the overall distortion within reasonable bounds, without going hog wild and counting on global feedback to cure poor design elsewhere.

I don't have a schematic for the A-760x, but I'll bet dollars to donuts that the Carver elves have done something similar to what I've described. I do know that they took special care in selecting high-speed, low-noise transistors for the front end. Each channel's output stage uses ten 150-watt Motorola triple-diffused planar bipolar transistors (five from the positive supply, five from the negative), yielding a combined safe operating capability of 1,500 watts per channel.

The power supplies in the A-760x bear a resemblance to those in Carver's Lightstar amplifiers but differ in that the A-760x's Magnified Current power source simply supplies two tiers of rail voltages, whereas Lightstar rail voltages follow the audio signal itself more or less continuously. According to the manual, the supply "uses two 160 amp peak current power MOS-FETs per channel, with nanosecond switching speed to assign twice the continuous voltage to the output stage when high voltages are required, or more than twice the continuous

current when higher current is needed. This maximizes both the voltage and current (peak or continuous) available for any loudspeaker load, even those that have a substantial reactive component that is difficult for conventional amplifiers to drive."

Indeed, the A-760x's ratings are impressive, and the amplifier is almost indifferent to load impedance. It's specified to deliver 380 watts per channel into 8 ohms (20 Hz to 20 kHz with less than 0.08% THD), 600 watts per channel into 4 ohms, and 1,200 watts into 8 ohms when bridged. This greatly exceeds Lucasfilm's minimum requirements for Home THX certification. Carver says it employs "precision passive components. . . in all critical signal paths" (read, no electrolytics in the signal path), "fully-complementary differential circuitry using low-noise, high-speed transistors throughout," and a "double-stage ground isolation system [that] prevents ground loops and RF interference."

Measurements

The Carver A-760x was simply outstanding on my test bench. Rarely have I seen a product meet or exceed virtually every one of its specifications as handily as this. The only two specifications it missed—and then by hardly a smidgen—were A-weighted noise (which I measured at -94.7 dBW, worst case, compared with a -95 dBW specification) and THD at rated power into 8-ohm loads, which, worst case, hit 0.0863% at 20 kHz in the right channel compared with a 0.08% claim. Needless to say, I don't consider these serious discrepancies.

As you can see in Fig. 1A, which plots total harmonic distortion plus noise (THD + N) versus frequency in both channels at 1 watt, 10 watts, 100 watts, and rated power (380 watts) into 8 ohms, the Carver's distortion stays under 0.03% to 10 kHz under any condition, and the left channel clears the 0.08% specification at rated power even at 20 kHz. These measurements (and all others) were made with the level controls fully advanced, yielding the THX-required gain and sensitivity.

Figure 1B shows THD + N versus frequency in the stereo mode with 4-ohm loads. Curves were again taken at 1, 10, and 100 watts and at rated output (600 watts per channel). Distortion remains under 0.05% at all frequencies and power levels

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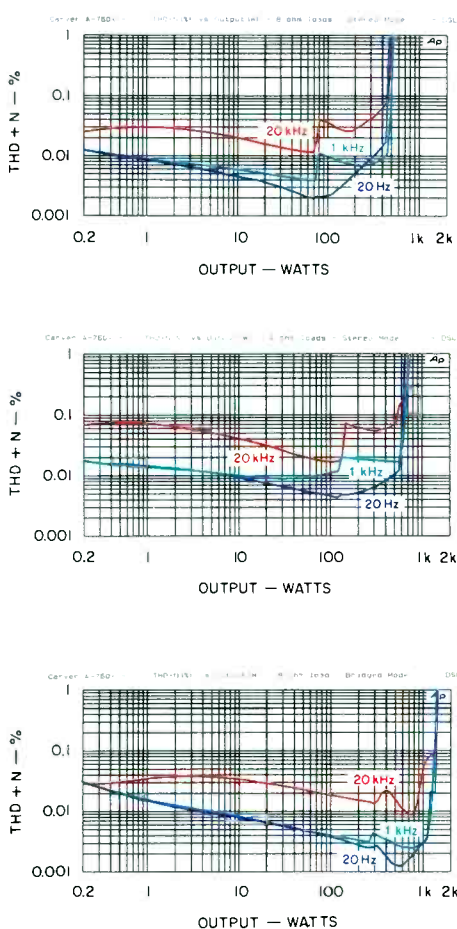


Fig. 2—THD + N for three frequencies in stereo mode into 8 ohms (A), in stereo mode into 4 ohms (B), and in bridged mode into 8 ohms (C).

up to 100 watts per channel. However, as you can see, it climbs to 0.161% at 20 kHz with the amp putting out 600 watts per channel. Let me tell you, that's a heck of a lot of power, and I had the lights and every unnecessary piece of test equipment in the lab turned off to keep the line voltage up. Even then, it was impossible to maintain a 120-volt line with my 20-amp Variac, and I was forced to scale the numbers to account for the line voltage drop.

I find Fig. 1C particularly interesting, especially when compared with Fig. 1B. Figure 1C shows distortion when operating the A-760x in bridged mode into an 8-ohm load. Technically, bridged operation into 8 ohms is similar to stereo operation into 4 ohms, in that the same total power is available and the output stages function with the same voltage and current swings. But per-

formance usually is worse in bridged mode because both channels contribute to distortion, noise, response irregularities, and so forth. For the most part, that wasn't the case with the A-760x.

As you can tell from Fig. 1C, distortion at high output levels is actually better (lower) when operating the amplifier bridged than when operating it in stereo, and the A-760x delivers 1,200 watts with distortion levels under 0.02% to frequencies in excess of 10 kHz. Even at 20 kHz, distortion is less than 0.07%! I can't recall seeing performance like this before, and I'm most impressed. I'm not certain why there is more distortion with stereo operation into 4 ohms than with bridged operation into 8, but I suspect it may have to do with the different way my 2-kilowatt load bank was configured for the two tests. When handling these kinds of currents at 20 kHz, it's not unknown for connections themselves to cause measurable distortion. If this, in fact, occurred, the A-760x is even better than my tests indicate.

Figures 2A through 2C show THD + N versus output at 20 Hz, 1 kHz, and 20 kHz into 8- and 4-ohm loads in stereo and into an 8-ohm load in bridged operation. The stereo curves were taken with both channels driven and the left channel measured.

(Data taken on the right was the same.) The seeming discontinuities in the curves are typical of amplifiers that use switched power-supply rails (a.k.a. Class H), as this one does. What's surprising about these curves is how well behaved the discontinuities are, their virtual absence in the 20-Hz curves, and the rather consistently low distortion right up to the clipping point. Based on these curves, the 1-kHz clipping point (1% THD) occurs when the amp delivers 500 watts per channel into 8 ohms, 725 watts per channel into 4 ohms, and when bridged an incredible 1,500 watts into 8 ohms.

With the IHF dynamic-headroom tone burst, stereo output power climbed to 560 watts per channel (8 ohms), 935 watts per channel (4 ohms), and nearly 1,500 watts per channel into 2 ohms—well above Carver's 2-ohm dynamic power rating of 1,150

MEASURED DATA

Data taken on one channel is for the left except for THD + N, frequency response, S/N, and separation, which are for the worse channel. Unless noted, data was taken with 8-ohm loads in stereo, both channels driven. Data for output power at clipping and for THD + N at rated power has been adjusted for sagging line voltage.

Output Power at Clipping (1% THD at 1 kHz): Stereo mode, 500 watts/channel (27 dBW) into 8 ohms and 725 watts/channel (28.6 dBW) into 4 ohms; bridged mono, 1,500 watts (31.8 dBW) into 8 ohms.

Dynamic Output Power: Stereo mode, 560 watts/channel (27.5 dBW) into 8 ohms, 935 watts/channel (29.7 dBW) into 4 ohms, and 1,480 watts/channel (31.7 dBW) into 2 ohms; bridged mono, 1,900 watts (32.8 dBW) into 8 ohms.

Dynamic Headroom: Referred to 8-ohm stereo rating, +1.7 dB; re 4-ohm stereo rating, +1.9 dB; re 8-ohm bridged mono rating, +2 dB.

THD + N, 20 Hz to 20 kHz: 8-ohm stereo loads, less than 0.086% at rated output and less than 0.019% at 10 watts/channel out; 4-ohm stereo loads, less than 0.161% at rated output and less than 0.027% at 10 watts/channel out; bridged mono into 8-ohm load, less than 0.067% at rated output and less than 0.021% at 10 watts out.

Damping Factor re 8-Ohm Load: 750.

Output Impedance: 11.2 milliohms at 1 kHz, 12.1 milliohms at 5 kHz, 14 milliohms at 10 kHz, and 17.4 milliohms at 20 kHz.

Frequency Response: 20 Hz to 20 kHz, +0, -0.09 dB (-3 dB below 10 Hz and at 142 kHz).

Sensitivity: 101 mV for 1 watt (0 dBW) output and 1.97 V for rated output.

A-Weighted Noise: Left channel, -94.7 dBW; right channel, -94.8 dBW.

Input Impedance: 50.8 kilohms.

Channel Separation, 100 Hz to 10 kHz: Greater than 57.3 dB.

Channel Balance: ±0.12 dB.

watts per channel. Bridged for mono, the A-760x delivered nearly 2 kilowatts of dynamic power into 8 ohms!

I measured output impedance and damping factor on the left channel in stereo mode. (There's no reason to believe the right was any different, so in the bridged mode the output impedance should theoretically double and damping factor drop

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Brent Butterworth- *Home Theater* (February 1997)

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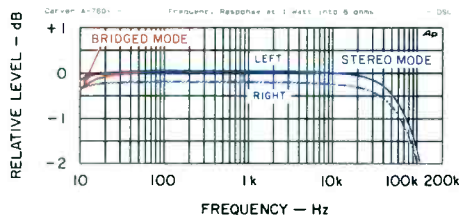


Fig. 3—Frequency response.

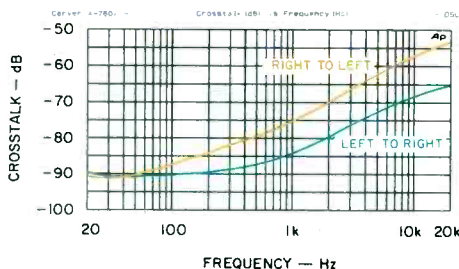


Fig. 4—Channel separation.

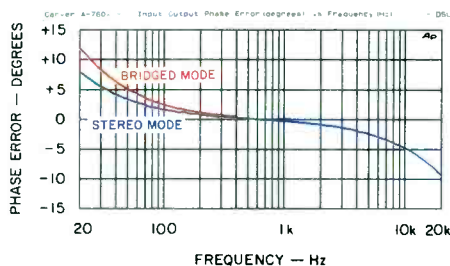


Fig. 5—Input/output phase difference.

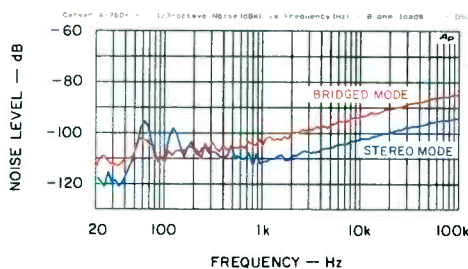


Fig. 6—Noise spectra.

by half.) I cannot remember ever measuring an amplifier with such a uniform output impedance and high damping factor. (The two are related in that damping factor is calculated by dividing the output impedance into the nominal load impedance, i.e., 8 ohms.) In this respect, the A-760x is in a class by itself, and I expect it will reveal the true frequency response of every loudspeaker that it drives.

The amplifier's own frequency response (shown with expanded scale in Fig. 3) is stellar. The -3 dB high-frequency limit extends to nearly 150 kHz, and the response in the audio band is within $+0, -0.09$ dB. Even more outstanding is the infinitesimal difference in response between stereo and bridged operation. Even on the expanded scale of Fig. 3, the two curves overlaid nearly perfectly; there's no difference whatsoever in the treble region (where there usually is), and the difference at 20 Hz amounts to only a few hundredths of a decibel.

Sensitivity in the stereo mode was right on the THX target (see "Measured Data"); when bridged, the amp had 6 dB more gain. Input impedance was high (many power amps come in at 10 kilohms or less in an attempt to reduce noise), and channel separation was adequate for all practical purposes. As the crosstalk curves of Fig. 4 indicate, channel separation at 1 kHz easily beats Carver's 70-dB specification, although it gradually diminishes at higher frequencies.

Since Carver chose to specify input/output phase difference, I decided to measure it in both the stereo and bridged modes. In stereo, the left and right channels were identical, so only the left is presented in Fig. 5. It handily beats Carver's tolerance of $\pm 10^\circ$. The noise spectrum analyses of Fig. 6, taken for both modes of operation, suggest that the noise floor is essentially "white," with rather small amounts of power-line-related hum at 60 and 120 Hz in the stereo measurements. The hum components are virtually absent when the amp is operated in bridged mode, although the lie of the curve is some 10 dB higher. (Six of those 10 dB are accounted for by the difference in gain.)

Use and Listening Tests

In the lab, I was surprised at how cool the A-760x ran. I mean, the top cover got toasty warm, but considering the amount of power I was dragging out of it, I would have expected a lot more heat. Furthermore, this

amp is convection-cooled—no noisy fans, thank heavens. The A-760x's cool operation is undoubtedly due to its Magnified Current (Class-H) topology, which is much more efficient than conventional designs.

I also blessed Carver heartily when it came to moving the amp from the lab to the listening room. At 39 pounds, it's really not heavy for a beast this powerful, and the handles make transporting it a breeze. With the handles, the front panel is 19 inches wide, but I'm not sure I'd try to rack-mount the package. The handles and wings to which they're attached are removable; doing so narrows the front panel to 17 inches, so the amp will fit easily on a shelf with other standard-width equipment.

I admit to having mixed feelings about Class H. I admire the efficiency, but I sometimes find the sound rather fatiguing. I didn't with the Carver A-760x. The sound was wonderful—transparent and effortless with anything I tossed at it and with the several different speakers I had at my disposal. Any way you look at it, this is a clean, powerful amplifier with virtually unlimited resources; it never wimps out. And although the speakers I had in house at the time were not particularly difficult to drive, I do believe that the A-760x will prove able to drive almost any speaker, for good or ill, to its fullest potential.

I recall a number of years ago recording my friend and neighbor, Igor Kipnis, in his home studio playing his favorite harpsichord, "Big Red." That was back in the early days of digital recording, and I wanted to see if I could hear a difference between digital and analog tapes recorded simultaneously using the same microphones and electronics. So did he, since he has an abiding interest in good sound.

Well, I made the recordings, we played them back, and we both agreed that the analog was much better—smoother, nicer, more "real." Fine, except for one thing. When I asked Igor to play again and I stood where the microphones were and compared each recording with the actual sound of the harpsichord heard by the microphones, the digital recording was much more accurate—pleasant, no, but accurate, yes. My point is that an amplifier like the Carver A-760x may reveal things you'd rather keep hidden. But, I ask you, isn't that what an amplifier should do? A

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makes Mark Levinson equipment, has long been a leader in digital technology, and every aspect of the No. 31.5 reflects this. The company's emphasis on digital engineering helps explain why many people felt the earlier Mark Levinson No. 31 was a leading contender for the title of best CD transport at any price. The No. 31.5 retains many of the No. 31's attributes, including its disc-clamping system. And the earlier model's isolated suspension has been enhanced in the No. 31.5 to float the disc, spindle, and laser pickup system within an 11-pound lead

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ring that rests on its own secondary suspension.

The 31.5 provides technophiliacs with a number of new features. These include a ruggedized version of the well-proven Philips CDM-12 double-speed CD-ROM mechanism, but with a CD-ROM controller whose oscillator precision is rated as accurate within 5 parts per million (ppm) instead of the 1,000-ppm oscillator that is standard with the CDM-12. The 31.5 also has an advanced all-digital servo and servo interface to get the best possible performance out of the CDM-12.

Further, the No. 31.5 has internal digital signal processing (DSP). The RF signal from the laser system is decoded into digital audio by a semi-custom gate array. The data is then transferred to an Analog Devices DSP chip that reads the subcodes in the data stream to provide faster control switching and time, index, and table-of-contents display information. Since the subcodes are used only by the transport, not the D/A converter, the 31.5 replaces the subcode data in the outgoing bitstream with purely random data. After extensive tests, Madrigal concluded that this produced better imaging and small-detail dynamics than leaving the original subcodes or replacing them with quasi-random codes.

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CIRCLE NO. 12 ON READER SERVICE CARD

its remote control; there's even a new, more gentle, lid assembly.

If you are of the Ferrari school of audio and crave ne plus ultra equipment simply so that you can have the best technology around, the 31.5's new set of technical bells and whistles should please you. What's more, if you already have a 31, you can upgrade it to a 31.5—which itself was designed with further upgrades in mind (including potential conversion to a CD/DVD transport).

But if you lack infinite wealth, you should consider whether the No. 31.5 offers sound quality to match its technology. After all, most audiophiles have to make reasoned trade-offs between sound quality, desire, and bankruptcy. That being the case, are the sonic benefits of the 31.5 worth the substantial investment?

The answer is yes for those well-heeled audiophiles who already own the \$15,950 Mark Levinson No. 30.5 D/A converter, particularly if they also have a No. 31 transport. The synergy that often exists between the same manufacturer's CD transport and D/A converter is readily apparent in the sound of the 31.5 transport and 30.5 D/A converter working harmoniously together.

Many regarded the earlier No. 31 and No. 30 combination as the best CD front end available. I found that combination to be slightly lacking in dynamics and bass energy, but, as I stated in my review in the March 1995 issue, the upgrade of the No. 30 to the No. 30.5 did much to solve these problems. The 31.5 completes the process. Some top-ranking CD combinations are still slightly more dynamic, and many have more bass energy. However, if your taste runs to natural musical dynamics and accurate bass detail rather than mere bass power, I know of no current CD front end that offers more realistic musical dynamics and bass reproduction.

With the AES/EBU balanced electrical connection and a high-quality interconnect, the 30.5 and 31.5 offered significantly more low-level detail than their predecessors. This was quite apparent on quality pop CDs, such as those from Emmy Lou Harris, Sting, and Barbra Streisand.

As a classical music buff, however, what I found most striking was the subtle improvement the 30.5 and 31.5 made in upper-octave harmonics, soundstage detail, and reproduction of solo instruments. I can almost guarantee you'll hear the difference in recordings of violin, piano, or harpsichord (a problem instrument for CD) as well as in recordings of massed voices and strings. I was particularly struck by the 30.5 and 31.5's outstanding ability to reproduce the subtle timbral information that distinguishes specific makes and generations of musical instruments.

The soundstage created by the No. 30.5 and 31.5 was superb. While some competitors present the soundstage in a different—but equally convincing—form, I have yet to hear any CD front end do a better job of revealing the soundstage detail that is actually on a recording.

Some CD front ends seem to be at their best only with audiophile-quality recordings (a phenomenon I can't explain), but this Mark Levinson combination retains the earlier Levinson models' ability to get the best out of old, lower-quality CDs. The No. 30.5 and No. 31.5 usually improved the sound of run-of-the-mill CDs—a not inconsiderable advantage, since average recordings often boast the best performances.

So if you already own a Mark Levinson No. 30.5 D/A converter and can afford a 31.5 CD transport, your decision is simple. Otherwise, the key issue becomes whether you can afford the 31.5 and what D/A converter you intend to use it with.

Economically challenged audiophiles will want to consider the merits of the Mark

Levinson No. 31.5 relative to those of the numerous CD transports that provide fine sound at considerably lower prices. There is, for example, Mark Levinson's No. 37, at \$3,995 (not to mention the \$5,995 No. 39 CD player, which uses much of the same technology found in the company's separates). I also recommend the PS Audio Lambda Two and the Theta Digital Data Basic II (each about \$2,000). Additionally, very good transports are available from Classé Audio (the CDT-1, for \$2,495), Sonic Frontiers (the SFT-1, at \$2,295), and Wadia Digital (the Wadia 20, at \$4,500). Theta Digital's Data III (\$4,500) is not only an excellent CD transport but an outstanding laserdisc player as well.

The most you can expect from the best CD transports is a relatively subtle improvement in bass definition and dynamics, transient definition, and low-level detail. A very good D/A converter and speaker are required to hear the differences between very good, excellent, and state-of-the-art transports. If I were forced to make a choice, I'd almost always invest in a better D/A converter and speakers and make a compromise with the transport, where sonic differences are much less significant.

The Mark Levinson No. 30.5 D/A converter sounded consistently better with mid-priced transports than the No. 31.5 transport did with mid-priced converters. I heard roughly the same quality of sound when I listened to the No. 31.5 with the Meridian 565 and Wadia 27 as I did when I connected it to the much more expensive Levinson 30.5. But while the Theta Digital DS Pro Generation V-a Balanced D/A converter sounded very good with the 31.5 transport, it sounded just as good with Theta's own much lower-priced Data III transport when I used Theta's proprietary optical interface to connect the two. The slight sonic differences I heard between the Theta/Levinson and the Theta/Theta combinations were not musically consequential. This demonstrates that experimentation is required with different types of digital connection. You cannot assume that the No. 31.5 will outperform another manufacturer's transport with the same manufacturer's D/A converter.

The Mark Levinson No. 31.5 produced some sonic improvements with other mid-priced D/A converters, but these varied by



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brand and model. And it quickly became clear that there is no more point in putting a ne plus ultra CD transport into a medium-quality sound system than there is in giving that system an ultra-expensive analog front end. If your D/A converter is more "lovable" than accurate or has significant colorations, you probably will get equal performance from a less expensive transport. I heard little improvement of any kind when I used the No. 31.5 with the kind of "audiophile" D/A converters that attempt to "enhance" CD sound by rolling off the highs, adding their own euphonic colorations, or softening dynamics.

I also found, incidentally, that you can screw up the sound of almost any transport/DAC combination by using the wrong

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kind of digital cable. I would not even begin to audition a transport as good as the No. 31.5 without using an AES/EBU or RCA coaxial cable that I knew met all of the relevant technical specifications. A good cable manufacturer will make it clear that a given cable does meet specification. If not, hype notwithstanding, there is a good chance the cable will turn out to be overpriced, gimmicky rubbish—no better or worse than the anonymous digital interconnect with yellow RCA plugs that lurks in every audiophile's junk box.

The foregoing comments are no reflection of the value of the No. 31.5 or of any other state-of-the-art CD transport, if your system's other components match its quality. It's just common sense that you should not pay for improvements you cannot hear and not invest too much in one component relative to the others. Admittedly, this is like telling a junkie not to buy dope. If you spend a lot of time with the Mark Levinson No. 31.5 transport, particularly in combination with the No. 30.5 D/A converter, you may start considering what non-audio-related assets you can sell off to pay for the purchase. A



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—Wade R. Church
National Music
Edmonton, Alberta, Canada

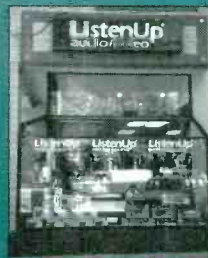


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—Dave Jackson
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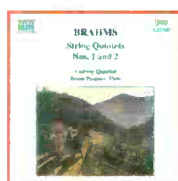
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CLASSICAL RECORDINGS



Brahms: Piano Trio No. 1 in B Major, Op. 8 (1889 version), and Sextet No. 2 in G Major, Op. 32 (arranged for trio by Theodor Kirchner)

Trio Parnassus
MDG 303 0655; DDD; 71:51
Sound: A, Performance: A-



Brahms: String Quintet No. 1 in F Major, Op. 88, and String Quintet No. 2 in G Major, Op. 111

The Ludwig Quartet and Bruno Pasquier, viola
NAXOS 8.553635; DDD; 59:58
Sound: A+, Performance: A



Brahms: String Sextet No. 1 in B-Flat Major, Op. 18, and String Sextet No. 2 in G Major, Op. 36

L'Archibudelli
SONY CLASSICAL SK 68252
DDD; 69:41
Sound: A, Performance: A+

One sign that a composition is a masterpiece is its ability to stand up to a wide range of interpretations. In the deep Romanticism of Johannes Brahms' chamber music, performances can differ greatly in tempo, style, accents, and nuances but remain valid and convincing. These three CDs are performed skillfully and thoughtfully, yet each reveals different aspects of this composer.

Brahms wrote chamber works—primarily for string and piano ensembles—throughout his life. These pieces are very demanding technically and interpretatively, as they fuse individual challenges with layers of ensemble complexity. From the early Piano Trio, Opus 8, to his String Quintet No. 2, Opus 111, Brahms created beautiful music that has tormented a century of chamber music

performers. String players smile grimly when they read the comment in one of the composer's letters to the renowned violinist Joseph Joachim: "My things really are written with an appalling lack of practicality!"

The piano trio disc by Trio Parnassus is an excellent display of Brahms' melodic genius. Rather than stressing the vertical sonorities, the performers emphasize the linear, revealing melodies that are sometimes lost in the harmonic mix of sound. Microphones are placed close to each instrument, and the individual parts are played with almost soloistic care. Atypical of most Brahms piano performers, Chia Chou uses the pedal sparingly and thus avoids obscuring the melodic effect. The result is exhilarating, especially in the B Major's Scherzo and finale, where the playing

Photograph: © Charles Shotwell/Panoramic Images, Chicago, 1997

R E S P I G H I

La Boutique Fantasque and Cinq Études-Tableaux

Cincinnati Symphony Orchestra, Jesús López-Corbos
TELARC CD-80396; DDD; 66:09
Sound: A, Performance: A

Ottorino Respighi was nothing if not a master orchestrator, as witness these two orchestral suites—one based on pieces by Gioacchino Rossini and the other on works by Sergei Rachmaninoff. The Rossini-based *La Boutique Fantasque*, actually a one-act ballet score, was commissioned by impresario Serge Diaghilev, who had a good deal to do with shaping it, according to the interesting notes. The Rachmaninoff tableaux—chosen by the composer, at the suggestion of conductor Serge Koussevitzky, for Respighi to orchestrate—form a far less familiar suite but are all the more welcome because of it. Still, it is the zesty Rossini ballet that will draw most listeners to this disc. The performance and the sound are both exemplary: fresh, lively, and full of savory detail.

Robert Long



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remains clean and precise even at uncommonly fast tempos.

A different approach is taken by the Ludwig Quartet, which is joined by another violist to perform Brahms' two string quintets. The remarkable blend of homogeneous sound that characterizes the recording is immediately striking. The players have obviously spent many hours matching one another's tone and phrasing; the ensemble often sounds more like one player than five. The recording, made in Temple Saint-Marcel in Paris, is very live and captures organ-like chords of luscious beauty. The slow movement is played in an unabashedly Romantic style, with rubato that is usually found only in Brahms' solo piano works.

In its CD of string sextets, L'Archibudelli delivers us Brahms in yet another light. Using period instruments equipped with gut strings (rather than modern steel, nylon, or synthetic strings), this ensemble presents authentic Brahms, reflecting L'Archibudelli's well-deserved reputation for historical accuracy and careful research. These performances are painstakingly precise but retain a warmth created by the players' natural musicality.

Brahms was one of the few composers who wrote something for everyone—symphonies, concertos, songs, choral music, and solo works. It is hard not to admire him, however quixotic he was. Once, as he left a party, Brahms called out, "I beg a thousand pardons if there should be anyone here whom I have not insulted tonight!" The crowd roared its approval. His chamber music fans will surely approve of these CDs. *Patrick Kavanaugh*

Brahms: Ein Deutsches Requiem

Christiane Oelze, soprano; Gerald Finley, baritone; La Chapelle Royale and Collegium Vocale and Orchestre des Champs Elysées, Philippe Herreweghe
HARMONIA MUNDI FRANCE HMC
901608; DDD; 66:15

Sound: A, Performance: A

Brahms: Ein Deutsches Requiem

Charlotte Margiono, soprano;
Rodney Gilfry, baritone; Monteverdi Choir
and Orchestre Révolutionnaire et Romantique,
John Eliot Gardiner

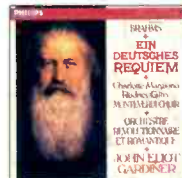
PHILIPS 432 140; DDD; 65:48

Sound: A-, Performance: A-

These two recordings of Brahms' Ein Deutsches Requiem, though five years apart, have more in common than either does with any conventional performance of the piece. Each uses period instruments and limits chorus size, giving the recordings a more intimate feeling than usual. And both are outstanding performances, without any weak elements. So, while I lean in favor of the

Harmonia Mundi, which is recent, over the Philips, which is not, you can't go seriously wrong with either.

For the record (ahem!), I compared both to two popular conventional recordings: Robert



Shaw and the Atlanta Symphony Orchestra (Telarc CD-80092) and James Levine and the Chicago Symphony Orchestra (RCA Gold Seal 09026-61349). Arleen Augér's superb soprano solo for Shaw is probably the best on record, but the choral sopranos show a good deal of strain on the high notes.

Levine is more imaginative and melodramatic, as befits a conductor steeped in opera, and achieves the more mellifluous sound.

But Telarc's and RCA's industrial-strength renderings seem a bit pat after hearing the present recordings. The most obvious differ-

English Classical Clarinet Concertos

Colin Lawson and Michael Harris,
clarinets and basset horns;

the Parley of Instruments, Peter Holman
HYPERION CDA66896; DDD; 70:05

Sound: A, Performance: A

This 39th volume in Hyperion's English Orpheus series proves once again that there need be no trade-off between scholarship and musical delight. None of the concertos presented—one apiece by John Mahon, Johann Christian (the "London") Bach, and James Hook—can claim profundity. Indeed, Hook, who was the effective music director of London's fabled Vauxhall Gardens, may be called a master in music that is intended to delight the ear without ruffling deeper waters. Bach, whose memory Mozart cherished, was a pillar of the London musical scene. And Mahon, who also wrote the two basset-horn duets that here serve as interludes between concertos, was a clarinet virtuoso himself and thus knew whereof he wrote. Colin Lawson, the soloist, is both a specialist in the historical clarinet and a persuasive performer.

The soundstage was captured in close perspective in May 1996, though precisely where neither the notes nor the sound betray. The personalities of the chamber group, the soloist, and the music all come through vividly and beguilingly. If you enjoy decorative music of the late 18th century, don't miss this CD. And don't neglect reading the interesting and informative notes by both the conductor and the soloist. *Robert Long*



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ence between the latter two is in dynamics. John Eliot Gardiner takes the opening passage, marked “piano” in my score, at what I would call a pianissimo, and that sets the scale of the recording. For some (including me), this may be exaggeration; for others, it will be what CD's dynamic range was meant to re-create. Even given the Gardiner/Philips dynamic range, however, Philippe Herreweghe manages to outpoint on the climaxes by the utter conviction with which he performs them. Again, the difference is not great, but it does favor the Harmonia Mundi.

Neither of the new recordings presents a very specific soundstage; the sense of space is appropriate for the music and stable, but it is rather generalized. The only other distinguishing feature on my listening system is that the Harmonia Mundi disc sounds a touch cleaner in the choral passages. *Robert Long*

Glass: “Heroes” Symphony

American Composers Orchestra,

Dennis Russell Davies

POINT MUSIC 454-388; 44:13

Sound: A–, Performance: A–

Low, *Heroes*, and *Scary Monsters* comprise a trilogy of late-'70s David Bowie albums. Produced and largely co-composed with Brian Eno, their repercussions are still felt in contemporary pop music. A few years ago, Philip Glass adapted *Low* for his “Low” Symphony; now he's done the same with *Heroes*.

The “Heroes” Symphony isn't just an orchestration of pop tunes, something done with Yes's or The Rolling Stones' music. Instead, Glass takes themes and fragments and reworks them into a more expansive work. On the “Low” Symphony, he dialed directly into Bowie's dark psychological undertow, taking chillingly confrontational electronic music and transferring it to an orchestra.



For *Heroes*, however, Glass has missed the mark. He turns the title theme into a “Pomp and Circumstance”-style orchestration, leaving what Eno called the “brave and resigned” mood of the piece behind. It's only on “Sense of Doubt” (with its belching horns played against glistening flute lines) and “Neuköln” (with its lowing brass and pristine vibe cycles), that Glass grabs Bowie's and Eno's sense of foreboding and expands on it.

The “Heroes” Symphony is more Glass than Bowie, and that's unfortunate. Though Bowie has reinvented himself yet again on his recent *Earthlings* album by adopting the latest in techno and jungle music, Philip Glass just keeps regurgitating the same themes dating back to *Koyaanisqatsi*—even when he's working with someone else's music. *John Diliberto*

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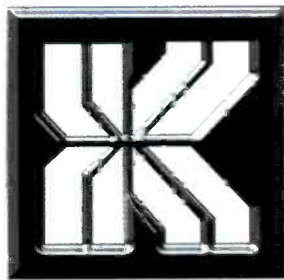
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**Alma Brasileira:
Music of Villa-Lobos**

*Renée Fleming, soprano; BBC Singers;
New World Symphony,
Michael Tilson Thomas*
RCA VICTOR RED SEAL 09026-68538
DDD; 78:10
Sound: A+, Performance: A+

Brazilian composer Heitor Villa-Lobos created some of the 20th century's most colorful and original music. His Bach-inspired Bachianas Brasileiras suites (of which Nos. 4, 5, 7, and 9 are included here) are gorgeous examples of his talent. For this explosive and sonically colorful album, Michael Tilson Thomas and the New World Symphony, an assembly of graduate music students from around the world, deliver rhythmic, highly volatile performances that should satisfy those familiar with Villa-Lobos' musical world and entrance those just arriving.



The choral movement of Bachianas Brasileiras No. 4 commences with a room-shaking example of Brazilian percussion. Number 5 is here with its famous Aria, the composer's best-known melody. Number 7

ERIK SATIE


**Quatre Préludes, Danses Gothiques,
Sonneries de la Rose-Croix,
and Three Preludes**

Reinbert de Leeuw, piano
PHILIPS 454 048; 70:15
Sound: A, Performance: A

This is the third in a series of Satie discs that Dutch avant-garde pianist Reinbert de Leeuw began some years ago. De Leeuw slows Satie's tempos to about half those of other performers, giving the music a dreamy, spiritual quality. This technique is especially effective with these semiliturgical works—after all, Satie began his musical career as a church organist. But the slower tempos also imbue each note with more depth. This may not be the best place to begin an acquaintanceship with the umbrella-collecting composer, but it's an important release for his admirers. *John Sunier*

C

oming from the mystical/austere side of eccentric Parisian musical wit, these infrequently heard piano pieces are quite different from Erik Satie's well-known "Gymnopédies" or "Gnossiennes." While they do incorporate some of the same surface simplicity and static rhythmic structure, they carry these elements further.



uses a Romantic-period full symphony and almost Dvorákian style, while in No. 9, a string orchestra evokes the sound of a pipe organ performing Bach. The closing selection, *Chôros No. 10*, is a powerful tone poem for chorus and orchestra that portrays Brazil from the Amazon to the streets of Rio.

This is a multimiked, though carefully mixed, recording. Such an approach is entirely appropriate for bringing out the varied timbres and rhythmic colors of this vibrant music, which are sometimes lost in the mono recordings conducted by Villa-Lobos himself (EMI CZS 7 67229). *John Sunier*



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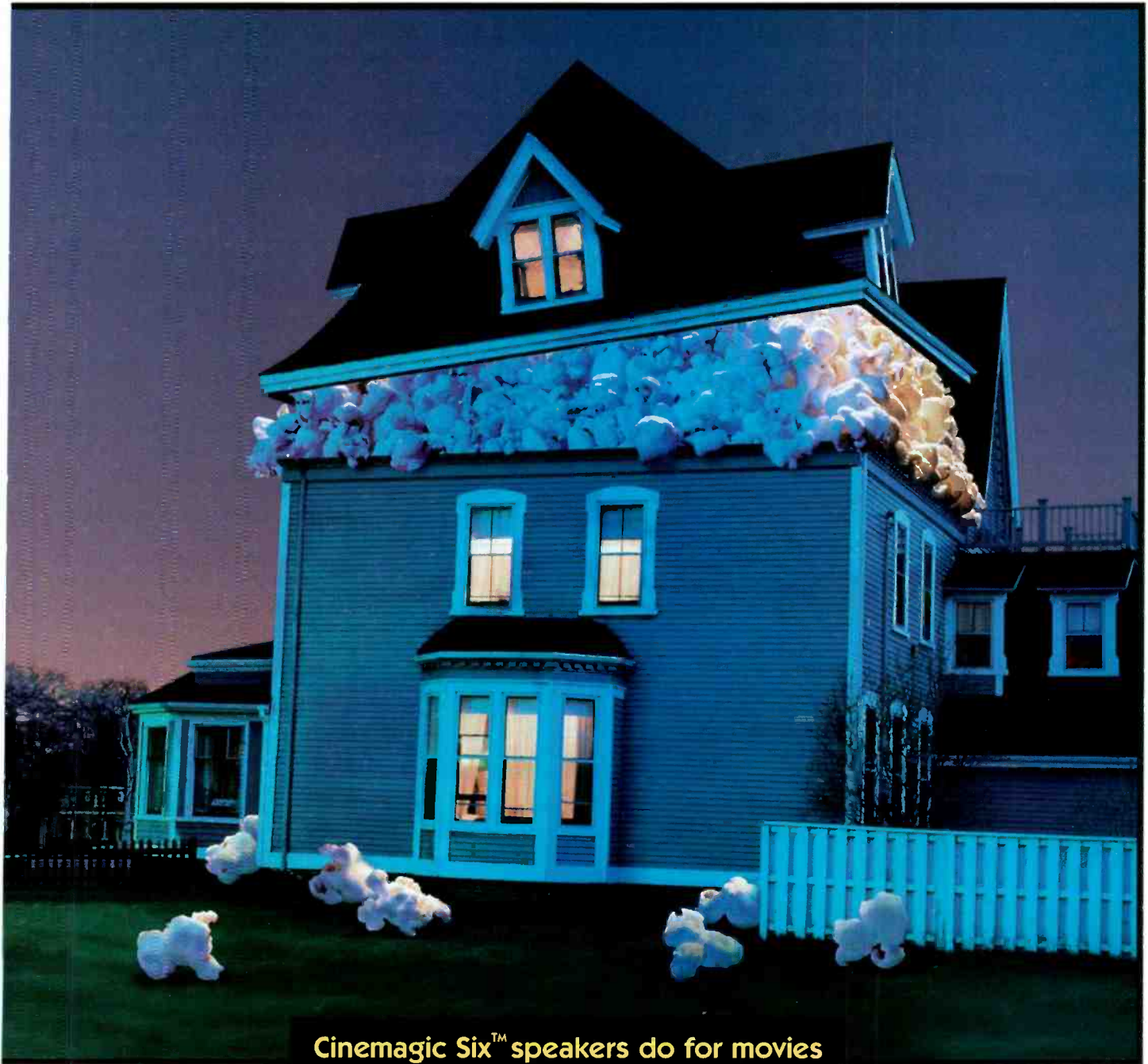
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ROCK ~ POP RECORDINGS



Du Jazz dans le Ravin

Serge Gainsbourg

MERCURY 314 522 629, 44:36

Sound: B+, Performance: B

Couleur Cafe

Serge Gainsbourg

MERCURY 314 528 949, 43:52

Sound: B+, Performance: B

Comic Strip

Serge Gainsbourg

MERCURY 314 528 951, 54:07

Sound: B+, Performance: A

If we kept score of various countries' contributions to rock 'n' roll, France would probably rank low. It has given the world '70s prog-rockers Magma, '80s garage band The Calamities, and Laetitia Sadier of Stereolab, but not much else. Still, one figure more than redeems this nation's apparent inability to rock: Serge Gainsbourg, the legendary racon-

teur, pioneering rapper, and all-around rogue who brought to mid-'60s rock a distinctive sneer, a lecherous wink, and an attitude that was 100% French.

The son of Russian-Jewish immigrants, Gainsbourg dabbled in painting and the piano in the mid-'50s while sipping Pernod in the seedy nightclubs and cafes of the Pigalle. In 1958, at age 30, he found his truest calling when he launched his recording career delivering romantic and risqué monologs about the bohemian arts scene with a distinctive voice—a mix of Lou Reed and Maurice Chevalier. Largely unknown in this country, Gainsbourg has become the toast of the underground in recent years, with such hipsters as Beck, Nick Cave, Mick Harvey (whose 1996 album, *Intoxicating Man*, covered Gainsbourg songs exclusively), and Luscious Jackson dropping his name. So Mercury Records has assembled three diverse new Gainsbourg compilations, span-

ning 1958 to 1975, that showcase his French raps and rants as well as his superb arranging abilities.

Du Jazz dans le Ravin features jazz tracks released between 1958 and 1964. A fan of Monk, Miles, and Diz, Gainsbourg had superior taste even

TARNATION

Mirador

REPRISE 46482, 50:39

Sound: A, Performance: B+

Tarnation's take on country music strongly resembles Ennio Morricone's spaghetti-western film scores, with Paula Frazer's voice echoing as if she were singing in a vast canyon rather than a recording studio. Its 1995 debut, *Gentle Creatures*, only hinted at Frazer's songwriting talent. On *Mirador*, that asset is much more effectively displayed.

The wild west/boy explorer tone is set from the album's opening strains, and the band successfully sustains it. Ominous percussion (the kind an overactive mind would imagine) is balanced by Frazer's electrifying Yma Sumac-like vocals on the opener, "An Awful Shade of Blue." A whistle reminiscent of the memorable music from *A Fistful of Dollars* punctuates the loneliness of "A Place Where I Know." It's easy to imagine "Is She Lonesome Now" being sung around a campfire. And you can see the prairie brush tumblin' as Frazer, in a style reminiscent of Patsy Cline's, sings about an uncaring lover in "Destiny" and in the riveting, untitled bonus track.

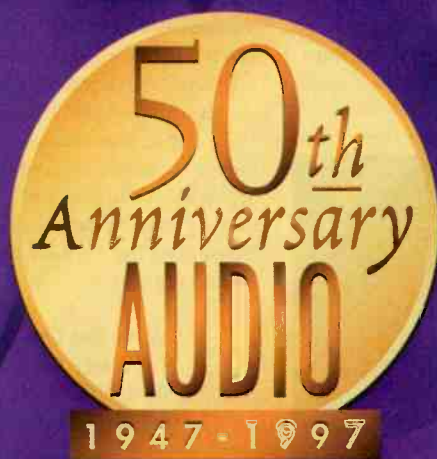
Tarnation establishes such a distinctive musical identity that it's surprising when traces of other pop groups become noticeable (The Cranberries in "Your Thoughts and Mine," Chris Isaak in "A Place Where I Know," and Mazzy Star in the dirge-like "Christine"). And the songs, like many country ditties, chronicle busted love affairs, broken hearts, and yearning, yearning, yearning. Nonetheless, the solidly produced (by David Katznelson and the band) and performed *Mirador* may stand out as one of the best of 1997.

Marie Elsie St. Léger



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if his own piano playing wasn't extraordinary. Some of these songs might be mistaken by Gen Xers as sounds from the recent lounge-music revival; other songs, such as "Intoxicated Man," feature performances from members of the Paris jazz scene who were inspired by their unconventional host to create music that is, indeed, intoxicating.

Couleur Cafe chronicles the same period but focuses on Gainsbourg's attempts to introduce France to various "ethnic musics," including Latin American and Afro-Cuban rhythms and what today would be termed Afro-pop. "Erotico Tico" and "New York USA" smack of novelty but are more accom-

plished than most of what world-beaters David Byrne and Paul Simon have delivered.

The real gem, however, is *Comic Strip*, which presents Gainsbourg's rock forays from 1966 to 1969. In true Little Richard or Johnny Rotten fashion, Gainsbourg makes the most of his naughty persona, playing bad boy to the hilt on "Docteur Jekyll et Monsieur Hyde" and corrupting innocent nubile Brigitte Bardot and Jane Birkin in a series of memorable duets. The backing is as weird as the vocals: Witness the strange, psychedelic shrieks on "Bonnie and Clyde" and unusual instrumental combinations, such as accordion and a howling feedbacked guitar.

The disc ends with Gainsbourg's most infamous tune, "Je T'Aime. . .Moi Non Plus." Over a mid-tempo groove and a dense organ not dissimilar to the one heard on Dylan's "Like a Rolling Stone," Gainsbourg uses all his wiles to lure Birkin to bed, where her orgasmic gasps are ample testimony that he performed acceptably. Gainsbourg topped this outrage only once, with a video for his 1985 song "Lemon Incest," in which he appeared with his 13-year-old daughter, making fun of an incestuous situation. Mercury must be holding that track for the next compilation.

Sadly, Serge Gainsbourg isn't around to enjoy his comeback; he died of a heart attack in 1991. But he was consistent to the end. "For me, provocation is oxygen," he once said. Months prior to his death, he caused an uproar by voicing carnal desire for Whitney Houston on live TV. Let's see if Marilyn Manson can top that. *Jim DeRogatis*

What Else Can Go Right

Terry Anderson

EAST SIDE DIGITAL ESD 81152, 55:44
Sound: B-, Performance: B+

If any artist were destined to be confused with others, Terry Anderson couldn't do much better than to be confused with Terry Adams and Al Anderson of NRBQ. Like those present and former members of the 'Q, Anderson is a rock 'n' roller of the old school, composing guitar-drenched songs about girls, cars, and having fun. And like NRBQ at its best, Anderson makes that seemingly time-worn sound feel fresh and vivid again.

As the leader of North Carolina's The Woods for one album on Twin/Tone in the mid-'80s, Anderson came up with his best-known song, "Battleship Chains," a mid-level 1986 hit for The Georgia Satellites. That same raucous feel can be found here in "Read My Picture," "What in the Hell," "Nothin' on You," and the cover of "Street Fighting Man" (which is, perhaps, just a little too faithful, if still stirring). Sadly, the ravers also elucidate this disc's one big flaw, which is Anderson's tendency to bury his vocals in the mix.

But that's a minor quibble with an album that's all about fun, fun, fun, as titles like "Beer Drinkin' Woman" and "College Girls" indicate. Sure, *What Else Can Go Right* isn't quite as gem-studded as Anderson's last album, 1994's *You Don't Own Me*, but it's still about as good a legal high as you can manage in the late '90s. And if you aren't singing along with Anderson by the closer, the Faces-styled "Rotted on the Vine," then it's time to trade in your Chuck Berry singles for the greatest hits of Kenny G. *Rob Patterson*



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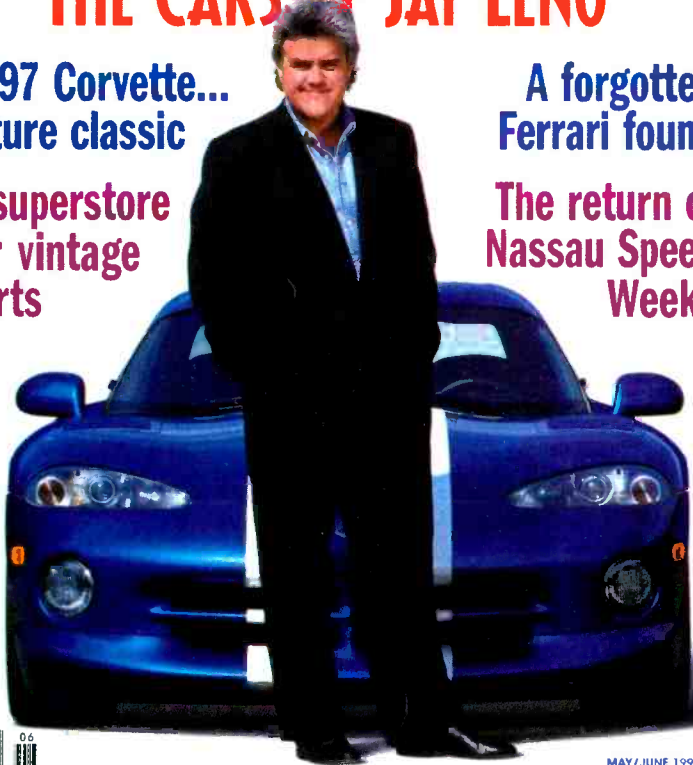
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Brighten the Corners

Pavement

MATADOR/CAPITOL CDP

7243 8 55226, 46:31

Sound: A, Performance: A

When it comes to rock music, it wouldn't be stretching things to say that we distrust smart people and their smart ideas. Since, supposedly, rock is based on passion, we figure dumb people *feel* it and understand it; smart-asses, on the other hand, think too much, make jokes, and act superior, thereby risking nothing and making brainy music that is correspondingly empty.

Pavement is a smart person's band—"post-grad" rock, I've heard it called. The band's "accidental" approach to recording, where a



mistake is never a mistake if it pushes the sound forward, matched with singer Stephen Malkmus's tendency to free-associate (reports say he kept a copy of John Ashbery's poetry around for lyric rips), make Pavement seem like a pretentious graduate student's wet dream. However, the result isn't brain-heavy. At its best, Pavement rocks and gets playful without losing its focus.

The band's previous album, *Wowee Zowee*, got so loose it unraveled. *Brighten the Corners* winds things back up with strong songs and cohesive production, courtesy of (in part) Mitch Easter (early-R.E.M.). Malkmus has some great lyric moments. His questions about Rush's Geddy Lee ("Stereo") are priceless. The band's multiple guitars shift textures beautifully ("Embassy Row"), and the group almost sounds sincere ("Type Slowly"). Sure, Pavement is a bunch of smart guys playing smart games, but this time out, they've kept track of the essentials. The rhythms bust through, and the melodies catch your ear. And when Malkmus half sings/half raps over a hip-hop beat ("Blue Hawaiian"), it doesn't sound superior or smug. It feels right. *Rob O'Connor*

The Boatman's Call

Nick Cave and The Bad Seeds

MUTE/REPRISE 46530, 52:13

Sound: A, Performance: A

Nick Cave is, without question, the king of melancholy bombast. From the assaulting nihilism of his early '80s band, The Birthday Party, and his collaborations with performers like Lydia Lunch to the bloody blues of his early solo albums and his 1988 masterpiece, *Tender Prey*, Cave has been dependable. He's a guy we can always count on to deliver songs about love, death, and God (usually all at the same time) at a volume commensurate with the emotional fervor that those subjects evoke.

With 1990's relatively subdued *The Good Son*, Cave showed he was capable of turning the levels down a bit. The perception was that the record's softer tone was due to his kicking a heroin habit. It's a perception reinforced by the two energetic studio efforts that followed: the bristling *Henry's Dream* and last year's comically overwrought *Murder Ballads*.

The Boatman's Call is in an even lower gear than its predecessors. With support from an uncharacteristically serene Bad Seeds, not only is it Cave's most consistently austere record, it's also his most emotionally charged. The lyrics dispense with allegory and third-person poetics to reveal Cave not screaming or growling but singing. And singing his most engaging and expressive lyrics ever. Of course, they're still about love, death, and God: the weirdly romantic "Far from Me," the translucently heavy "Where Do We Go Now but Nowhere?" and the soft-hewn "Into My Arms," almost Tom Waits-like in its lyrical lucidity. *The Boatman's Call* isn't the Nick Cave album you expected, but it is the Nick Cave album you've always wanted. *Jason Ferguson*



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Don't Look Back

John Lee Hooker

POINTBLANK/

VIRGIN 42771, 53:32

Sound: A-, Performance: A-



the blues lineage stretches from Skip James and Robert Johnson to Muddy Waters and John Lee Hooker. After Hooker, well, it ends. The soon-to-be octogenarian is the last of the great Mississippi Delta bluesmen. Sure, B.B. King's still playin' the blues, but he's of a different style altogether. And as significant as King is, it was Hooker who broke through to a larger audience in the '60s, when The Stones, John Mayall, The Yardbirds—nearly the entire British blues scene—fell under his spell. Hooker's blues also had more staying power than anyone else's, and in the '70s,

you could hear his droning, one-chord boogie in the music of George Thorogood, Canned Heat, ZZ Top, and J. Geils. With Hooker, there's always that connection to his dark Delta past—his primal, direct-to-the-sternum sound has never really gone out of fashion, at least not for long.

Don't Look Back departs from the star-studded approach that overshadowed Hooker on his recent big sellers *The Healer*, *Mr. Lucky*, and *Chill Out*. Thanks go to his friend Van Morrison, whose lean production gives Hooker plenty of breathing room. The easy-rollin' band clinches the deal: Charles Brown is on piano and organ; he brought aboard bandmates Ruth Davies on acoustic bass and Danny Caron on guitar, while drummer Kevin Hayes (on loan from Robert Cray's band) rounds out the core group.

Los Lobos (with John "Juke" Logan on harp) takes the sole star turn, kicking off the album with a head-first charge into Hooker's classic, "Dimples." John Lee, whose phrasing hasn't changed in 20 years, clearly revels in the Chicago-style blues heat.

After the opener, Hooker and Morrison pay tribute to each other. They're in perfect sync as they light up Morrison's destined-to-be classic "The Healing Game." But on the

Jimmy Thackery & The Drivers

Drive To Survive

BLIND PIG BPCD 5035, 45:50

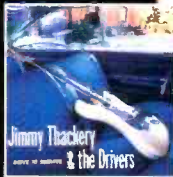
Sound: B+, Performance: B

Jimmy Thackery first gained attention through his flashy fretboard work and incendiary style with The Nighthawks. But his last few outings as a leader for Blind Pig have helped advance his rep among fellow guitarists and blues fans, particularly those who like their blues cut with a generous dose of Hendrix-flavored, rock-edged bite.

On his latest, recorded by renowned blues/rock producer Jim Gaines, Thackery leans heavily on the distortion pedal in a jumped-up, John Lee Hooker-influenced boogie number, "You Got Work To Do," as well as in Jimmy McGriff's driving shuffle "All About My Girl" and the soulful ballad "That's How I Feel." Although his singing voice is somewhat lacking, Thackery is ably spelled by drummer Mark Stutso, who turns in strong vocal performances on three tracks, including the revved-up rocker "Long, Lean & Lanky."

The stripped-down guitar/bass/drums format (with minimal guitar overdubs) suits Thackery well. He cuts loose with wild abandon on "Play To Win," his guitar screaming with fuzz and wah-wah pedals in full service. He reprises a classic surf-guitar instrumental from the early '60s in "Apache" and even has a go with a jazzy uptempo swinger in "Burford's Bop," a style pioneered by T-Bone Walker and Tiny Grimes. But Thackery makes the biggest impression when he gets raunchy and screams with a vengeance, as on "Rub on Up."

Bill Milkowski



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subsequent tracks you might wonder whose record this really is. Its feel and sound exude moody Morrison, even when it's Hooker handling the vocals solo. But never mind—Hooker does a damn fine Morrison. A turnabout comes later, on "Rainy Day," where Hooker's snarling guitar and raw vocals have Morrison on the ropes.

Hooker and company shine on Jimi Hendrix's "Red House," and when they pound out Hooker's trademark raucous boogie on "Spellbound," some part of your body better be moving! Even now, at 79, Hooker still kicks serious butt.

Steve Guttenberg

da" builds off a chunky Latin rhythm, Wall spreading a glaze while Abercrombie unleashes a flood of wah-wah one-liners. "Bo Diddy" immerses a New Orleans-style groove in gritty guitar picking and a rollicking Bo Diddley beat. Conversely, the superb trio finds sweetness in the standards "You and the Night and the Music" and "Long Ago and Far Away." Having worked in a variety of past configurations, these players integrate their performances into a sound that's both ethereal and potboilingly energetic. *Tactics* is a work that successfully acknowledges the past while dressing for the present.

Ken Micallef

Tactics

John Abercrombie/Dan Wall/Adam Nussbaum

ECM 1623 78118-21623, 76:28

Sound: A, Performance: A

The greasy, groovy, grits-and-gravy organ trio—popularized by '60s swingers Jimmy Smith, Richard "Groove" Holmes, and Jack McDuff, among others—has made a comeback. At least, that's what many major labels would have us believe. But I find



nostalgia a sickening trend. Many otherwise competent keyboard technicians ooze soulless retro sounds from Hammond-sampled synths, their records consisting of noodling forays on standards from The Meters to Booker T. & The MGs. But *Tactics*, recorded live at Visions in New York last year, avoids these pitfalls.

Over the turbulent drumming of Adam Nussbaum, guitarist John Abercrombie and organist Dan Wall trade growls like they're surfing clouds in an electric storm. "Chumbi-

FAST TRACKS

Shack-man: Medeski Martin and Wood (GRAMAVISION GCD 79514, 54:49). Recorded entirely in a solar-powered shack in Hawaii, MMW's latest features more of its Hammond organ-based soul/jazz. The trio seems to be making an effort to keep each piece down to four to five minutes. Does this make them songs? It's arguable; there are distinct heads or melodies, but then (true to the jazz form) it's off into improv land, where keyboardist John Medeski pushes his B3 to its limit and bassist Billy Martin and drummer Chris Wood funk and vamp underneath. On *Shack-man*, Medeski has also expanded his sonic palette to include a Hohner Clavinet (pumped through an old guitar amp for a twangy but overdriven effect) and a few synths. But home plate was, is, and hopefully always will be the Hammond, for which he carries the mantle left him by pioneers like Larry Young. **M.B.**

The Holmes Brothers

Promised Land

ROUNDER CD 2142, 46:24

Sound: A, Performance: A

brothers Sherman and Wendell Holmes and drummer Popsy Dixon have been playing blues, R&B, soul, and country for more than three decades.

With an unrelenting groove, theirs is the kind of sound you don't accidentally arrive at but strive toward for many years. Whether covering Tom Waits' "Train Song" or The Beatles' "And I Love Her" or playing its own compositions, the band finds the emotions on



Promised Land while performing in the great juke-joint tradition.

Recorded in Maurice, Louisiana, *Promised Land* intensely captures the vibe of live performance. The title track in particular smokes like a barbecue. Wendell and Sherman each take powerful turns at the mike, but The Holmes Brothers' true power lies in the ensemble singing and playing, passing the spotlight to no one in particular until the sound forms an intricate web. The brothers augment things with Dixon, whose seasoned voice smoothes their approach for the late-night balladry of "Thank God for You." **Rob O'Connor**

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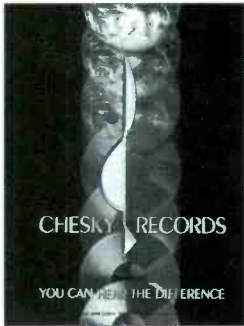
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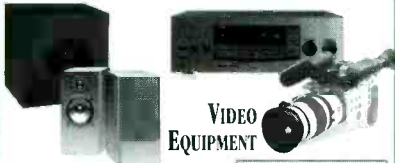
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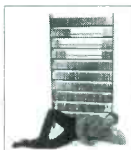
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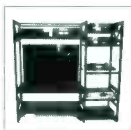
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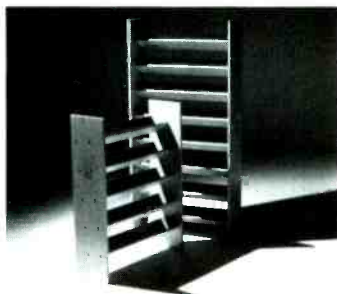
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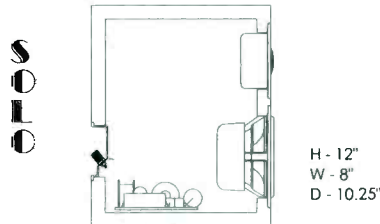
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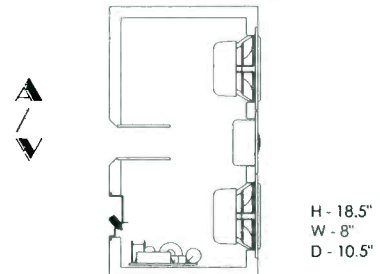
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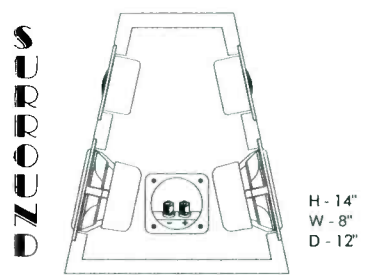
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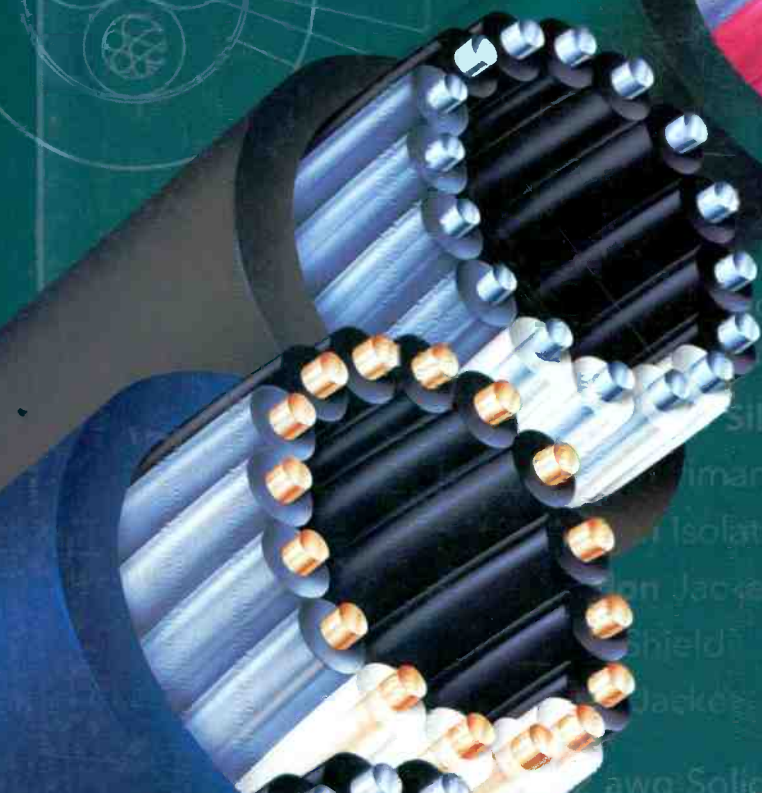
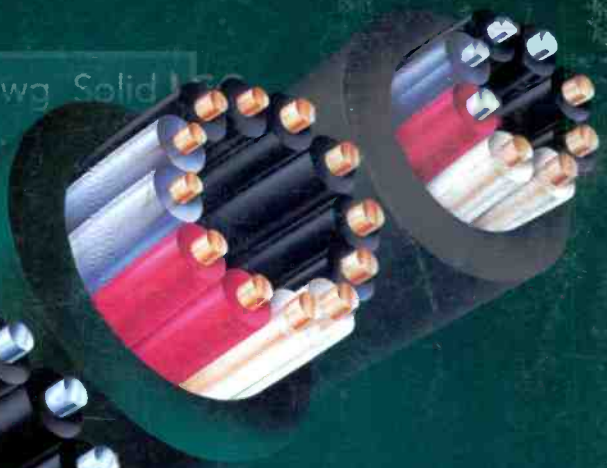


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