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AUDIO

THE EQUIPMENT AUTHORITY

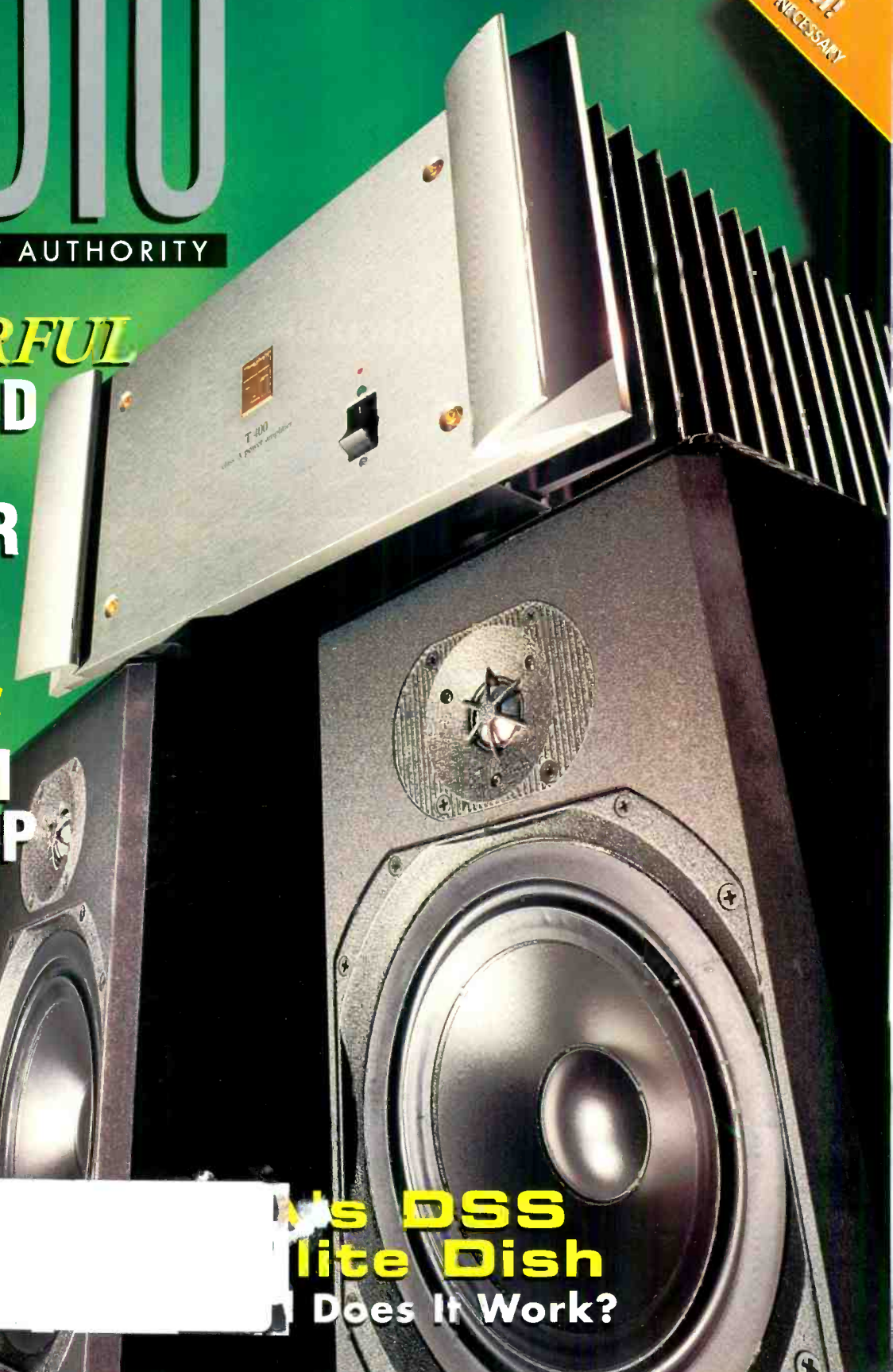
AUGUST 1995

WONDERFUL

**THRESHOLD
T400
AMPLIFIER**

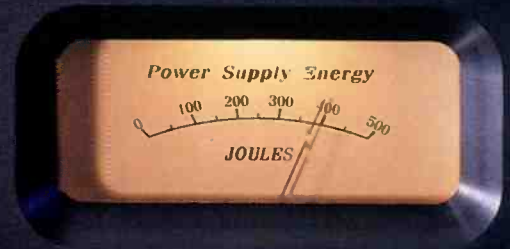
**GREAT
STAGING**

**PARADIGM
ECLIPSE/BP
SPEAKER**



As DSS
lite Dish
Does It Work?

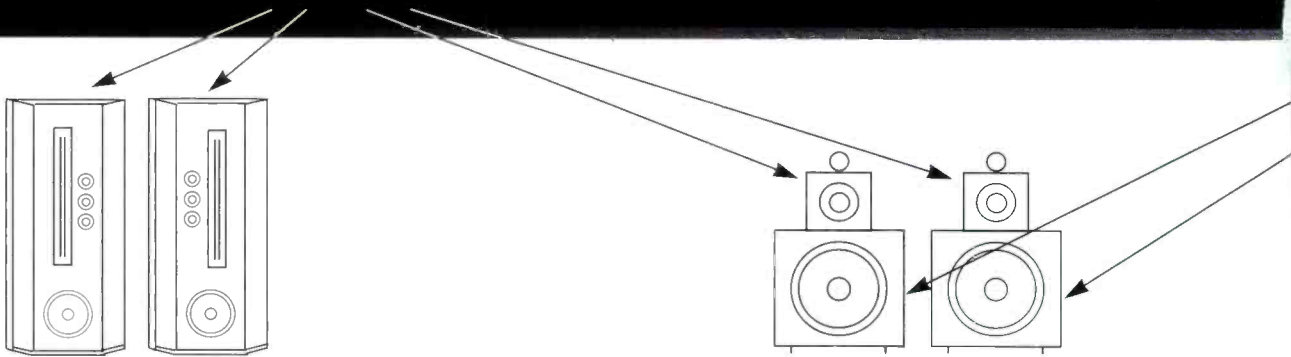
Sunfire



Load Invariant High Fidelity Stereo Power Amplifier

Imagine. A muscular 600 watt amp with the soul

Current output:



The new Sunfire stereo amp: sonic magic by Bob Carver.

It's not a 9 watt triode of course, and we wouldn't want it to be, but it does share a very important characteristic with one. It incorporates the current-source (high output impedance) property of a triode -- the very property that is *the* dominant factor (perhaps ninety percent) of the sonic magic that makes listening to classic vacuum tube amplifiers so much fun. So when you choose our current-source output connections for your system, you'll have a sumptuous high end, and a midrange that positively glows.

At the same time, the new Sunfire amp, with its uncanny tracking downconverter, has the ability to raise goose bumps with its awesome power. Using 12 herculean International Rectifier Hexfets, it can drive *any* load to *any* rationally usable current or voltage level.

A choice of outputs.

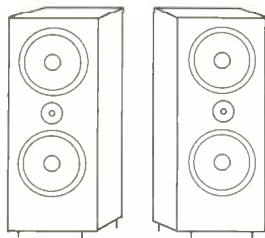
You can connect most speakers to the voltage-source

Sunfire Corporation

.....from the mind & soul of Bob Carver

of a 9 watt triode.

Voltage output:



output, with its near zero impedance, to experience the powerful dynamics and tight bass you've always wanted more of.

Or let's say you own electrostatic, planar magnetic or ribbon speakers, then connecting the higher impedance current-source output can coax forth a sensuous, delicately detailed musical voice associated with low-powered classic tube amplifiers.

Or if you're able to biwire, you may just arrive at the best possible interface: voltage output to woofer

Price: \$2,175

* F.T.C.: 300 watts continuous per channel, both channels driven into 8 ohms from 20 Hz to 20 kHz with no more than 0.5% THD

Inputs are gold XLR balanced and gold RCA standard.

for incredible bass whack, current output to midrange and treble for a huge three-dimensional soundstage with detail retrieval so stunning that you will often hear musicians *breathing*.

Each choice will reveal the delicate musical soul that complements this amp's astonishing muscle and control. And each will lead to a multilayered soundstage so deep and wide it will take your breath away.

Performance that's difficult to believe.

The basis for all this is designer Bob Carver's versatility. He's worked successfully for over twenty years with both tube and solid state designs, and he understands the intrinsic subtleties of each.

For the new Sunfire, he insisted on an enormous 138 ampere peak-to-peak output current capability with 600 watts rms per channel continuously into 4 ohms* and 2400 watts rms into 1 ohm on a time-limited basis. Courtesy of 24 massive Motorola triple-diffused output devices, each capable of 20 amperes without taxing current reserves.

Imagine all that in a single amp. Or better yet, visit a Sunfire dealer. That's where you'll hear for yourself how it all comes together.

Dealer inquiries invited. (206) 335-4748 Ask for Bob Carver.

For more information on the Sunfire, and especially the uncanny tracking downconverter, use the reader service card or write to Sunfire Corporation, PO Box 1589, Snohomish, WA 98290

The Road Kill Diaries



July 20

Spent the morning burrowing.

Heard the sound of some powerful amps.

Ran out in the road to investigate.

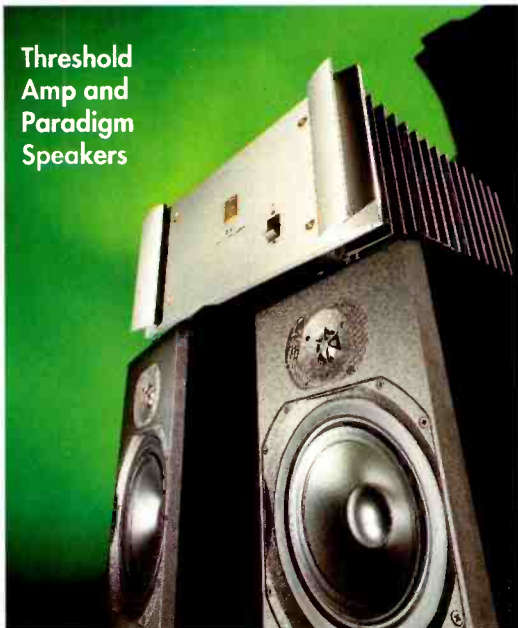
Should've looked both ways.

In no way does Pioneer advocate running over road critters. Every last one of us would swerve. © 1995 Pioneer Electronics (USA) Inc. Long Beach, CA

PIONEER AMPS. Power. It's something all of nature craves, from mankind right down to whatever's frozen in your headlights. Pioneer® amps give you that power. Not only do they deliver high current performance, they also come with a bass boost that will curl your hair. And the multichannel capability, along with built-in crossover, means greater system flexibility. Remember, if little fuzzy paws aren't tightly pressed over little fuzzy ears, you need better amps. Call 1-800-PIONEER for dealer information.

AUDIO

THE EQUIPMENT AUTHORITY



Threshold Amp and Paradigm Speakers

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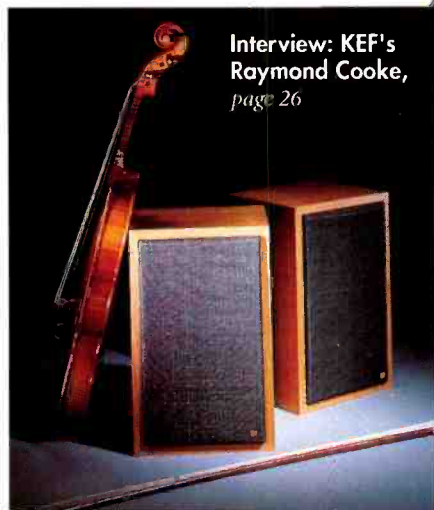
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The Cover Photographer: Bill Kouirinis Studio
The Cover Equipment: Threshold T400 amplifier and Paradigm Eclipse/BP speakers

Audio Publishing, Editorial, and Advertising Offices, 1633 Broadway, New York, N.Y. 10019

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Grado Earphones, page 54

TO BUILD THE WORLD'S BEST SUBWOOFERS, WE WENT BIPOLAR. AGAIN.

At Mirage, we've proven the sonic superiority of Bipolar loudspeaker design. Now we're proving it once again with our powerful new line of Bipolar subwoofers.

From the compact 100-watt BPS-100 to the flagship 250-watt BPSS-210, all four feature dual bass drivers in a unique Bipolar configuration. This eliminates transfer of low frequency energy to the floor, a major source of coloration in single driver subwoofers.

All feature our new "Auto-On" circuitry. And, for the ultimate in outboard control convenience, combine any of them with one of our LFX-Series of external crossovers.

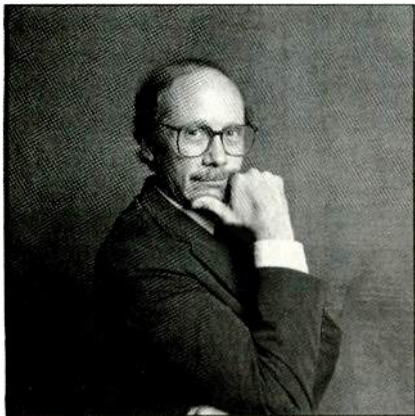
From the original Bipolar explorers comes the world's first complete line of Bipolar subwoofers, the ideal means of adding dramatic new depth to both audio and home theater systems. Track one down and explore the possibilities yourself.



Mirage

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CIRCLE NO. 11 ON READER SERVICE CARD



Almost exactly one year ago, as I write this, on the final morning of the Summer CES, I sat down with Ken Kessler in the coffee shop in the Chicago Hilton. As you probably know, Ken started doing a column for us called "Mondo Audio" in the October 1994 issue. I had admired his writing for some years, in particular for his way with words, for his lack of stuffiness or pretense, and—most of all—for the humane way he dealt with the people of our industry. By breakfast's end, we had negotiated a deal—so much writing about x, y, or z, to be done over such and such a period, for thus and so money.

As I recall now, the first idea that I suggested to him was a series of interviews of some leaders of British audio, because Ken is a Yankee transplanted to England. The first name we put onto the "do him" list was Raymond Cooke of KEF. While other ideas and names intervened, I am very pleased to finally be publishing Ken's interview with Mr. Cooke. Unhappily, our interview is not as complete as I would have liked, in that it covers only his early years, up to the founding of KEF. Mr. Cooke felt that the later years, when the blood, sweat, and tears were paying off, had been well covered in other interviews, and he was right in guiding our interview so that it would include something on that early period. While Kessler and Cooke had planned to meet again, that second meeting did not take place, and this profile is, then, a memorial. Despite the truncation, I think what we're publishing

presents Mr. Cooke accurately. I hope you see him as I remember him—as insightful and incisive as every good business leader is, and as warm and wise as every good friend is.

For those who would know Mr. Cooke better, there is a fine piece in the current issue of the *Journal of the Audio Engineering Society* (May 1995), written by two of his friends and colleagues, Laurie Fincham and Floyd Toole.

About a year ago, Arhoolie Records released a fine blues CD, Mance Lipscomb's *You Got To Reap What You Sow* (CD 398). The original recording was done on May 2, 1964, when Lipscomb was the house guest of Arhoolie's owner, Chris Strachwitz. Lipscomb had been performing in Northern California; the booklet has photos of him playing at the UC-Berkeley Folk Festival and meeting a young Pete Seeger. Recorded by Chris in his living room with a single Capps mike and a Magnecord tape recorder, the sound is very fresh and immediate, with very little tape noise. Mr. Mance, however, is *extraordinary!* This is one to search out.

Da Capo Press has released a paperback version of *I Say Me for a Parable*, Lipscomb's oral autobiography, which was compiled by Glen Alyn. The patois got in the way of my reading, but the fascinating stories kept me at it. There's Lyndon Johnson's visit to a Texas Folk Festival to see Lipscomb, and some almost credible tales about Texas Ranger Frank Hamer. Get this one too.

AUDIO

THE EQUIPMENT AUTHORITY

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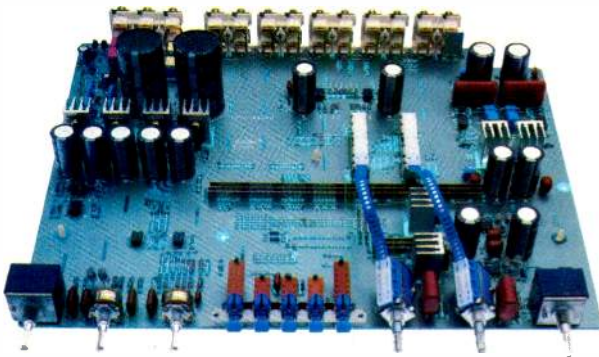
Adcom's GFP-565 Preamp: Pure and Simple.



In Search of Sonic Perfection, Adcom Took the Path of Least Resistance

The fewer circuits a musical signal encounters on its way to your loudspeaker system, the greater its musical purity will be. Now, through obsessive attention to detail and design ingenuity, Adcom has created the GFP-565 — the world's first affordable preamplifier with direct, linear gain path circuitry. By combining the GFP-565 with any of Adcom's power amplifiers, you can experience the exceptionally lifelike sound which has astonished even the most demanding critics.

From Input to Output,
the Signal Path is
as Direct, Pure and
Simple as Possible



By gold plating all input and output jacks, and then directly mounting all jacks, switches, potentiometers and other laboratory grade components on a double copper-plated, glass epoxy printed circuit board, signal losses and noise are dramatically reduced.

Three Sets of Outputs for the Perfect Balance of Performance and Flexibility

You can use one or more sets of outputs: 1) **BYPASS** - direct-coupled before tone controls, filters, etc. for the most direct path to your power amplifier while retaining control of volume and balance. 2) **LAB** - direct-coupled with no output-coupling capacitors yet with tone, filter and loudness controls. 3) **NORMAL** - same as LAB but with highest quality output capacitors for use with amplifiers needing the extra protection of ultra-low-frequency roll-off.

Bi-amped and tri-amped systems are easily accommodated by this flexible arrangement.

Pure Convenience

The minimalist aesthetics of the GFP-565 are deceptive in their simplicity. Without being overly complicated to use, this preamplifier is able to integrate and control all of the components in the most sophisticated of music systems. There are five high-level inputs as well as a phono input. A separate front-panel switch allows the use of an external processor, only when needed, leaving both tape circuits free. And, of course, you may listen to one input while recording from another.

More Sound, Less Money

Adcom stereo components have a reputation for sounding superior to others costing two and three times more. Keeping faith with this tradition, Adcom took the path of least resistance. Why not do the same? Ask your authorized Adcom dealer for a demonstration of this remarkable stereo preamplifier. Please write or call for a fully detailed brochure. You'll discover the best value in high performance preamplifiers.

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details you can hear

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WHAT'S NEW

Definitive Technology Bipolar Speaker



Standing 50 inches high, the Definitive Technology BP 2000 occupies only about 1 square foot of floor space, despite its inclusion of an active subwoofer system using one 15-inch driver. Upper frequencies are handled by two D'Appolito driver arrays, one front and one rear, each consisting of two 6.7-inch bass/midrange drivers and a 1-inch aluminum dome tweeter with dual-chamber transmission-line loading. Overall frequency range is 15 Hz to 30 kHz. Power handling is 500 watts rms, but sensitivity is said to be high enough to allow powering by many receivers. Price: \$1,499 each. For literature, circle No. 100



Sanyo Portable System

All bases are covered by Sanyo's unique MDC-2000 boombox: AM, FM, cassette tape, CD, and MiniDisc. The first "universal" unit we know of, it even synchro-copies

from CD to MiniDisc or tape at the touch of a single button. Copies with custom track sequencing also are possible. Price: \$999.99. For literature, circle No. 101



SAUDER EQUIPMENT CABINETS

Among its new Coventry entertainment centers, the 2585, 2584, and 2583 (left to right) are just three of over 30 user-assembled furniture kits that are available from Sauder Woodworking. This approach reduces cost (compared to factory assembly) by 25% to 50%, according to the company. The full line includes styles that range from Shaker to contemporary. Prices: \$130, \$240, and \$190, respectively. For literature, circle No. 102

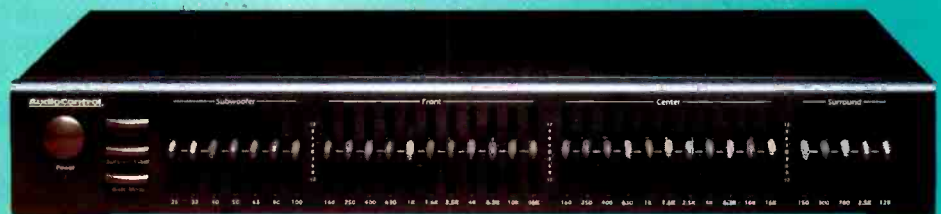
Audio Control Equalizer

Designed with home theater in mind, the Audio Control Rialto is billed as the world's first seven-channel equalizer. While many system hookups are possible, the unit basically feeds left and right main channels, a center channel, two surrounds, and two

subwoofers. A built-in 24-dB/octave crossover, preset to 90 Hz but user programmable, can be used

for the subwoofers. The subwoofer channels' EQ circuit has seven bands, the three front channels have

11-band controls, and the EQ for the surrounds has five bands. Price: \$579. For literature, circle No. 103





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Numbers. CDs are loaded with them. A great bunch of ones and zeros just waiting to be transformed into music. Sonic Frontiers has effectively tackled this transformation of numbers into music with their complete line of digital products. The critical press, the world over, has been raving about the remarkable price/performance of these products. In fact, the level of performance Sonic Frontiers offers is usually found only in units in much higher price categories. This all adds up to incredible sound value for the discerning listener.

SFD-2 MKII DIGITAL PROCESSOR

One of the first Digital Processors on the market with HDCD® capabilities, the SFD-2 MKII has set a benchmark by which other units must be measured. It is a true, fully balanced design; two of every component, from the DAC modules to the tube output stage, all packaged onto modular boards for easy upgradeability.

SFD-1 MKII DIGITAL PROCESSOR

A scaled down version of the SFD-2 MKII, the SFD-1 MKII also boasts the HDCD® filter/decoder chip and a virtually identical tube analog stage to the SFD-2 MKII. The SFD-1 MKII Digital Processor offers some serious competition to processors many times its price.

SFT-1 TRANSPORT - NEW!

The SFT-1 Transport is the newest addition to the Sonic Frontiers line of digital products. This unit offers exceptional performance and accuracy in reading information off CDs. It is unmatched in the area of jitter, leading the field with the extremely low measurement of 10 picoseconds, from 100 Hz to 40 kHz (as independently verified using UltraAnalog's latest Jitter Analyzer).

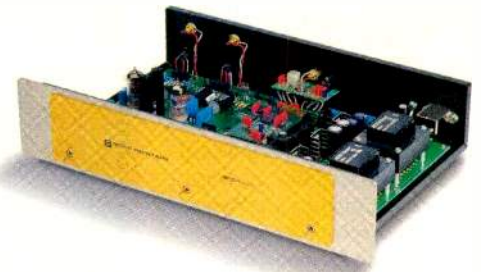
ULTRAJITTERBUG

Utilizing UltraAnalog's AES21 AES/EBU ultra-low jitter input receiver, the UltraJitterbug reduces the jitter from a digital source such as a CD transport or DAT. The UltraJitterbug (housed in a small-sized chassis), when linked between the digital source and processor, decodes and attenuates the jitter that is present in a digital datastream to a figure of 40 picoseconds or less (beginning at 1 kHz at a rate of 6 dB per octave). This means improved performance for many transports, without a costly upgrade.

TRANSDAC

The TransDAC, Sonic Frontiers' first product to implement op-amps in the analog output stage, offers outstanding performance and is a welcome addition for audiophiles without a kilobuck budget for a DAC. The deal gets even sweeter when the TransDAC is packaged with the UltraJitterbug. Known as the "Dynamic Duo", these two units offer remarkable performance at a never-before-seen price - a great way to improve any CD player with a digital output.

Call, write or fax Sonic Frontiers for brochures and reviews on these digital product or for information on Sonic Frontiers' complete line of amplifiers and preamplifiers.



SONIC FRONTIERS
INCORPORATED

BREAKING THE SOUND BARRIER

WHAT'S NEW



Advent Theater Speakers

Sleek black-ash vinyl styling dramatizes the slender proportions of Advent's acoustically matched HT103 speaker suite. Included are 8-ohm units for left, center, and right use. Frequency response is rated at ± 3 dB between 60 Hz and 20 kHz. All are two-way systems with magnetically shielded 5-inch woofers and PPTA (Polypara Phenylene Terephthalamide) tweeters. (The stands shown are not included.) Price: \$479 per set. For literature, circle No. 106



Avalon Acoustics Custom Speaker

A new HC (for High Current) version of Avalon's Radian loudspeaker is tailored exclusively for users of high-current amplifiers and appropriate cables. By optimizing the crossover expressly for such systems, Avalon says, harmonic integrity, microdynamic accuracy, and low-level resolution are improved. Price: \$12,500 per pair. For literature, circle No. 107

a/d/s/ Subwoofer

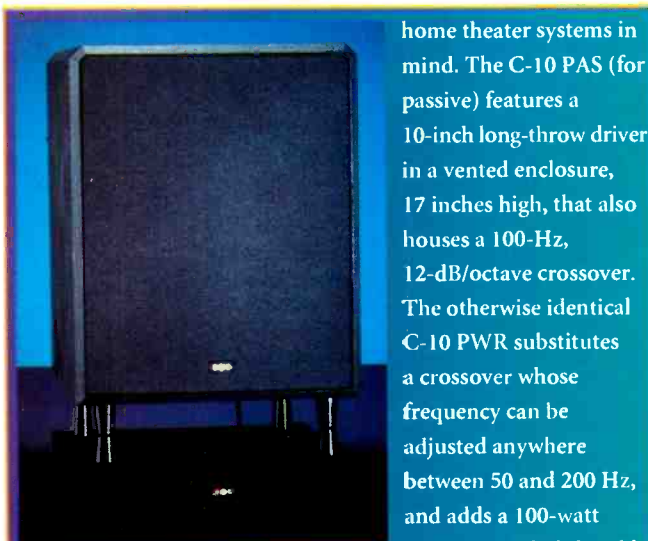
Latest of the a/d/s/ MS series of subwoofers, the MS4 is powered by a built-in amplifier rated at 250 watts. Coupling is via negative impedance servo feedback, credited with keeping sonic output exceptionally clean. In addition to mahogany and ebony, the unit is available in textured charcoal. Price: \$1,299 each. For literature, circle No. 104



GERSHMAN ACOUSTICS SPEAKER

Looking like its name, the Avant Garde speaker system from Gershman Acoustics might be described as a modified obelisk. Its front contour is designed to preserve time coherency between the three drivers (a 1-inch fabric-dome tweeter, a 3-inch dome midrange, and an 8-inch long-excursion fiberglass-cone woofer). The piano finish adds to the drama of the enclosure, which stands 3 feet high. Price: \$3,600 per pair.

For literature, circle No. 105



B+I+C Subwoofer

You have your choice of powered or unpowered versions of B+I+C's C-10 subwoofer, designed with

home theater systems in mind. The C-10 PAS (for passive) features a 10-inch long-throw driver in a vented enclosure, 17 inches high, that also houses a 100-Hz, 12-dB/octave crossover. The otherwise identical C-10 PWR substitutes a crossover whose frequency can be adjusted anywhere between 50 and 200 Hz, and adds a 100-watt amplifier with defeatable automatic on/off switching, triggered by bass in the audio signal. Prices: C-10 PAS, \$229 each; C-10 PWR, \$449 each. For literature, circle No. 108

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5 Product of the Year Awards* in the past year alone,
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“Stunning!”

- The Inner Ear Report on the Esprit/BP

Paradigm's spectacular bipolar speakers are an engineering and sonic marvel! With years of design expertise and our highly advanced R&D facility, Paradigm engineers and acousticians set out to build the world's finest bipolar speakers, regardless of cost!

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- (PAL™) pure-aluminum convex domes
- Critically coupled diecast chassis
- Oversized damping chambers
- Oversized magnetic structures

Cascade™ Enclosures:

- Sophisticated cascade of interlocking, full perimeter horizontal and vertical braces
- 1" thick MDF front and back baffles
- High velocity, low turbulence ports



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“Awesome!”

- Audio Ideas Guide on the Eclipse/BP

**THE ULTIMATE IN
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These astonishing state-of-the-art bipolar speakers combine exceptional spaciousness, precise image placement, superb timbral balance, extraordinary resolution, thunderous deep bass and tremendous dynamics for absolutely staggering realism!

Combine any of our bipolars with our Ultra-Clear™ center channels, amazing ADP™ surrounds and astounding PS powered subwoofers for the absolute finest in home theater!

The Critics Agree...

Paradigm has achieved the highest standard of performance in bipolar design. **So don't settle for less, listen to these sensational speakers today!**

* Sound & Vision Critics' Choice Awards
* AudioVideo International Grand Prix Awards

† Apical is a trademark of DuPont

Tape Head Alignment Headache

Q *The components relating to my problem are two Hi-Fi VCRs, a CD changer, an FM tuner, and a three-head cassette recorder. I record CDs onto cassette for use in my car. I often record Metropolitan Opera broadcasts on a Hi-Fi VCR, later to be copied onto cassettes. Everything worked fine until I had the cassette machine serviced. From the way it appears, the heads must have been realigned. New recordings made on this deck sound fine, but tapes which were recorded prior to the repair (I have perhaps 2,000 to 3,000 of them) sound terribly dull. Cymbal crashes that once were beautiful now appear to be coming from a distant room with its door closed. I really don't want to have my deck realigned again because my recent tapes, which now sound fine, will sound lifeless. Do you think I can restore the original brilliance of the previously made tapes by using an equalizer? I used Dolby C noise reduction when making these tapes, so will hiss be a problem?—Name withheld*

A It's always best to have properly aligned machines, because it makes your tapes compatible with most other decks, including car stereos. (You don't say whether your old or new tapes sound better in your car.) So first determine whether your deck is now properly aligned or whether it was aligned properly before it was serviced. If you do not have a standard alignment tape, play a few commercially recorded tapes; should they, too, sound dull and lifeless, you can be relatively certain that your machine is now misaligned.

I hope that this is indeed the case. If it is, what you can do is to copy your few new recordings back to one of your VCRs. After realigning your cassette deck's heads so that the majority of your tapes again play properly, copy the videotapes back to cassette. If you have the videotapes from which your cassettes were originally made, you can skip some of the extra copying and keep sonic losses down.

The king-sized headache is if your deck's heads were misaligned when you made those thousands of old recordings. You

could never find the time and ambition to recopy the whole collection. For home play, the simple solution would be to obtain another good cassette machine and set its azimuth so that all of your original tapes play back properly. This second machine will be used only to play these tapes; any newer recordings will be made with the machine whose azimuth is correct. This fact must be shown on the cassettes' labels and also entered into any database you maintain.

It is unlikely that you could compensate for improper azimuth by using an equalizer. The Dolby system will not have the correct frequency response, which will lead to many sonic problems. Further, even with the Dolby system switched on, tape hiss will be unacceptable.

TV vs. A/V System Loudspeakers

Q *I feed my TV's audio output jacks to the auxiliary inputs of my amplifier. Unfortunately, these jacks are affected by the volume control on the TV. Because I don't want to hear sound from the TV's loudspeakers, I have to keep its volume control turned low, forcing me to turn the amplifier's volume control quite high. Should I use some kind of auxiliary amplifier between the TV set and the amplifier? Or can I just run the signal from the set into my amplifier's low-level phono inputs?—Robert D. Miller, Grosse Pointe Woods, Mich.*

A If you obtain sufficient volume without excessive noise from the arrangement you are now using, I see no compelling reason to do anything more than relax and enjoy your TV audio. But I can see where you might be uncomfortable with a high amplifier gain; inadvertently switching to another input without lowering the volume could be disastrous.

However, most TV sets with audio output jacks also have switches (usually on the back) to disable the set's internal speakers when external speakers or amplifiers are used; check your TV's instructions if you don't see such a switch. With the speakers disabled, you could adjust the set's volume control for optimum input level to the am-

plifier. If your TV has a headphone jack, putting a dummy plug into that jack may also shut the speakers off. No harm should result from this. Alternatively, you might splice a switch into one of the wires feeding each of your TV's speakers.

Phono inputs are completely unsatisfactory as auxiliary signal amplifiers. These inputs feed into equalization circuits that deliberately alter the frequency response, overemphasizing bass and cutting treble. What's more, even the signals coming from your TV when its volume is turned down may be strong enough to overload a phono input, causing audible distortion.

Stopping Tape-Stop Noise

Q *When the tape-end sensor on my open-reel recorder turns the machine off, there is a very loud cracking through my system. I'm concerned this will eventually make my tweeters fail. I try to compensate by turning down the volume before this switch kicks in. But because I usually forget or don't make it to the amplifier in time, the noise still gets to the speakers. Do you know of any device that can be connected between the deck and the preamplifier to eliminate this noise? If there is no such device, can anything be done inside the deck to cure the problem?—Robert De Angelis, Seaside Park, N.J.*

A I know of no device that can be plugged between the tape deck and the rest of your sound system to eliminate the offensive switching transient. The likeliest cure would be to wire a series RC filter circuit across the contacts of the end-of-tape sensor switch. Experiment with different values, but try 100 ohms in series with a 0.02- μ F capacitor. (The resistor should be rated at 1 watt, the capacitor at 600 V d.c.)

This should work for decks that simply shut off motor power at the tape's end, leaving the capstan engaged with the pinch roller. More complicated systems use solenoids to retract their pinch rollers when power is removed. When power to the solenoid is shut off, the magnetic field in the solenoid's field windings collapses, producing

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

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By Martin Colloms
Reprinted from
HI-FI NEWS & RECORD REVIEW
February 1994

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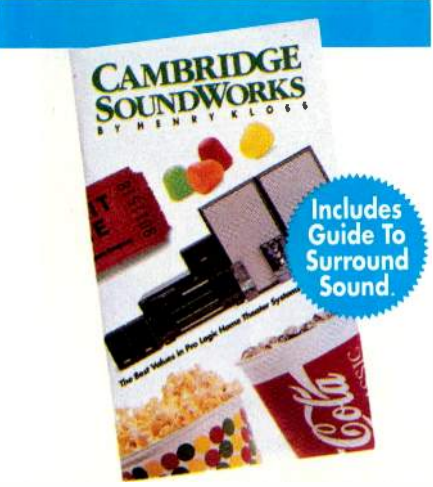
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By Robert Hartley
Reprinted from
STEREOPHILE
Vol. 17, No. 18, August 1994

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a transient that can sometimes find its way into the electronics and produce the noise you mention. The cure is to place a diode directly across the field winding. It must be wired so that it is back-biased while the field is energized, but will conduct freely when the field collapses. The diode must be capable of carrying 2 amperes or more.

I have also found it's sometimes necessary to place an RC network (like the one described above) across the contacts of relays that feed power to the motors.

Three-Second Sound-Saver

Q I recently bought a Sony D421-SP portable Compact Disc player, which features a defeatable 3-second buffer memory. With the buffer on, not only is the shock protection great, but there is also a tremendous amount of error correction: The unit flawlessly plays discs with serious chunks of missing data. In fact, this portable's error correction is much greater than that of any of my other CD players. With the data stream bypassing the buffer, however, the error correction is the worst of all my players. Why does the use of this buffer memory improve both shock resistance and error correction?—Den- nis M. Krebs, Philadelphia, Pa.

A Your portable is “smart” enough to recognize errors, but it takes time for it to construct its best possible corrections. When the buffer is switched into the circuit, the extra 3 seconds gives the machine the time it needs. When the buffer is off, the machine will make some attempt to correct an error, but it may not have enough time to prevent the error from affecting the sound in some way.

It makes relatively little difference whether the need for data reconstruction is occasioned by a flawed CD or by interruptions in the data stream due to physical shock. Either way, there's missing data that the player's logic circuits must either reconstruct from “redundant” information or simulate by interpolation if you are not to hear anything amiss.

Subwoofers for Home Theater

Q My home theater system has a mono output designed to feed a subwoofer. What kind of signal is this output passing? Is it a left-plus-right signal derived from the main left and right front channels? If so, wouldn't some frequencies be cancelled, rob-

bing me of good sound? Can I get smoother response by using two full-range loudspeaker systems for the front channels? Can I then add two separate subwoofers, one in each channel?—Name withheld

A The signal from your subwoofer output will be the sum of both the left and the right channels' low frequencies. Stereo signal components that are not in phase will be cancelled and not fed into the subwoofer, but this is not terribly important because low frequencies on a recording or soundtrack are, most often, essentially in phase. If you use a separate subwoofer for each channel, some out-of-phase bass frequencies will cancel acoustically, but the cancellation will vary with frequency and position in the room.

If the subwoofer output is a phono jack, it's probably line level, designed to feed a powered subwoofer or a separate amplifier feeding the subwoofer. If that output appears as a pair of terminals rather than a phono plug, it's probably designed to be connected directly to the voice-coil of a subwoofer.

If you have two full-range loudspeakers (I mean really full range), there is no reason to use a subwoofer. Otherwise, you can indeed use two subwoofers, one per front channel, via appropriate crossover networks. Two subwoofers will have more overall output than one and will extend lower in frequency. (This is not a matter of signals being cancelled when the channels are summed, by the way.)

Bi-Wiring's Benefits

In response to Wilden Valencia's question regarding the benefits of bi-wiring that appeared in the September 1994 “Audioclinic,” I feel that bi-wiring loudspeakers can be beneficial for two very specific reasons. First, cable resistance is cut in half; second, crossover effects occur at the amplifier's output, reducing crossover component interaction. Both of these effects can improve overall performance. I almost always advise against loudspeaker bi-wiring that uses the A/B amplifier outputs, the setup Mr. Valencia asked about. These outputs usually insert switch or relay contacts into the signal path, increasing resistive losses. In the end, though, it's up to the listener to determine if this alternative wiring method has improved the system's sound quality.—Name withheld **A**

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Because we sell carefully matched and tested home theater speaker systems Factory-Direct, and through cost-efficient Best Buy stores, you can save hundreds of dollars. We believe the products on these pages represent the country's best values in high performance home theater components. Audio critics, and thousands of satisfied customers, agree. *Stereo Review* said, "Cambridge SoundWorks manufactures loudspeakers that provide exceptional sound quality at affordable prices." *Audio* suggested that we may have "the best value in the world."

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to a Cambridge SoundWorks *Ensemble* satellite (but with magnetic shielding). \$149⁹⁹. *Center Channel Plus* uses an ultra-low, ultra-wide design that is ideal for placement above (or, with optional support stand, below) a TV monitor. \$219⁹⁹.

Surround Speakers

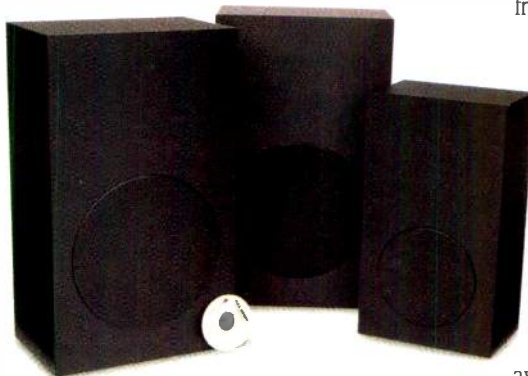
Cambridge SoundWorks makes two "dipole radiator" surround sound speakers. Dolby Laboratories recommends dipole radiator speakers for use as surround speakers. *The*



Surround has a very high power handling capacity and is often selected for "high end" surround sound systems. *Audio*, describing a system that included *The Surround* said, "In many ways the surround sensation was every bit as good as far more expensive installations." \$399⁹⁹ pr. The smaller *The Surround II* is arguably the country's best value in a dipole radiator speaker. \$249⁹⁹ pr.

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Our *Slave Subwoofer* uses the same woofer driver and cabinet, but does not include the amplifier or crossover. It can only be used in conjunction with the *Powered Subwoofer*. \$299⁹⁹. The new *Powered Subwoofer II* uses a 120-watt amplifier with an 8" woofer. \$399⁹⁹.

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CIRCLE NO. 6 ON READER SERVICE CARD

Whose AM? Part II

Dear Editor:

I am writing in response to Bill Kleronomos' letter in the February issue. The first correction I'd like to make concerns Mr. Kleronomos' assertion that radio stations, especially on the AM band, routinely overmodulate, causing poor, distorted audio and listener fatigue. This is an illegal practice. So, sir, if you believe a broadcaster is acting in violation of the FCC's [Federal Communications Commission's] C.F.R. Sections 73.25 to 73.69 and overmodulating, why not avail yourself of the appropriate legal remedies? Before you call your nearest FCC field office, however, you should check the calibration, front-end gain, and tuning of the Type Accepted Modulation Monitor you are surely using to back up your claims. You will find that the majority of broadcasters, while certainly striving to maximize their effective coverage, are not in the habit of trashing their audio or willfully violating technical rules. The engineering community, through its self-policing of technical compliance, has historically done an excellent job of maintaining modulation levels within the law. This, and the reliability of modern devices, has been recognized in the FCC's recent NPRM [Notice of Proposed Rule-Making] to allow unattended transmitter operation.

The FCC has not, as you assert, "accommodated virtually every rule change proposed by the NAB [National Association of Broadcasters] to allow ever more stations to be licensed in a given market." In fact, the NAB has traditionally discouraged additional allocations in either band. What you are referring to was a compromise, administered by the NAB, between the clear-channel allocations and local, previously daytime-only allocations that were interested in a larger slice of the pie. It was the NAB that prevented a massacre and protected the interests of clear-channel operators when operating rules were revised. The demand for nighttime authorizations was orchestrated by local business leaders, lobbyists, and minority groups who were putting pressure on Congress to force the FCC's

hand. The FCC has never been a puppet of the NAB.

In fact, when the FCC has listened to the AM marketplace rather than the NAB, as you would have it do, we get results like the AM stereo debacle. It took nearly 15 years from the first mention of AM stereo until the FCC defined a Standard, after becoming frustrated with letting listeners and equipment manufacturers decide. On the other hand, when guided by the NAB, the FCC and the industry recently, and quickly, implemented two of the most significant improvements in AM fidelity. Those improvements are the NRSC-2 mask, to reduce adjacent-channel interference, and the AMAX Standard for AM receiver design. You may find it hard to believe, but most of AM's reception problems are not at the transmitter site, as you assert: The problems have been largely with receivers. The AMAX Standard, which applies to all stationary and mobile AM receivers, is designed to correct the hapless receiver designs of previous years. Mr. Kleronomos also neglects to mention the added 1 MHz of spectrum provided in 1992 by the new expanded band. This band seeks to alleviate crowding in the present band, which will reduce interference and allow some clear channels to return to their prior dominance.

According to the Communications Act of 1934, which the FCC enforces, radio broadcast allocations exist primarily to serve the local community, not the regional or nationwide audience. National coverage comes from network programming provided to local broadcasters. Congress, and the FCC, enacted the short-spacing rules, the expanded band, Docket 80/90, and other similar legislation to restore local service to those markets that were underserved or had no local outlet. Unfortunately, the r.f. spectrum is a limited resource. While I generally am not in favor of governmental oversight, that is sometimes the only way to preserve a natural resource for all to enjoy. If you enjoy listening to out-of-town signals, perhaps you should try DXing the ham bands. You have no right to seek a "remedy" that would deny your neighbors their local cov-

erage of news, weather, sports, and public affairs.

Lack of maintenance, cheap and shoddily produced programming, and poor processing are not unique to radio broadcasting. Every industry has its slums, but not every owner or manager is a slumlord. In fact, I resent the insinuation that radio is overrun by such people. For many stations, the proper management of technical and programming concerns is a key consideration and part of a station's success.

The last inaccuracy addresses the common misunderstanding of Arbitron's role in the media-buying process. Arbitron exists to serve advertisers, not broadcasters. The reality of combining news and entertainment with advertising, in an attempt to generate both ratings and revenue, has yielded polarized allegiances. On the one hand, there are listeners who want to be entertained, hence the phrase, "Shut up and play the next record." On the other hand, there are advertisers who want the most exposure per hour they can get. More exposure means less music or news. But to have exposure, you must have listeners. To have listeners, you have to play what the audience wants to hear—but don't tell an advertiser that. Advertisers will settle for a more predominant presence if their ads can't get more repetitions per hour. How do we give them more presence? By using audio gimmicks and by making their ads loud, as loud as the next guy—because the advertisers are the ones who pay the bills, and that's what they want. To judge the potential penetration of their ads, advertisers use a ratings service, such as Arbitron. While station formats may live or die by the ratings, ratings ultimately serve the needs of advertisers in negotiating advertising rates. The ratings services are not structured to serve the listener or the station. If you have a problem with the laws, you complain to Congress; if you have a problem with the programming or technical content of a station, complain to the advertisers. Tell the local advertiser in the station's city of license that you picked up the signal in the hinterlands. The advertiser's local vendor probably couldn't care less. Neither the station owner nor the vendor gains anything from broadcasting beyond the ratings boundary of their sales territory. National advertisers, however, may be attracted by a sufficiently large coverage

“RECOMMENDED COMPONENTS...” —Stereophile, Vol. 18 No. 4, April 1995

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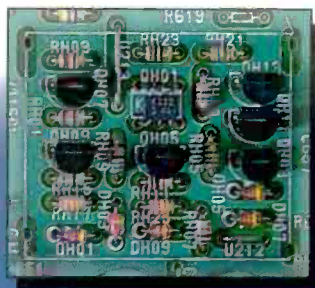
—SAM TELLIG,
Stereophile, Vol. 17 No. 11, December 1994

★★★★★ —What Hi-Fi?, March 1995



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area and may listen to your complaints. In any event, complaining to the FCC or to a particular station is a fruitless endeavor as long as broadcasters are beholden to both Congress and advertisers.

Clear-channel broadcasting was a fine and necessary service in the industry's infancy, when the population was half what it is now, less literate, and less worldly wise, and technology was cumbersome, expensive, and unreliable. However, a more educated and literate public is thirsty for information. In the age of the "global village," that thirst is easily met by reliable, low-cost broadcasting and satellite and computer technology. With the help of local advertisers, local radio continues to provide a cheap, portable, mobile, and irreplaceable source of instant regional and national news. Think of it as the cheapest and most readily accessible component of the Information Superhighway.

*Edwin Bukont, Jr.
Certified Senior Broadcast Engineer
and Vice Chairman, Chapter 37,
Society of Broadcast Engineers
Washington, D.C.*

Mr. Kleronomos Responds: One of the points I was attempting to make in my prior letter was that, except for the superior noise-cancellation properties of FM, there was no technical reason why, within the limitations of bandwidth regulations, AM broadcast quality had to be the inferior broadcast medium it typically is today.

It is a fact, supported by data in numerous engineering texts, that AM receivers using envelope (or diode) detectors produce significantly higher levels of audio distortion as the modulation percentage of the transmitted signal increases; such receivers probably comprise better than 99% of what the public owns. This is one end of the problem.

The other end of the problem occurs at the broadcast station itself. Every AM broadcaster uses audio processing of one kind or another to control modulation peaks, primarily to insure compliance with regulations. An AM signal has two "types" of peaks, positive and negative. Exceeding 100% negative modulation is highly illegal, for it produces effects such as adjacent-channel crackles, splatter, or "buckshotting." When one exceeds 100% positive

modulation, the net effect is to increase the apparent loudness, or punch, in a signal. Doing so is not illegal. Add some fast compression or other tricks, and you've got audio that'll knock your socks off! Typically, most broadcast stations will limit their negative modulation peaks to 95% and will set positive peaks to 110% to 115%. Unfortunately, by definition, altering the waveform of an audio signal from that of the source is distortion, and AM broadcasters routinely do this as part of the modulation process to sound loud—as loud as the next guy, as Mr. Bukont freely admits. Add to this the direct correlation between modulation percentage transmitted versus distortion generated in a diode detector, and it's no mystery why the public has turned away from AM as a source of quality program material: It simply sounds lousy on their receivers.

For the NAB to promote superior AM broadcast receiver standards (AMAX) is akin to putting the cart before the horse. Manufacturers and the free market probably would have put superior AM receivers on the market long ago had there been a reason to do so—like public enthusiasm driven by the availability of a quality program source. In spite of the efforts of the NAB, AMAX receivers are going to be another unsold technological marvel until many AM broadcasters cease trying to suck in listeners by emulating the compressed, distorted sound of a Mexican border station. Given the state of the medium, it's regrettable but typical that dissatisfied members of the listening public, such as me, are told to complain to the manufacturers of our receivers.

Technical issues aside, one of the areas in which AM broadcasting has distinguished itself has been in the presentation of news and other matters of immediate public interest. The backbone of this service has been the 50-kilowatt clear-channel stations located in our major metropolitan centers. Several award-winning stations, such as KNX in Los Angeles and WBBM in Chicago, provide world-class news service over a wide region, particularly at night. Additionally, such stations as WBAP in Dallas, WWL in New Orleans, and WSM in Nashville count thousands of loyal travellers and truckers in their nighttime audiences who rely on their unique blend of entertainment and timely weather and highway reports.

Clearly, to create a positive image of AM broadcasting, these continuing success stories are a good place to start. Instead, Mr. Bukont first states that the NAB tried to protect this resource, then implies that listeners are a bunch of technological geeks who get a kick out of picking up Muncie, Indiana, on a crystal set. Well, listeners wouldn't bother trying to listen to the aforementioned stations except for the fact that the majority of the local AM stations Mr. Bukont praises fail miserably in providing the timely, comprehensive information services that the big boys do. Yes, perhaps the heyday of the clear-channel broadcaster was years ago, but the technology still works and is available for anyone to utilize. There's absolutely no point in trashing the mode until some alternative technology becomes as cost-effective and practical.

I must also add that my own desire to listen to out-of-town news sources has nothing to do with wanting to deny others their local news coverage, as Mr. Bukont concludes. There are literally scores of local AM and FM broadcasters in every metropolitan area; small towns that merit a freeway exit often have a local AM outlet. How reserving a handful of AM channels for the use of wide-area broadcasters could muzzle local news coverage is a mystery known only to Mr. Bukont.

Yes, I did neglect to mention the recent expansion of the AM broadcast band to the region between 1,600 and 1,700 kHz—not out of ignorance or for any sinister reasons, but because stating so was irrelevant to the points I was trying to make. As of this date, the new band is unoccupied, its potential unclear. And since facts are essential to any discussion, I must point out that the broadcast band was expanded by a mere 100 kHz, not the 1 MHz Mr. Bukont cites.

Let me conclude by restating that, on a number of levels, the AM broadcast industry has been doing itself in. And, as Mr. Bukont's letter makes clear, AM broadcasters have been blaming everyone but themselves. In an era where, in order to succeed, a business must provide exceptional customer service, broadcasters all too often take the low road. As Mr. Bukont states, don't waste your time complaining to the advertisers, stations, or the FCC, and, by all means, don't bother taking your complaints to the NAB! Clearly, if an AM broadcaster has inferior

audio quality, the explanation must be our hapless receiver designs, that listeners don't know what they're talking about, or that the hardware made the engineer jack the audio up into 20 dB of clipping! In my first letter, I never stated or implied that any broadcaster would deliberately violate government regulations, but they can—and commonly do—violate good engineering practice for the transmission of quality audio. Separating what should be two entirely different issues is something Mr. Bukont needs to do for himself. And as long as the status quo continues, the obviously misinformed listening public is going to continue to vote for FM. Which is a darn shame, because my point all along has been that it doesn't have to be that way.

Come Home to *Audio*

Dear Editor:

In the October 1994 issue, a reader thanked *Audio* for being his prime source of information about hi-fi for many years. Unfortunately, he had to give up his subscription because he was going more toward the professional side of sound (i.e., recording).

His choice was to leave *Audio* and enter the world of professional audio magazines to educate himself.

I must say I went through the same process some time ago, reading *Mix*, *EQ*, *Professional Sound*, and others. I soon found out those magazines come nowhere near *Audio* as far as *serious* technical content is concerned. Their editors often lack knowledge and respect for the laws of physics (which I happen to follow).

When I read this man's letter, it left me smiling and thinking: Boy, he'll be back, too. Sure, there is still lots of room for more technical content in *Audio* (wasn't that one of the conclusions of your readership survey?). But some of the best pros *are* with *Audio* (Keele, Eargle, Long, Foster—and they happen to come from the pro sound field). Sure, these experts don't share as much of their expertise as they might with the readers of *Audio*, but adding the bits and pieces of a few issues amounts to a decent technical meal (one can't say that after even 10 issues of *Mix*).

The loss of Len Feldman is sad, but then the man replacing him, Ed Foster, is of as

high caliber, no doubt about that. I recall reading Mr. Foster many years ago in *High Fidelity* magazine, and I still read his texts in *Audio* and *Sound & Vision*.

There's yet another reason why the reader mentioned earlier will be back to *Audio* sooner or later. You are now reviewing some pro gear (*at last*), such as the Sony TCD-D7 portable DAT recorder (June 1994), the Electro-Voice N/D 857B microphone (December 1994), and the Mackie MicroSeries 1202 portable mixer (January 1995). I have owned a Mackie for at least two years, and I, too, think it is a best buy. Proof: Ross copied it, and Soundcraft also did so. There must be a reason. . . .

Yes, the man will come back some day, just as I did, especially considering the improvement in pro-gear coverage that your magazine is starting to make. The more, the better. Who knows, maybe one day we'll see some microphones again in the Annual Equipment Directory, since one can't pretend to be "The Equipment Authority" without covering them.

Richard Mercier
Laval, Quebec, Canada

NIGHTNOISE

A DIFFERENT SHORE

A Different Shore is an adventurous new collection showing why critics call **Nightnoise** "The Celtic Supergroup."

A band that writers find difficult to describe, Nightnoise creates a passionate mix of traditional Irish influences with elements of pop, chamber music, and modern jazz. They are one of the pioneers of the "new Celtic" sound, popularized by superstars including Enya, Clannad, and Loreena McKennitt, and are one of Windham Hill's most enduring groups.



WINDHAM HILL

MORE MARCONI



Herewith, more “Did you know?” questions concerning Guglielmo Marconi and the early days of radio transmission (otherwise known as wireless telegraphy), as described in Peter R. Jensen’s book, *In Marconi’s Footsteps, 1894-1920: Early Radio*—one of the subjects of last month’s column.

Did you know that the very first Marconi receiver used a vacuum tube as its essential detector? That was back in 1896, a mere 99 years ago. No, it was not the present tube (or valve, in British parlance), but indeed it was made of glass, evacuated, pumped out, then sealed. The curious-but-logical name of this proto-radio tube was the coherer.

I had vaguely heard of the coherer before I read Jensen’s book, but now

I know how it works. The tube was filled with loose metal filings, about 95% nickel and the rest silver, which had a most curious property discovered not by Marconi but by a series of earlier workers: In their loose state, the filings offered just enough collective resistance to hold back a low voltage, such as that from a single cell, but—this was the big discovery—when a strong electrical spark went off, even at a considerable distance (at first, merely inches and feet), the filings suddenly compacted themselves and allowed a current to flow. This reaction could be quite strong, enough to ring an old-fash-

**MARCONI HAD ONE OF
THOSE GENIUS MINDS
THAT KNEW INSTANTLY
WHAT OTHERS HADN'T
SEEN BEFORE.**

ioned doorbell. (It was a very rudimentary sort of amplifier.)

To this day, this very odd reaction remains less than entirely explained. It must have been as baffling at the time as the earlier discovery of electricity. A thing to wonder at, but of what practical use? Yet there, you can see (if you are a Marconi), was the germ of some sort of practical wireless communication.

Typically, the earlier distinguished scientist/engineers who examined the phenomenon could not see that far ahead. But Marconi, like Edison—though an utterly different and much better educated personality—had one of those crucial minds that pulled things together at a definitive point in time, one of those minds that understood in an instant what generations of savants had not seen before. Like Edison, Marconi based his work on others who preceded him. Like Edison, he got into assorted troubles as a result. Both of them survived handily. And rightly. Such minds are crucial to civilization.

Well, you, too, would probably have troubles if you tried to make a radio, a receiver of signals, without any intervening wire connection, out of the coherer! Marconi found that it was as obstinate as a mule. The first problem was overwhelming: When it detected one spark burst, it would get stuck in the conducting state and not let go. The particles continued to

“cohere,” the word the Englishman Sir Oliver Lodge had used only a year or so before, and the current continued to flow. One burst, and that was it. A fine communication, a sort of one-bit signal!

Unless . . . unless what? Unless you could physically tap on the tube and loosen up the filings to detect another burst, being careful not to break the glass. Then you would have two

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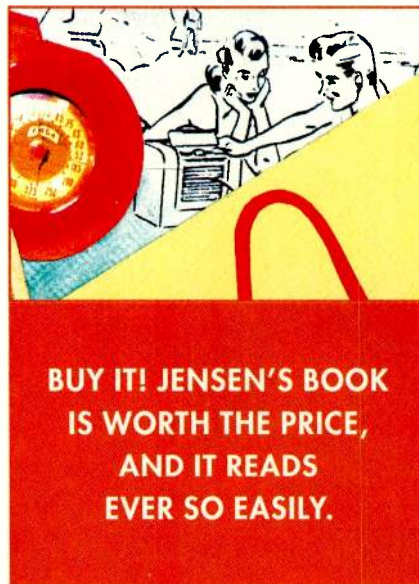
bits. Is your Marconi-like brain working yet? Your aim, of course, is to receive Morse telegraph code via a succession of many spark bursts, sent through the so-called air.

Keep in mind that the 1890s were still technically the mechanical age. Electricity was not yet in full sway; electronics was completely unknown in any practical sense. So your solutions to most problems—from typewriters, can openers, and alarm clocks to newfangled wireless detectors—was bound to be found in some sort of mechanical action: Gears, levers, ratchets, and all the rest. Thus, in no time at all, there was a challenge to the coherer's obstinacy. It was called a tapper. And it did just that, producing a rapid series of taps on the coherer's glass, careful not to break it, so that each spark pulse was instantly followed by a de-cohering jounce on the filings to loosen them up for the next pulse. You had to wind it up, clockwork. Crude, you may say, but it worked. And in the Marconi mind it was sufficient to allow for enormous improvements, which very soon lengthened his wireless transmissions from a few feet to many meters, then to well over a kilometer of separation between his transmitter and receiver. Or, to honor the English part of his heritage, a good mile distant. Just as in the 1830s there were simultaneous frantic efforts to develop a telegraph via electricity and wires, there were numerous other minds then furiously working on the problem of wireless communication. Marconi's breakthroughs were miles ahead of the competition's.

The clumsy coherer, with its accompanying tapper, continued to be used during these years of rapid wireless expansion, with greater and greater distances achieved, including the somewhat premature (and doubtful) transatlantic communication of 1901, some 2,170 miles. Only a shift toward different sorts of spark creation—damped, tuned, assorted “solid-state” detectors, and, finally, the vacuum tube—put the coherer on the shelf along with its windup tapper.

The details regarding the coherer are merely one aspect, if an unusual one, of this fascinating book. A large part of the ensuing development of the wireless hinged on an increasingly precise understanding of the workings of conductance, capacitance, and, notably, the crucial effects of tuned resonances and selectivity in the electro-

magnetic spectrum as applied to this entirely new physical phenomenon. It was here that Marconi differed from Edison. His knowledge of the basic laws of electricity were as perceptive as anyone's at the time, though mostly self-taught at the typical



early age of the genius mind. The germ-idea of all radio hit Marconi at age 19 when he was on an Alpine vacation and read about the sudden death of Hertz, a pioneer along with the older Maxwell in electrical theory. Hertz, too, had transmitted “signal,” the omnipresent spark, but only a very short distance and with no thought of large-scale communication or any communication at all, for that matter. In seconds, young Marconi saw the future in the Hertz experiments backed by the Maxwell codifications. He spent some 40 years thereafter carrying out his perception—simple enough for us today but an idea barely nascent in 1894. Genius may be 99% perspiration, but it's also 99.5% perception!

The one big misconception, the only monumental mistake on Marconi's part (and others'), was the assumption that the longer the wavelength of the transmission, the greater the distance that could be covered. This fundamental untruth persisted for an astonishingly long time, even in the face of rapid progress and large-scale commercial success. Along with this misperception went a lack of understanding of tuning and the crucial resonance of circuits.

Instead, with grossly inefficient transmission, the wireless equipment of those early years quickly grew to monstrous size and

longer wavelengths, using sheer brute force to increase the distance. Not only did antennas, held up on towers up to 400 feet high, grow larger to cover literally miles of territory, but the power of the electrical equipment grew from one or two simple hand-held “batteries” into monster generators with outputs of hundreds of kilowatts and voltages up to 20,000. All this was usually located in remote shore installations that were difficult to service. The transatlantic commercial station near Clifden, in western Ireland, was built in 1907 on a huge tract of peat bog. (The first airplane crossing of the Atlantic in 1919 by Alcock and Brown ended in that very bog, next to the station.) That remote plant, with its enormous generator house which sported six tall chimneys, could have powered a small city. At least they were able to generate, by burning peat, the very stuff on which the buildings sat! There were 30-foot-high condenser (capacitor) plates set a foot apart, hanging from a ceiling, and other incredible monstrosities of the sort.

As understanding of transformers, induction coils, chokes, and circuit resonances steadily improved (yet still within the long-wave misconception), the equipment continued to grow more complex. A small device soon coupled the big antennas to resonate with other circuitry; it was called a jigger. What a name for a mere radio-frequency transformer! Yet it was even more significant for the wireless than for the coherer and its tapper. As Shakespeare said, what's in a name? Plenty, as you can easily see.

Another thing: The Jensen book, published by Kangaroo Press in Australia, is especially good for students. Basic electrical laws today are all too precise and mostly dull in the studying. From Ohm's law to the further projections of Einstein, it's all on paper (or other medium), so you sit there and memorize, solve problems, and pass exams. Very tedious. Once that student drill is over, life begins to be practical and interesting. The Jensen book is a good way to bring those formulas and rules and regulations alive during their actual development, their progressive applications to every stage of radio's swift progress into the real-life world of electronics and audio engineering. Buy it! Worth the price, and it reads ever so easily. **A**



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IVAN BERGER

ASPECTS OF INTEGRATION

Factory car stereo systems are becoming more tightly integrated with the car itself. The GM/Delco/Bose systems started this about a dozen years ago, with custom equalization for each car model. Pontiac advanced it a bit, with radio controls built into the steering wheel. The 1995 Lincoln Continental carries this trend a step

CD changer is in the passenger compartment. According to a spokesman for Lincoln, putting the tuner in the back makes the system more theft-resistant, which is true. Yet I suspect it may have even more to do with keeping the tuner close to the rear-window antenna, where it can get every drop of signal from a type of antenna that (in my experience)



The Eyes Forward dash design, from Delco, puts the sound system's controls—and everything else—right where the driver needs them.

further, integrating its stereo equipment with many of the car's other systems via a multiplexed communications bus. Multiplexing cuts assembly costs, increases reliability (fewer wires and connections to go wrong), allows one-point testing of all the car's electronics, and saves 8 pounds of wire. As far as the stereo is concerned, it allows preset station selections to be tied in with the same Memory Profile System as the seat and mirror positions, the suspension and steering-assist settings, the instrument lighting levels, et al. Signals from either of two supplied car-key fobs (or pressing a button on the driver's door) tell the car whether to set itself (and the radio) for driver 1 or driver 2.

The multiplexing system also simplifies breaking the Lincoln's sound system into modules: The control head and cassette player are in the dash, the tuner and amplifier are in the trunk, and an optional six-disc

doesn't bring in much signal power. The window antenna does, however, eliminate one source of wind noise, and is safe against car washes or all but the most destructive vandals.

An optional car phone can be multiplexed with the stereo. When the phone is in use, the radio not only mutes but also puts the CD or cassette transport into pause.

All these links, plus the new radio's nonstandard oversized panel, will probably give aftermarket installers fits when they try to put other audio components into new Lincolns. But if they think this level of integration is a problem, wait till they see what Delco has up its sleeve.

Delco envisions entirely new dashboard designs. One of these, a prototype called Eyes Forward, puts both a sound system's controls and its displays in front of the driver. The multicolor display panel just above the steering wheel carries information on the sound system as well as

on the running gear and such, and can be reprogrammed at will.

The main menu screen (see photo) includes the usual dashboard items (speedometer, odometer, fuel, coolant temperature, time, and indicators for turn signals and high beam)—but note the basic data on stereo and climate-control settings, in the upper half of the display. Also note the gray areas at the four corners of the display, which correspond to rocker switches on the steering wheel. Pushing on "Sound Controls," "Route Info," "Phone," or "Climate Control" changes the display—and changes the rockers' functions. Press "Sound Controls," for instance, and the display will show what stations are in preset memory and which audio sources are available, while the rockers' functions change to let you scroll through presets or sources, switch tape or CD tracks, change radio stations, and activate RDS.

The integrated system in Delco's Maestro demonstration vehicle (a Mercedes with a totally rebuilt dashboard) has a fancier audio system than the Eyes Forward car. Its dual-antenna tuner has digitally sampled i.f. feeding a digital audio system (complete with DSP for spatial effects and speaker time compensation), 17 speakers (including a center channel in the dash and Lineaem midrange drivers in the front doors), and 900 watts of amp power. Other audio facilities include Dolby AC-3 digital surround, a DCC player, and changers for CDs and MDs.

Both the Maestro and Eyes Forward demo cars were designed to incorporate Digital Audio Broadcast satellite reception, RDS, and GPS navigation systems. The Maestro also includes a system that allows you to transmit your exact location to an auto club, the police, or other sources of assistance just by pushing a button—even if you don't know where you are. But then, the Lincoln, already in production, has this feature, even though it does not use GPS as a navigational aid. **A**

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 JVC JAZZ FESTIVAL

raymond cooke

he shift from loudspeaker design as black magic to that as science has been as fundamental (if not as precipitate or dramatic) as that from analog to digital media. And prominent among those who saw to it that science supplanted cut-and-try was the late and deeply missed Raymond Cooke.

Most of us knew him exclusively as the founder, Managing Director, and latterly Life President of KEF Electronics in Maidstone, Kent. Kent is a gently rolling, largely rural corner of southeast England, tucked between the Thames River estuary and the English Channel and dominated by the city of Canterbury, with its history-encrusted cathedral. In the quiet town of Maid-

stone, Cooke discovered a disused building owned by Kent Engineering Foundry, a maker of heavy equipment used in farm-

ing and orcharding, and there he set up his business. He found it more practical to preserve the pre-existing name (as KEF) rather than to invent a new one from scratch.

To some audiophiles, the KEF name has been epitomized by its utterly unique B139 oval design, with a flat diaphragm and concave surround, a version of which is still in production. Even more closely associated with Cooke himself is the use of

Bextrene plastic in building drivers, which he instituted. The company's growth, via a very successful, compact, near-field



KEF's first home—what is known in Britain as a “Nissen hut.” It was owned by Kent Engineering Foundry; hence, KEF.

b Y K E N K E S S L E R





As a tribute to its founder, KEF has reintroduced classic models as the Raymond Cooke Signature Series. These are the LS3/5A near-field monitor, co-developed with the BBC, and the radical Model 104/2.

Model LS3/5A



Model 104/2



monitoring speaker and on to the triumphs of the 104, 105, 107, and 104/2, was to have been the subject of an *Audio* interview by Ken Kessler. Late last year, Kessler began the process by sitting down with Cooke to talk about the time before KEF was founded. Kessler was encouraged to see how much better Cooke looked than he had on their previous meeting. This first stage of the interview completed, they made plans to meet again for its continuation.

It was not to be. Raymond Cooke died on March 19th. He was 70 years old. Among the honors mentioned in his *Times* (London) obituary were Fellow of the Audio Engineering Society and Order of the British Empire.

What follows, then, is but a fragment of the interview that should have been, left the more piquant by its incompleteness. But the information it contains is particularly valuable because it delves into Cooke's years with Wharfedale and into his relationship with his employer there, the legendary Gilbert Briggs. Doubtless Cooke himself will rate that epithet, "legendary," in due course—if, indeed, he does not already. And those who want to understand the legend will want to know about these early years. *Robert Long*

Before you created KEF, you worked with the great Gilbert Briggs of Wharfedale. . . .

. . . and he was great.

Was he your mentor at the beginning?

He was my mentor in the commercial sense, but not in the technical sense; Briggs was not an engineer and he wasn't a scientist. We got together to complement each other. He had very clear ideas about business. That isn't to say he was the world's greatest businessman or a tower of strength and expertise in the boardroom. But the things that he opined to me during the time that we worked together still come to mind, and they're still true.

For instance, Briggs was not a marketing man. But he once said to me, "The public confused buys nothing." And, of course, he was absolutely right. But what was even more extraordinary was how many of the big companies in our industry failed to heed that simple rule. When, for instance, the Japanese went into four different four-channel systems in the 1970s, they all lost. And look at the number of completely false starts that people like Sony have made. You'd think that they'd have brighter people on their boards to prevent that. But Briggs was always very clear. Every proposition and every move made by his

company was examined from the point of view of how it looked from outside.

What kind of a company was Wharfedale when you worked there?

Very solid. It had a high reputation, but it was quite small. When I joined, the turnover was less than half a million pounds a year, total. But the global reputation that Briggs fostered was so well founded that, in its restrictive way, it was highly focused at the prime people. He very quickly made friends with C. G. McProud [*Audio's* long-time editor, owner, and publisher], and it was through contacts like McProud that he came to take his delightful audio books to the States. He eventually arranged the distribution through British Industries Corporation. And that's how we got started; I eventually joined him in editing the books, as technical editor.

When I joined, Briggs was running the firm himself—head boss, production boss, leaflet writer. He was doing all the things in that firm absolutely right. Anybody who's got anywhere in the hi-fi business since, be it in Japan or in the U.S., has always done it his way. I joined to take the technical design off his back. Subsequently I was able to take over other things. When he reached 65 and was getting rather tired of the whole thing, I was the one who'd go off and see distributors. I took over the advertising. We were already writing the books; then he gave me the leaflets to do. I had a remarkable, unintended apprenticeship. When I eventually decided to quit the Rank Organisation after its takeover of Wharfedale and come and start KEF, I already had far more experience than I could possibly have had in the ordinary way in another industry.

How I came to leave Wharfedale. . . I could see high fidelity wasn't going to get anywhere unless a lot more science was applied. Gilbert Briggs was a bit suspicious of science. Or, shall we say, of scientists. He once wrote of the folly of employing technical people at the head of things because they tend to go after brilliant technical solutions rather than practical, commercial solutions. He had seen many firms go down that way.

It was great working with Briggs because, although he wasn't always right in all directions, he was right more than most.

So what was Wharfedale's technological state at the time?

When I joined them, extremely conventional. Gilbert Briggs had designed the drivers himself, and they were all paper-coned. Big magnets and so forth. The things worked well; they had high

efficiency. Wharfedale's best system was the three-way, sand-filled corner enclosure.

But Briggs' claim to fame was that from about 1955 onwards, he embarked on a series of lecture-demonstrations, all over the world, in which the sound of live players was compared with recorded sound. The first one was in Canada, in a university hall, then St. George's Hall in Bradford, and then in 1955 or '56 he hired the Royal Festival Hall in London. You could hire it for a day for £140 [approximately \$300 at the time], would you believe, complete with all the stuff. . . .

Was Wharfedale one of the most important British makes then?

It was neck-and-neck with Goodmans.

Were you starting to want to put your own stamp on a product early on?

Yes. It seemed to me, being a scientist, that when I looked into sound reproduction—which wasn't my subject; I was originally a chemist, and then an electronics man—if only one could bring scientific procedures even to the experimental work, like listening tests, and then to the production work, we ought to be able to produce a better loudspeaker, smaller and cheaper. I think I was the first person to realize that you didn't have to have a 15-inch loudspeaker to get down to 20 Hz.

I wrote it up for Briggs, on one occasion, that we ought to be able to get that response from a 10-inch loudspeaker provided that the resonant frequency of the driver was sufficiently low. He wrote back that while what I was saying might be theoretically correct, he wouldn't have anything to do with it practically, because a 10-inch loudspeaker would very rapidly go out of alignment and get its voice-coil rubbing. And I replied that that was true only if you thought of it in terms of the current suspensions. If the suspension were redesigned and made in other ma-

terials, like nylon, it would be possible. This correspondence goes back to 1950 to '51, before Edgar Villchur began building the drivers for AR loudspeaker systems this way.



**Gilbert
Briggs was
a bit
suspicious
of science.
Or, shall
we say,
of scientists.**

some vaguely defined ambitions in radio and TV. They could see a future in domestic entertainment. The notion was that if they could buy a

Your remarks about the need for more science surprise me, because certain of your contemporaries—ones who are leery of subjectivists—imply that all of the designing back then was pure science.

No. Very little science.

Sort of wild 'n' woolly, seat-of-the-pants. . .

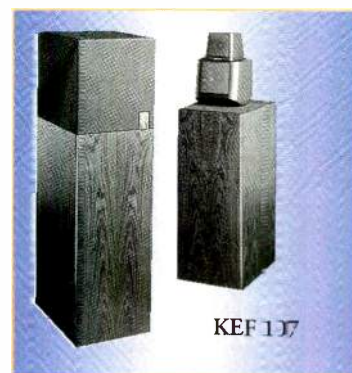
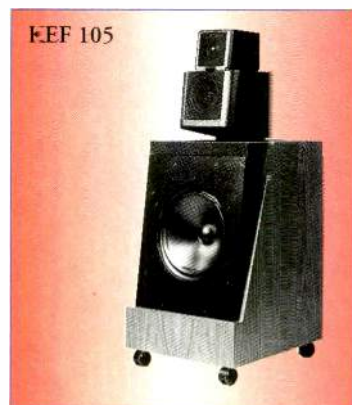
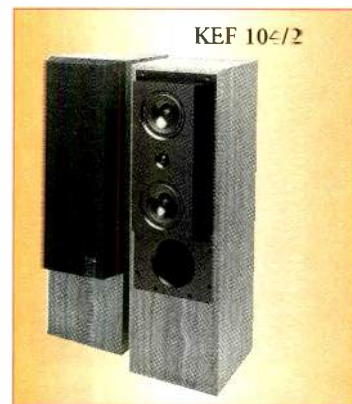
The only people who were into science were Villchur, when he came along, and Paul Klipsch before that. Most of the other people who were great names in hi-fi in the States were just fumlbers; they worked strictly on a cut-and-try basis.

But the BBC was so influential in the commercial sector, and the dominance of Wireless World. . .

That was later. Even in the '40s, when I started into it, all development work was done subjectively. One cut a hole, had a listen, cut a bigger hole, had another listen, and so on. There were very few people around in the trade who fundamentally understood how it worked.

We got to the point where I took out a number of patents on enclosure design, as it was very clear that I wasn't going to get anywhere with drive-unit design. The firm couldn't afford the cost of the tooling, and every new design needed a diaphragm mold and die casting plus the magnet. I then finally came up against it in 1959, after Rank acquired Wharfedale. It was staring me in the face that we needed to do something about the design of our diaphragms.

Rank was trying to get into the record business and also had



The first 104/2 was the showpiece of the Reference Series. The Model 105 placed a tweeter and midrange "head" atop the woofer enclosure. The Model 107 combined a "head" with a woofer system like the 104/2's.





I got on my
bike and
went off
to Europe;
when I came
back, I knew
I'd got
a business.

KEF

wholesaler, they'd have the whole thing down pat. Complete vertical integration. So they bought a wholesaler. Wharfedale had been a very successful, long-established firm run by its founders, but the whole thing was beginning to crumble.

In 1960, I thought, "I don't know what I'm going to do here." I was director of Wharfedale, but one never got to talk to the people in London. I wasn't being introduced to Rank and couldn't speak to the new bosses. It became clear that Briggs wasn't anxious to leave; on the other hand, he had turned 70, so he wasn't scintillating or looking to the future. He was just trying to keep his little company together for the benefit of the people who had worked there for a long time. There was no point in my talking about new ideas.

Was it hard creating a hi-fi company in 1961?

Because my relationships in the industry were so good, I had no problems starting up. At a meeting in Paris, at the Festival du Son, John Gilbert of *The Gramophone* said, "I'll go on record for the British press if you decide to start on your own. Call a meeting to explain your product, and we'll all be quite happy to take tea." And I did just that the following November, and everybody came. In

droves. Percy Wilson, Technical Editor of *The Gramophone*, said, "We'll support you—glad to see a new face." They were getting a bit tired of some of the older faces when they didn't seem to be doing anything.

We formed KEF legally in September 1961. We finally managed to get assembly started about the end of October and managed to put together at least two of everything we intended to offer. There was a three-way system in a thin box, the same again in a 4-cubic-foot cabinet, which had much better bass, a line-source speaker, and a very thin, flat speaker to go against the wall. We organized the meeting for the whole day. In the morning we set up, and in the afternoon everybody arrived—the press, wholesalers, that sort of thing. Ralph West actually took over the demonstration, and we went on through the evening. By the end of that day I knew we had no market in the U.K. at all. One by one, the wholesalers all said, "We need another loudspeaker line like a hole in the head."

Too many brands even in the early '60s?

Too much product, too few sales. And so in the end, I got on my bike and literally went off to Europe. And after a week in Europe, I came back and I knew I'd got a business. A

I first met Raymond Cooke about 30 years ago and later

worked with him for 25 years at the loudspeaker company he founded in 1961, KEF Electronics, Ltd.

Raymond was a stern but stimulating taskmaster who demanded from his co-workers the clarity of thought and attention to detail he so admired in his mentors. Half-formed hypotheses, masquerading as facts, were quickly challenged but not necessarily dismissed. He liked to say, "Your theory on the laws of gravity are interesting—now let's throw the stone and the feather from the top of the tower, and then we'll discuss it." Raymond valued action as much as he valued ideas, and he had financed one of the best-equipped acoustic laboratories so that pet theories could be

CODA

by Laurie Fincham

put to the test. To him, hard scientific facts always far outweighed wit and opinion. An indefatigable con-

versationalist and raconteur, he loved to discuss and argue about his two lifelong passions, music and the science of musical reproduction, with anyone who would listen. Raymond influenced a whole generation of engineers. An excellent lecturer and writer himself, he encouraged others, including me, to follow in his footsteps.

Raymond was charismatic, catalytic, sometimes cantankerous but always compassionate. Knowing him, and working for him, was a rewarding experience. I would not have missed it for the world.

Laurie Fincham is Senior Vice President Engineering at Infinity Systems in Chatsworth, California.

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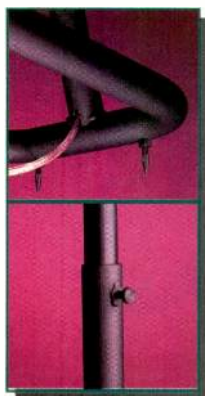
Are you getting the most out of your speakers? Did you know that proper mounting and room placement dramatically improves sound quality? Most major speaker manufacturers recommend loudspeaker supports for optimum performance; many of the best known brands specifically recommend or use Sanus Sound Foundations. Demand the most from your audio dollar. Give your music a Sound Foundation!



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A Gourmet Dish or a

D

veloped by RCA and Hughes, the Digital Satellite System (DSS) has quietly sold more units in its first year on the consumer market than the CD player, the VCR, or color TV did. This is impressive, and the sales figures are destined to become even more impressive now that additional companies have joined RCA in making DSS equipment. But DSS, which delivers television programs via satellite to small (18-inch) home dish antennas, is not

without detractors. Among them is *Audio* reviewer Anthony Cordesman, who feels that the system's technological negatives outweigh its positives. True to our pursuit of equal time for all points of view, we asked James Harper, Manager of News and Information at Thomson Consumer Electronics, RCA's parent company, to respond to Mr. Cordesman's criticisms. The following is, we hope, a fruitful dialog between the two opposing viewpoints.

The Editors

USER'S REPORT

by ANTHONY H. CORDESMAN

There are times when technology makes you say "gee whiz!" and other times when it makes you say "gee whoops!" The RCA Digital Satellite System is a good case in point. On the one hand, DSS is technologically promising, and sometimes the companies that provide the signals transmitted via DSS actually make full use of its potential. On the other hand, RCA's DSS is being sharply over-marketed; there are usage problems your friendly salesman may not tell you about. And sound and video quality is often mediocre, in my opinion.

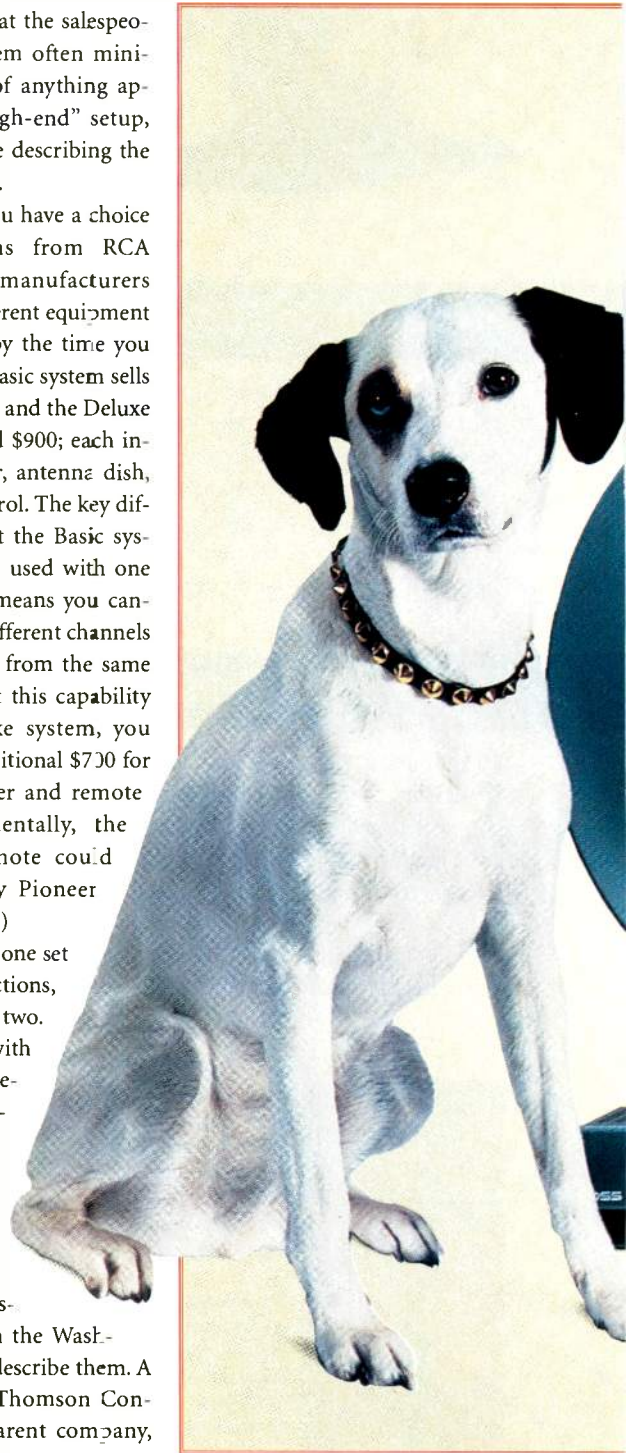
To start off, you may have real problems finding accurate information about the equipment options and the real installation

costs. I found that the salespeople for the system often minimize the costs of anything approaching a "high-end" setup, and have trouble describing the system's features.

In practice, you have a choice of two systems from RCA (though other manufacturers should have different equipment on the market by the time you read this). The Basic system sells for around \$700, and the Deluxe system is around \$900; each includes a receiver, antenna dish, and remote control. The key differences are that the Basic system can only be used with one receiver, which means you cannot watch two different channels on two TVs fed from the same dish. And to get this capability with the Deluxe system, you must pay an additional \$700 for a second receiver and remote control. (Incidentally, the "universal" remote could not operate my Pioneer LaserDisc player.)

The Basic receiver has only one set of audio/video output connections, while the Deluxe receiver has two. The Basic system also comes with a less durable dish and a remote with fewer control features, and it has fewer upgrade capabilities.

As far as DSS upgrade features are concerned, a spot survey revealed that not one of six different salesmen at six different firms in the Washington, D.C. area could fully describe them. A series of calls to RCA and Thomson Consumer Electronics, RCA's parent company,



Pot of Trouble?

by **Anthony H. Cordesman**
and **James Harper**



Photograph: Courtesy of RCA

MANUFACTURER'S RESPONSE

by **JAMES HARPER**

Anthony Cordesman obviously has had some difficulties with his RCA Digital Satellite System, and we regret any inconveniences he may have experienced. But sales results and surveys of consumer satisfaction indicate that RCA's DSS ranks as one of the most popular consumer electronics products to reach the market since the VCR.

To cite figures, RCA's DSS system totalled nearly 600,000 unit sales between the time it was introduced at retail, in June 1994, and the end of December 1994. By April of this year, we shipped our millionth DSS unit to dealers, achieving that goal in only 10 months. No other product—including the VCR, color TV, or CD player—comes close to matching those numbers for consumer demand.

Sales numbers are impressive, but to be certain of consumer satisfaction, Thomson Consumer Electronics and its partners, DirecTV and USSB, commissioned studies of DSS owners. These independent surveys consistently show a strong satisfaction among those owners. Some 97% of the respondents have reported that the system's picture and sound "met or exceeded" their expectations, and nearly 85% were equally satisfied with the program offerings.

Regarding the specific complaints of Mr. Cordesman, Bill Mengel, Product Development Manager for the RCA Digital Satellite System, offers his comments.

Cordesman: "... sound and video quality is often mediocre..."

Mengel: DSS has capabilities for delivering video that rivals LaserDisc, and audio that rivals CD. The results are dependent on several factors. Those factors include: The source material, the display device and audio equipment to which the DSS receiver is connected, and how the DSS receiver is connected to those devices (i.e., with a traditional channel-3 or -4 tuner input, an A/V input, or an S-video input).

The best video and audio quality is found on the pay-per-view channels, because they have prime source material and are totally under the control of the signal provider, DirecTV. Other channels are rebroadcasts of feeds provided by others. Both the program content and quality are under the control of the original supplier, not DirecTV or USSB. In almost every case,

revealed that both RCA's Basic and Deluxe receivers have a wideband data port intended to support high-definition TV, but only the Deluxe unit has a low-band data port for interactive use with a computer. Even the manufacturer's experts differed over whether this port is intended to be used for games or other purposes. Neither receiver has an upgrade option for the new 5.1-channel digital audio systems, such as Dolby AC-3; when these become commercially available, you will need new hardware for them. So should you spend \$200 more for the higher priced system? Who knows? Your salesman almost certainly won't.

You will probably need to pay for professional installation—that is, unless you live on a smooth plain with no nearby buildings or trees and you have experience in running long, well-grounded video cables. The system does come with good instructions, and the receiver has a signal-strength meter that uses your TV screen as a display. Setup accessories, such as cables and antenna mounts, are available from almost every RCA DSS dealer at reasonable cost (although you'll find many similar items for less at Radio Shack). There's also a consumer hot-line number to call, staffed by competent and friendly people.

Unfortunately, the dish is not easy to site and align for maximum signal strength unless you're very knowledgeable about line-of-sight reception and about which brackets really work. Anything that blocks the line of sight is important; even the foliage on trees can make a difference. A very experienced installer spent 30 minutes at my home finding the best location for the antenna on my property, plus another hour's work (and specially made brackets) to position the antenna on my roof. You will probably need a lot of video cable, and you will probably have to make a hole in at least one outer wall. All told, you'll spend around \$200 for a good professional setup in a single-TV installation, and an additional \$100 to install a second controller for an additional TV. Further, you'll need one telephone jack near

each TV set if you want to order pay-per-view programs—another \$60 to \$100 expenditure, if those jacks aren't already there.

Unless you have an exceptionally honest salesman, it's hard to get an accurate idea of monthly service costs. There are two different provider services: USSB Entertainment Plus provides Cinemax, HBO, Showtime, the Movie Channel, and some key cable services like MTV, VH-1, Lifetime, and Nickelodeon; the second provider, DirecTV, offers pay-per-view movies and sports events, the Disney and Golf channels, Encore, and most standard cable programming (A & E, CNN, C-Span, Discovery, Family, TBS, TNT, USA, et al.). DirecTV also provides 28

have not had cable in the last three months or it is unavailable in your area. If you are a *Star Trek* fan, forget it, as Paramount isn't on either system. You cannot get local broadcasting without subscribing to cable or using an external antenna.

If using two providers sounds complicated, it is! Worse, it can rapidly become extremely expensive. While you can access pay-per-view movies for only about \$7 a month, a wide range of services can cost from \$26 to \$35 a month for each provider used. If you want lots of channels from both providers, or even a few channels from both, DSS can get very expensive. For example, if you happen to like both HBO and A & E, you can easily end up shelling out more than \$50 a month for services most cable companies provide for less than \$35.

At its best, DSS quality can be very good, and it is clear that the system has great potential. I did a series of direct A/B comparisons between a sampling of pay-per-view movies (which almost always have high picture and sound quality) and the same movies on LaserDisc. Both media proved to be virtually equal in subjective quality. Further, the DSS movies had less video noise than LaserDiscs, and did not suffer from LaserDiscs' occasional problems in reproducing moving horizontal straight lines. However, the DSS movies revealed some occasional digital artifacts during fast-moving scenes; also, DSS was not consistent in the apparent light-to-dark contrast of certain movies, sometimes leaving the picture a bit dark. Color, light balance, and definition were slightly better on most of the DSS-transmitted movies, although a really good LaserDisc, like *Jurassic Park*, was equal or superior in quality to DSS. Sound quality was about equal, depending on the particular movie, LaserDisc, or program. DSS often gives this same outstanding

picture and sound quality with certain sports broadcasts.

What some salespeople forget to mention (and six out of six at six different vendors in my area did forget) is that what you see and hear with DSS is only as good as the signal fed into it. Most of the time, that signal is mediocre to poor. My A/B tests



*At its best,
DSS can be very good;
it's clear that
this system has
great technical potential.*

channels of "CD-quality" background music, eight channels of special-interest programming (Love Stories, Westerns, Mystery, Action, etc.), and such extra-cost options as the Playboy Channel.

You can only get the main broadcast networks (ABC, CBS, Fox, NBC, and PBS) for another \$3.95 per month, and only if you

**MANUFACTURER'S
RESPONSE**

however, what's delivered is better than with the analog signal received by cable consumers.

Cordesman: "The Basic system. . .comes with a less durable dish and a remote with fewer control features, and it has fewer upgrade capabilities."

Mengel: While the two dishes are constructed from different materials, both are designed to withstand the impact of weather and other outdoor factors. The reflector for the Basic system is constructed of steel, and the upgrade reflector is of sheet-molded compound (plastic).

A more significant difference is that on the advanced system, the low-noise blocker that feeds the signal from the dish to the DSS receiver is, in fact, two low-noise blockers in the same package. This allows two or more DSS receivers to be operated simultaneously without any channel or tuning restrictions.

The remote control for both versions provides full and equal functionality of the DSS system and basic functionality for most brands of televisions. The remote provided with the upgrade system includes control of basic functionality for most brands of VCRs, cable boxes, and LaserDisc players.

Cordesman: ". . .the Basic system [won't let you] watch two different channels on two TVs fed from the same dish. And to get this capability with the [\$900] Deluxe system, you must pay an additional \$700 for a second receiver and remote control. (Incidentally, the 'universal' remote could not operate my Pioneer LaserDisc player.)"

Mengel: The suggested retail price for an additional Basic receiver is \$649. Promotional and collateral material, including the instruction manuals, state that the remote controls provided with both versions can operate the satellite receiver and most consumer brands of TVs, VCRs, LaserDisc players, and cable boxes.

Cordesman: ". . .only the Deluxe unit has a low-band data port for interactive use with a computer. Even the manufacturer's experts differed over whether this port is intended to be used for games or other purposes."

Mengel: The bidirectional, low-speed data port included in the advanced version of DSS is for delivery of data. Just as the video and audio ports provide the means to deliver video and audio to consumer TV receivers and home theater systems, the data ports provide the means to deliver data, of whatever sort, to consumer computer equipment.

The type of data and services to be delivered is still in the planning stages. DirecTV and USSB will ultimately make the decision as to the how, when, and what of those services. Although Thomson has developed the platform to deliver data,



*No other product,
including the
CD player, sold
more units in its
first 10 months.*

the intended use is clearly not the manufacturer's call, which explains the difference of opinion as to its intended use.

Cordesman: "Neither receiver has an upgrade option for the new 5.1-channel digital audio systems, such as Dolby AC-3; when these become commercially available, you will need new hardware for them."

Mengel: DSS transparently passes signals with Dolby Surround encoding to outboard decoders for processing. From the beginning, DSS has been designed and manufactured to worldwide MPEG-2 video and audio standards, which, on a global basis, means Musicam [data reduction] for audio. As such, it is hardly likely that AC-3 will be utilized in the DSS network. This is because, in order to support the growing installed base of DSS receivers, both Musicam and AC-3 would have to be transmitted, requiring twice the bandwidth now dedicated to audio.

And Musicam does support a multichannel equivalent of Dolby AC-3.

Cordesman: "You will probably need to pay for professional installation—that is, unless you live on a smooth plain with no nearby buildings or trees and you have experience in running long, well-grounded video cables. . . .Unfortunately the dish is not easy to site and align. . . .Further, you'll need one telephone jack near each TV set if you want to order pay-per-view programs—another \$60 to \$100 expenditure. . . ."

Mengel: Professional installation is recommended. However, it is clearly a con-

sumer option and one that has been elected by nearly half of DSS purchasers to date.

A standard installation by a skilled professional, which includes time to survey the property, select the best options, and install a telephone line, should not take longer than 2 to 2½ hours. Obviously, the type of home construction, along with the consumer's wants, needs, and desires, can cause this average to vary. It is also reasonable to assume that labor rates will differ by geographic region.

DSS has been designed to allow even a minimally skilled "handyman" a reasonable measure of success with installation. In addition, a number of accessory products are available at retail to support the self-installer. Again, we believe approximately half of the consumers who purchased DSS have opted to try installing it themselves and were able to site and align the dish.

movies on VHS Hi-Fi tapes and considerably less than that of LaserDiscs or CDs. The sound quality of most regular broadcast and cable channels with material other than movies was no better than on regular local cable.

The sound quality of the 28 "CD-quality" music-only channels on DirecTV wasn't bad, but it wasn't great either. Further, I found listening to these Music Choice channels about as enjoyable as a long elevator trip or randomly turning on my FM radio. If you can ignore the programming, the sound quality is roughly equal to that of the cheapest CD players.

If all these comments sound more like "gee whoops" than "gee whiz," I suppose they are. The best that DSS can provide is great. But I don't like all the hype and obfuscation involved in its promotion. I don't like the failure to make full and clear disclosure of the programming options, and their prices and limitations, in the sales literature. I don't like the fact that no one tells you the technology is not ready for AC-3. And above all, I don't like RCA's failure to warn consumers that most programming doesn't come close to living up to the system's potential picture quality and that "CD-quality" sound seems to mean low CD quality, at best.

If you live in an area without cable, DSS might be great. If you simply are disappointed with your existing cable company, I'd stick with it awhile. Right now, most of the A/V quality you get with DSS is pretty mediocre, and the price can sometimes be anything but fair. **A**

They are explained in further detail in the point-of-sale material available to the consumer prior to any purchase.

In addition to providing a retail centerpiece for the promotional material and product, each kiosk includes an interactive LaserDisc with a DSS demo disc that specifically addresses the DirecTV and USSB programming services, installation, and various related topics.

Again, we regret that Mr. Cordesman's experience with the RCA Digital Satellite System has been less than satisfactory, and we hope that our comments may lead to a better understanding of the product and its capabilities. **A**

showed that the quality of the sound and picture on the premium movie channels provided by USSB (Cinemax, HBO, etc.) was often no better than it was for the same programming on my local cable channels. The better transmissions on USSB did have better color balance and less video noise than those on my local cable channels, but this superiority was not consistent. The sound and picture quality of premium channels on both DSS and cable usually fell short of the quality of movies on LaserDisc and the pay-per-view channels. Occasionally, they fell far short.

The quality of the regular cable channels on DSS was almost exactly the same as on my local cable system. My A/B tests showed that the cable channels had more video noise, but cable channels on DSS sometimes lacked the range of light-to-dark contrast available on cable and the color on some of the channels was too warm. Additionally, the picture quality of the two Encore channels needed improvement; far too often, it was truly mediocre.

Does DSS provide "CD-quality" sound? Well, again, sound quality varies sharply by channel and program. The sound quality of pay-per-view movies and sports tends to be consistently high; at its best, the sound quality of pay-per-view movies was nearly equal to that of LaserDiscs. However, the sound quality of movie soundtracks on regular broadcast and premium cable channels was usually inferior to that of the same

MANUFACTURER'S RESPONSE

Cordesman: "Unless you have an exceptionally honest salesman, it's hard to get an accurate idea of monthly service costs."

Mengel: Each retailer selling DSS has to meet certain criteria in order to be a dealer. Part of those criteria includes displaying the product on a kiosk developed by Thomson/RCA, DirecTV, and USSB. This retail display was designed specifically to tell the complete DSS story, with or without a salesperson. The type of programming available, the programming suppliers (DirecTV and USSB), and the cost of those services are all part of the display.

some equations are simple.  KIMBERKABLE

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PROCOL
HARUM

The Hits

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Conquistador
Homburg
Simple Sister
A Salty Dog
Grand Hotel
Pandora's Box
(You Can't) Turn Back the Page
and more...

The Players

Original
Procol Harum Members

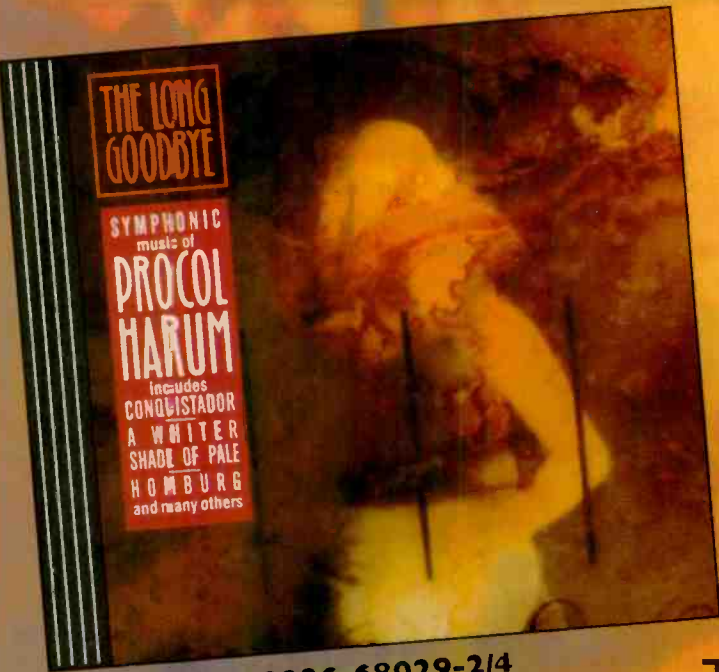
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EQUIPMENT PROFILE

EDWARD J. FOSTER & IVAN BERGER

ALPINE CDA-7939 CAR STEREO



Car electronics are Alpine's *raison d'être*. As one of the car audio industry's acknowledged leaders, Alpine has garnered an enthusiastic following that expects much of its products, both ergonomically and performance-wise. The CDA-7939 is an AM/FM/CD head unit that, in true Alpine tradition, is well conceived, quite competent, and easy to use from the panel or from its wireless remote control. Control buttons are uncrowded, distinguishable by touch, and arranged in a logical manner. This is a head unit you learn to use in short order and can operate while driving. Obviously, there's a lot to like about the CDA-7939.

When you first install the CDA-7939 (or if the car battery has been disconnected for service), a button behind the removable front panel resets the system microprocessor. Normally, the unit turns on and off with a small button ("PWR") placed just where it should be, at the panel's upper left corner. Actually, any control—except for the eject and "CLK/Title" buttons—powers up the unit, as will inserting a CD. There's little chance of mistaking the power button for the panel release or the disc-eject button, as there is on some head units; they are well differentiated in shape and position.

Typical of today's car stereos, one adjusts controls volume, bass, treble, balance, and the fader. These functions cycle, in the order I've listed them, at each brief tap of the "Mode/Loud" bar. The chosen function then appears in large letters on a well-lit display, with your choice of amber or green illumination. Numbers appear for the vol-

**IN TRUE ALPINE
FASHION, THIS UNIT
IS WELL CONCEIVED,
COMPETENT,
AND EASY TO USE.**

ume adjustment and bar graphs for the others. The mode defaults to volume at the end of the series or if you've not made a change for a few seconds.

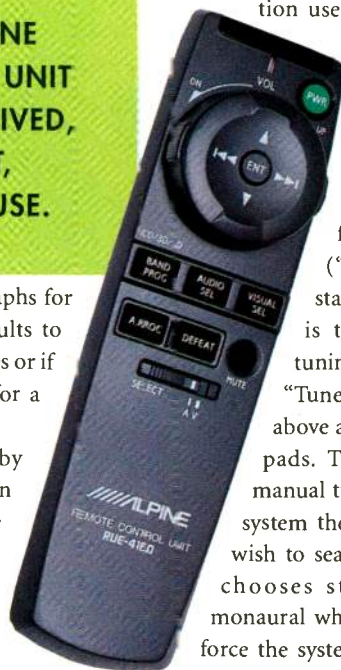
Adjustments are made by twisting a ring (rather than using up/down keys), the same way you'd operate a shuttle knob on a VCR. The loudness contour is toggled in and out by pressing the

"Mode/Loud" bar for a few seconds. If you use an Alpine Audio Processor (one of the options available for this unit), the loudness function is unavailable. When you make a change in control settings, the CDA-7939 beeps a confirmation; you can cancel this beep by pressing "PWR" for 3 seconds and then tapping on preset 2.

Alpine provides two dedicated FM preset banks, one dedicated AM bank, and a fourth bank—called D.A.P. (Direct Access

Preset)—that can be loaded with any combination of AM and FM stations. Because each bank holds six stations, there are 12 FM presets, six AM presets, and a half dozen more that you can dedicate to any AM/FM mixture. The regular AM and FM banks are accessed by pressing the "Tuner/Band/VCR" button at the lower left of the adjustment cluster (the "VCR" option uses equipment not sold in North America); the D.A.P. bank is selected by a separate button near "PWR."

You can tune manually or automatically seek for only strong stations ("Seek-LOC") or for all stations ("Seek-DX," which is the default mode). The tuning mode is chosen by the "Tune/A.ME" button, centered above and between the down/up pads. These pads are used for manual tuning and to tell the seek system the direction in which you wish to search. Normally, the tuner chooses stereo reception over monaural when possible, but you can force the system into mono (for lower



Photos: Michael Groer

noise and distortion when reception is bad) by pressing the "FUNC" button (below "Tune/A.ME"), followed by preset 1 (also marked as "Mono"). Pressing

SPECS

FM TUNER SECTION

Mono Usable Sensitivity: 9.3 dBf (0.8 μ V into 75 ohms).

50-dB Quieting Sensitivity: 13.5 dBf (1.3 μ V into 75 ohms).

Alternate-Channel Selectivity: 80 dB. S/N: 65 dB.

Channel Separation: 35 dB.

Capture Ratio: 2.0 dB.

AM TUNER SECTION

Usable Sensitivity: 22.5 μ V (27.0 dB).

CD SECTION

Frequency Response: 5 Hz to 20 kHz, ± 1 dB.

Wow & Flutter: Below measurable limits.

THD: 0.008% at 1 kHz.

Dynamic Range: 93 dB at 1 kHz.

S/N: 93 dB.

Channel Separation: 85 dB at 1 kHz.

PREAMPLIFIER SECTION

Maximum Output Voltage: 4 V.

Output Impedance: 10 kilohms.

Bass-Control Range: ± 15 dB at 30 Hz.

Treble-Control Range: ± 10 dB at 10 kHz.

GENERAL SPECIFICATIONS

Power Source: 14.4 V d.c., 11 to 16 V allowable.

Dimensions: Chassis, 7 in. W x 2 in. H x 6 in. D (17.8 cm x 5 cm x 15.2 cm); nosepiece, $6\frac{3}{4}$ in. W x $1\frac{3}{16}$ in. H x $1\frac{1}{16}$ in. D (17 cm x 4.6 cm x 1.8 cm); remote control, $1\frac{3}{4}$ in. W x $1\frac{1}{4}$ in. H x 6 in. D (4.4 cm x 3 cm x 15.3 cm).

Weight: Main unit, 3 lbs., 1 oz. (1.4 kg); remote, 2 oz. (60 grams), without batteries.

Price: \$750.

Company Address: 19145 Gramercy Place, Torrance, Cal. 90501.

For literature, circle No. 90

"FUNC" again returns to stereo reception whenever possible.

Stations can be stored manually in the normal manner (i.e., by pressing and holding a preset button for a few seconds while the station is being received), or you can have the tuner store stations by selecting the preset bank you want to load into and then pressing "Tune/A.ME" for a few seconds. According to Alpine's well-written and -illustrated owner's manual, the tuner will then "automatically seek and store six strong stations in the selected bank in order of signal strength." When all have been stored, the tuner selects preset 1 for reception. Usually, you would load the D.A.P. bank manually so you could mix FM and AM stations, but you can automatically load the bank if you'll settle for stations in one band, i.e., either all FM or all AM. You can scan stations in any bank by selecting that bank, pressing "FUNC," and tapping preset 2 (also marked "P.Scan"). Each station is heard for 10 seconds in the preset numerical order. Pressing "FUNC" again cancels the automatic scan.

In the tuner mode, the display normally indicates station frequency, bank, and preset number. You can "title" stations, if you think it's worth the effort, and cycle the display from showing station frequency ("Normal" mode), to time ("Clock Priority" mode), to title ("Preset Station Title" mode) by tapping the "CLK/Title" button, which is just below "PWR." When you are titling, you use the "CLK/Title" button and down/up pads to enter characters, letter by letter; eight characters can be stored for each station. With patience, you can title CD programs the same way: Eight characters per title, up to 18 titles per disc.

CDs are drawn into the mechanism smoothly and securely; they eject similarly when you tap the pad to the right of the slot. Unlike some head units, the CDA-7939 handles 3-inch CDs without an adaptor ring. Unlike many, this one has an honest pause function, which works like that on a home player. The radio tuning buttons

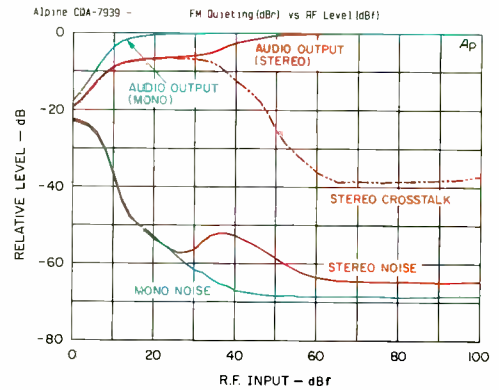


Fig. 1—FM quieting characteristics and stereo separation.

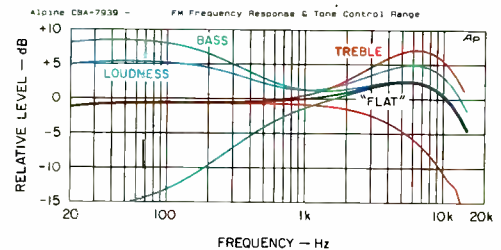


Fig. 2—FM frequency response and range of tone and loudness controls.

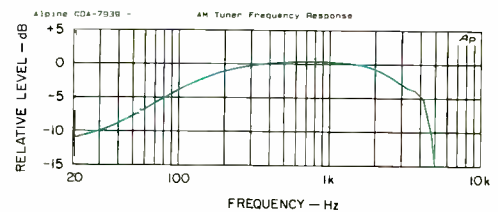


Fig. 3—AM frequency response.

serve as skip controls when playing CDs. Pressing and holding either button fast-searches in the chosen direction, with audible clues of where you are on the disc—another nicety sometimes lacking in car players. If you need more than the single-disc capacity of the CDA-7939, you can connect and control an Alpine CD Shuttle changer—or more than one, if it's Model CHA-5605, which is "Ai-NET" compatible. To use more than one six-disc shuttle, you'll also need the KCA-400C multichanger switching device.

Track repeat (but not disc repeat) is available for the sole disc in the head unit; single-disc repeat is available for any disc in the Shuttle—if there's one connected. There's also a random play mode, which Alpine calls M.I.X., and a scan mode that

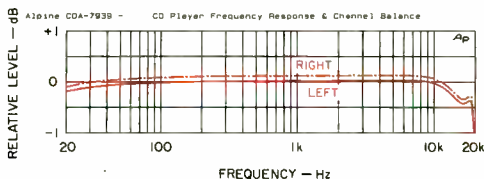


Fig. 4—Frequency response and channel balance, CD section.

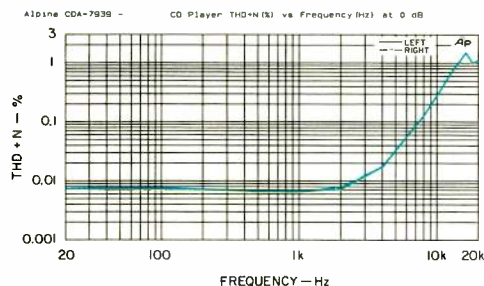


Fig. 5—THD + N vs. frequency, CD section.

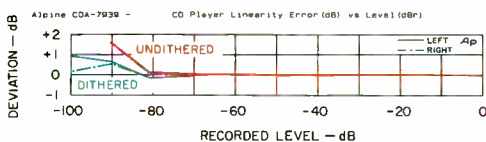


Fig. 6—Linearity error.

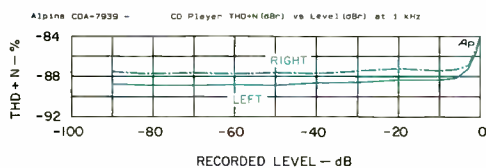


Fig. 7—THD + N vs. level, CD section.

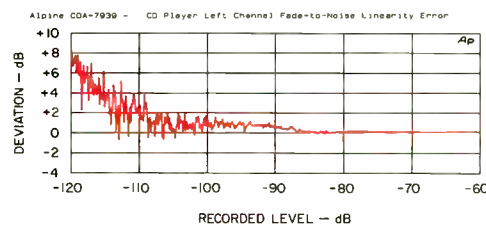


Fig. 8—Fade-to-noise test.

plays the first 10 seconds of each track. Playing modes are accessed by pressing “FUNC” and the appropriate preset button (“5” for repeat, “4” for M.I.X., “6” for scan). In addition to numerals, the preset pads have alpha legends to indicate their secondary functions.

The CDA-7939 can be expanded extensively. Besides adding CD Shuttles, you can add the PRA-H400 digital crossover with

adjustable time offset, feeding it from the CDA-7939’s optical digital output. In other countries, Alpine offers an Ai-NET compatible equalizer and a VCR and monitor. Users can turn that video system’s picture and sound on and off from the CDA-7939’s panel. The crossover and equalizer can also be controlled from the CDA-7939’s wireless remote. The remote accesses most basic functions and permits you to partially mute the sound, an operation that can’t be done from the panel.

Measurements

The Alpine CDA-7939 was a joy to operate on my test bench and, with a few exceptions, acquitted itself quite well. I’ll confine my commentary to the high and low points of the testing and relegate the “hard” data to the “Measured Data” Table and graphs, all of which I encourage you to review with care.

As can be seen in Fig. 1, the FM tuner “quiets” rapidly to -48 dB (at 14 dBf), after which the slope of the curve softens. Nonetheless, the tuner achieves close to full quieting on mono stations by 40 dBf, and “opens out” to stereo on relatively weak signals. At 45 dBf, where some other tuners are just beginning to show a sign of measurable channel separation, the CDA-7939 blossoms forth with a 15-dB spread, which certainly should be adequate for a decent stereo presentation on the road. The downside is a rise in background noise with stereo signals in the range of 35 to 50 dBf and the potential for noise pumping as signals fade. I’ll

leave it to *Audio’s* Technical Editor, Ivan Berger, to comment on whether this actually occurred in his road tests.

Ultimate quieting is quite good in both stereo and mono. Channel separation on strong signals was uniform, balanced in both directions, and more than adequate where it counts, i.e., in the mid- and upper frequency regions. Separation degraded only in the bass below 115 Hz, where it’s

pretty impossible to tell stereo from mono under any circumstance.

From a technical standpoint, FM frequency response (the “Flat” curve of Fig. 2) leaves something to be desired. There’s a 2.5-dB boost in output around 5 kHz and a rather steep decline above 12 kHz, but the boost may please some listeners by adding “presence.” The low end is more uniform, with response down only 1.2 dB at 20 Hz. Channel balance was excellent.

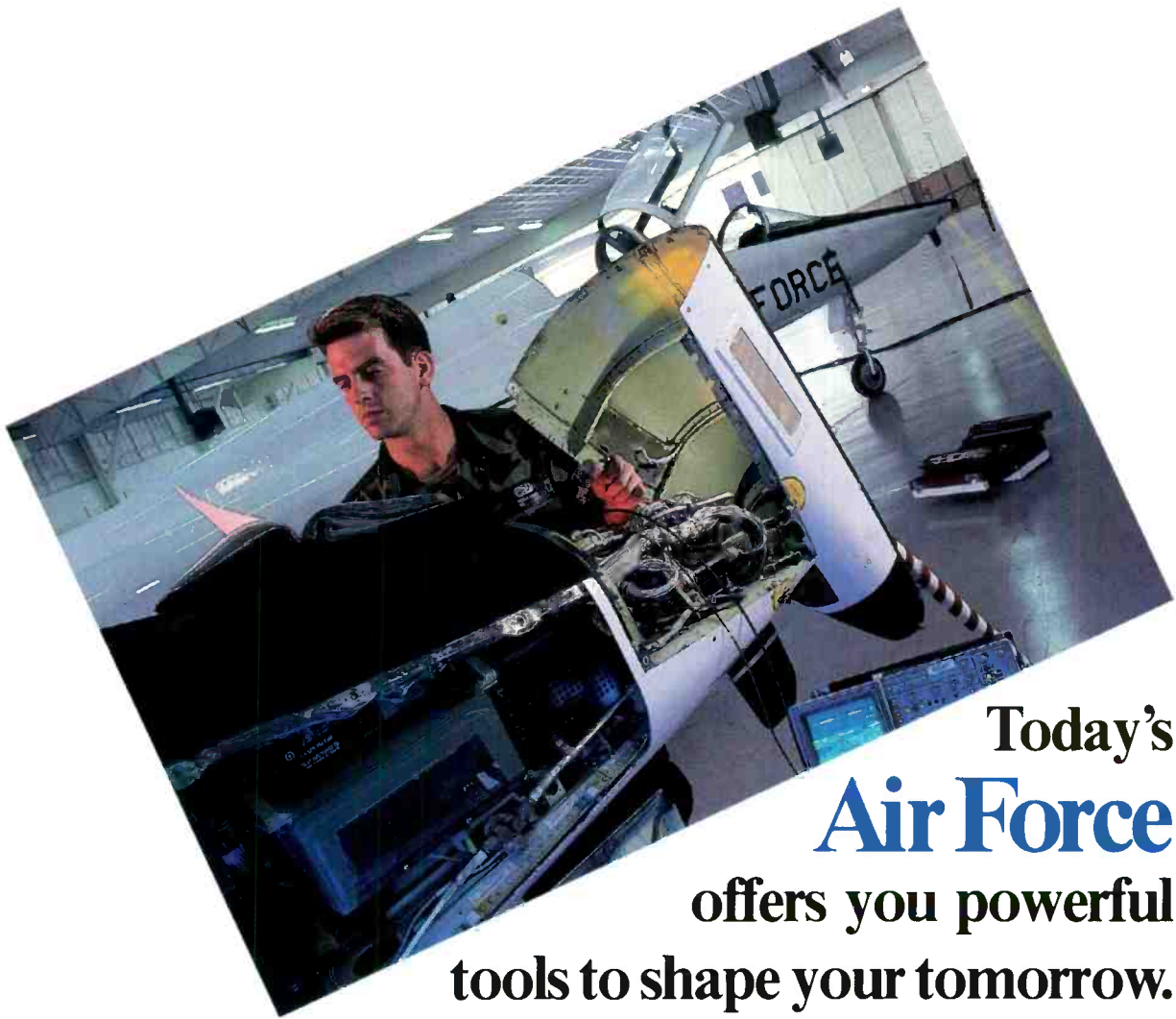
Besides showing response with the bass, treble, and loudness controls set “Flat,” Fig. 2 shows response with the bass and treble controls at their maximum and minimum settings, and with loudness compensation engaged. (Response shown is of the left

**THIS CAR STEREO
GAVE GOOD SOUND AND
GOOD PERFORMANCE,
AND IT WAS EASY
TO CONTROL.**

channel; the right was only negligibly different.) The loudness curve was taken with the gain reduced by 30 dB (corresponding to a volume indication of 15) and scaled to fit the graph. As you can see, the loudness boosts both bass and treble moderately, while the bass and treble controls do more in the way of cutting than of boosting. I seldom fiddle with tone controls, but those who do may find the Alpine’s tone controls a bit weak in the knees as far as boost is concerned.

Above 115 Hz, FM mono distortion was admirably low; it topped out at a maximum of 0.64% between 2 and 3 kHz. Distortion on FM stereo broadcasts was lower than with mono reception out to 3 kHz, but it then continued to rise at higher frequencies, as is normal.

Capture ratio was better than average for the current crop of car stereos, and AM rejection was also impressive. Together they suggest that the CDA-7939 should perform well in the face of multipath reception. Adjacent-channel selectivity was superb and alternate-channel selectivity better than I could measure with accuracy, so the CDA-7939 should handle driving conditions in the city very well. Image rejection ratio, the



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MEASURED DATA

ability to reject a transmission at a frequency 21.4 MHz higher than the one to which the radio is tuned, wasn't impressive. However, these conditions rarely occur, so I don't consider this of great significance. The AM tuner also is uninspiring. It's not very sensitive, although it does manage to eke out a bit more high-frequency response than some I've seen (Fig. 3).

CD player response (Fig. 4) is almost ruler flat to 10 kHz, droops negligibly at 19 kHz, and drops 1 dB at 20 kHz—far beyond my range of hearing. There's nothing to complain of about the channel balance, and channel separation was more than adequate across the entire range of test frequencies.

The curves of the CD section's distortion versus frequency, taken at 0 dB, are unusual (Fig. 5). Since the CDA-7939 delivers an unusually high output (4.13 V) from a 0-dB recording with the volume fully advanced, I reduced the volume setting to minimize distortion and maximize dynamic range. (The best test conditions occurred with a volume indication of 32, at which point the system produced a 2.9-V output from the 0-dB tracks. Even this setting is probably higher than you'd actually use.) As you can see from the curves, distortion is admirably low (less than 0.007%) from 20 Hz to almost 2 kHz, but above 4 kHz it rises sharply and peaks out at over 1% at 16 kHz. The strange behavior seems to be due to intermodulation between the signal and the data sample rate; this might be caused by an inadequate filter. The effect may be less severe at more normal recorded levels; I wonder if Ivan heard it on music.

While I have reservations about the digital filter Alpine chose, the converters themselves are excellent. As evident in Fig. 6, the linearity error is almost nonexistent to -80 dB and is remarkably small to the lowest test level (-100 dB with a dithered recording). The THD + N at 1 kHz (Fig. 7) just straddles -88 dB at all recorded levels below -30 dB. Excellent linearity also is apparent in the fade-to-noise plot (Fig. 8).

The results for A-weighted signal-to-noise ratio, dynamic range, and quantization noise—shown in the Table—are more than respectable. Additionally, spectral analyses of a 1 kHz, -60 dB recording, and of the "digital silence" track of the CBS CD-1 test disc, showed no anomalies within the audio band. The excellent low-level lineari-

FM TUNER SECTION

Mono Sensitivity: IHF usable, 13.0 dBf; 50-dB quieting, 16.9 dBf.

Selectivity: Adjacent-channel, 32.0 dB; alternate-channel, greater than 76 dB.

S/N at 65 dBf: Mono, 68.6 dB; stereo, 64.3 dB.

Stereo Frequency Response: 20 Hz to 15 kHz, +2.5, -4.7 dB; 20 Hz to 12 kHz, +2.5, -1.2 dB.

Channel Balance: ± 0.07 dB.

Channel Separation: Greater than 30 dB in either direction, from 115 Hz to 15 kHz.

THD + N at 65 dBf, 100% Modulation: Mono, 0.94% at 100 Hz, 0.48% at 1 kHz, 0.41% at 6 kHz; stereo, 0.25% at 100 Hz, 0.42% at 1 kHz, 0.85% at 6 kHz.

Capture Ratio at 45 dBf: 2.0 dB.

Image Rejection Ratio: 42.8 dB.

AM Rejection: 62.7 dB.

AM TUNER SECTION

Sensitivity: 25 μ V.

Frequency Response: 68 Hz to 4.3 kHz, +0.3, -6 dB.

CD SECTION

Frequency Response: 20 Hz to 20 kHz, +0, -1.0 dB; 20 Hz to 19 kHz, +0, -0.5 dB.

THD + N at 0 dB: Less than 1.40%, 20 Hz to 20 kHz, for either channel.

THD + N at 1 kHz: Left channel, below -84.0 dB from 0 to -90 dB recorded level, below -88.3 dB from -10 to -90 dB; right channel, below

-83.9 dB from 0 to -90 dB recorded level, below -87.2 dB from -10 to -90 dB.

Dynamic Range: A-weighted, 96.9 dB (left) and 96.2 dB (right); unweighted, 92.7 dB (left) and 90.9 dB (right).

A-Weighted S/N at Infinity Zero, re: 0 dB: Left, 93.9 dB; right, 93.1 dB.

Channel Separation: From left to right, greater than 62.1 dB from 125 Hz to 16 kHz; from right to left, greater than 62.5 dB over same range.

Channel Balance: ± 0.05 dB.

Linearity Error: At -60 dB, -0.00 dB (left) and -0.05 dB (right); at -70 dB, +0.01 dB (left) and -0.05 dB (right); at -80 dB, +0.09 dB (left) and +0.02 dB (right); at -90 dB, without dither, +1.58 dB (left) and +1.56 dB (right); at -90 dB, with dither, +0.62 dB (left) and +0.50 dB (right).

Quantization Noise, re: 0 dB: Left, -87.6 dB; right, -87.4 dB.

PREAMPLIFIER SECTION

Line Output Levels: For 100% mono FM modulation, 1.71 V; for 30% mono AM modulation, 0.61 V; for CD with 1-kHz, 0-dB signal, 4.13 V.

Line Output Impedance: 315 ohms.

Tone-Control Range: Bass, +8.5, -12.7 dB at 100 Hz; treble, +5.6, -10.4 dB at 10 kHz.

Loudness Contour: +6.1 dB at 50 Hz and +3.0 dB at 15 kHz, with volume at -30 dB.

Attenuator: 10.0 dB.

ty of the CDA-7939's converters suggests that this unit should retrieve the natural ambience captured on CDs with unusual aplomb. If you like to listen to naturally recorded music while parked in a moonlit grove (I can think of worse things to do), you're likely to appreciate what the CDA-7939 has to offer. *E.J.F.*

Behind the Wheel

Alpine's ergonomics are usually good, and the CDA-7939 is no exception. The

"jog-shuttle" audio control is easy to learn, easy to grab, and probably easier to adjust than a knob when the road is bumpy. (It does, however, make the detachable faceplate thicker, so that the plate will bulge your pocket when you carry it around.) As with previous Alpines, the station buttons are in a handy 3 x 2 matrix instead of a row of six, and pressing almost any button (or loading a CD) turns power on. The 7939 also has the D.A.P. feature I've liked on previous Alpines, an extra memory bank that

can hold both AM and FM stations; I've found it very handy for getting traffic reports when I drive to work. The display is on the far right, placing all the controls close to the driver. And the display itself, while the same size and brightness as those found on earlier Alpines, is now less prone to reflections.

This is the second car stereo I've tested whose remote has substantial controls (not just buttons) that project from its surface, with everything distinctively shaped for easy operation by touch. This is a big improvement over the credit-card-size remote controls, with flat or barely raised buttons, so common with car stereos until now. Alas, you can't just stick this one down to your console and run the stereo from it unless the console and the head unit are at the same height; this remote must be pointed almost dead on to the head unit's infrared sensor for commands to be received properly. (When they are, a red LED at the upper left of the control panel blinks; it also blinks when you enter commands from the front panel.) One big, round control handles most of the remote's functions; this worked fine in tuner mode, but in CD mode it put the transport in pause whenever I tried to adjust volume.

I did not like having to press the "FUNC" button to access such features as preset scan, but at least this scan gives a full 10 seconds to each scanned station—time enough to evaluate what's playing. Seek tuning did not work well in my sample. In DX mode, it stopped at almost every frequency on the lower two-thirds of the dial, whether there was a station there or not. Set to local mode, the scan skipped lots of stations that come in quite strongly in my area. Apparently, one threshold was set too high, the other too low.

Seek did, however, manage to find some stations when the unit was in *Audio's* photo studio, with no antenna connected, so I expected fantastically hot performance. What I got, instead, was noticeably but not dramatically better performance than my reference Alpine. The CDA-7939 picked up nine stations better than the reference did and weakly picked up two stations that my reference could not pick up at all. The two models were evenly matched on 26 stations, with the reference outperforming the 7939 on two stations. I did not hear the noise

pumping that Ed Foster was concerned about. The FM sound seemed a bit more open and extended in the highs than the reference's did, perhaps because of the 5-kHz boost noted by Ed. Several AM stations also came in more clearly on the 7939.

Operation on CD was as easy and intuitive as it was on tuner. I sensed, even before reading Ed's lab results, that the CD sound was a trifle soft; it sounded better to me when set at "+1," the minimum boost available. But even without the boost, the 7939 had more treble clarity than the refer-

ence Alpine did, and sounded more natural as a result. The odd distortion behavior that Ed measured in his lab was not audible to me on music recordings.

As with Pioneer's DEH-P815, which I tested for the July issue, the loudness contour had too much treble boost, at least for acoustic music. That, and the poorly set seek-tuning thresholds, were my major complaints about the Alpine CDA-7939.

In sum: Good sound, good performance, easy to control, and reasonable value for the money. *I.B.*

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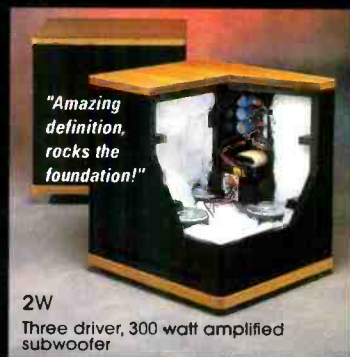


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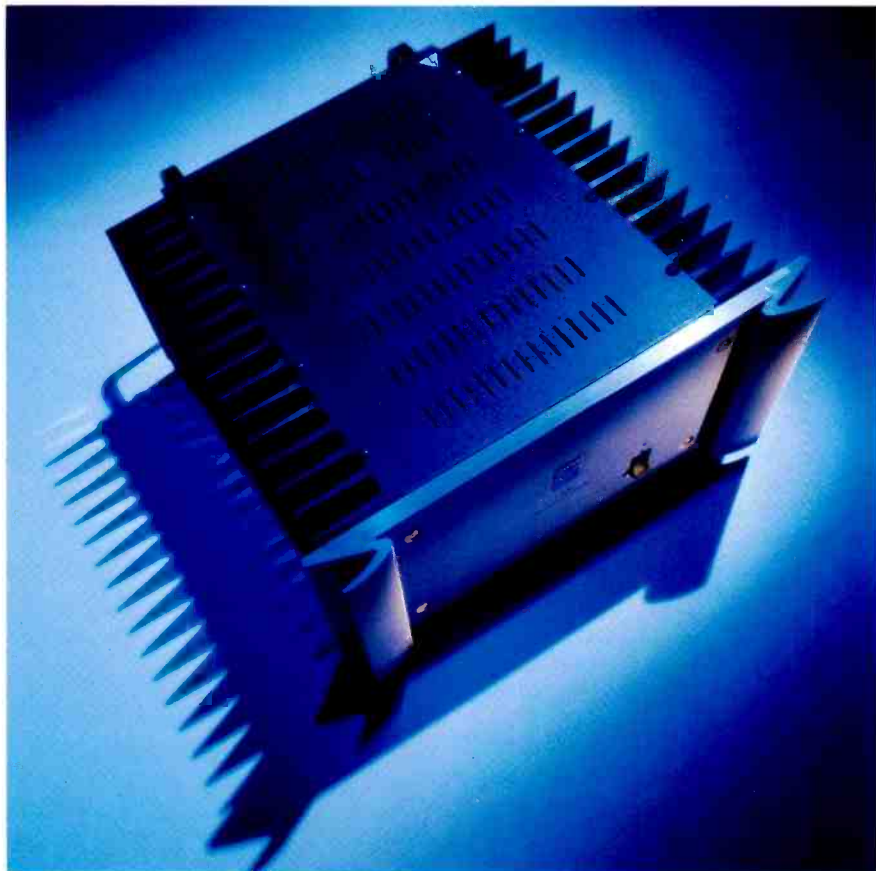
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THRESHOLD T400 AMPLIFIER



Among the well-known attributes of products from Threshold are their solidity, build quality, and aesthetic beauty. The T400 power amplifier surely embodies these qualities. Second largest of the T series, the T400 is rated at 150 watts per channel into 8-ohm loads and 300 watts per channel into 4-ohm loads. Threshold's design philosophy for its T series of amplifiers includes: Wide open-loop bandwidth, low open-loop distortion, short signal paths, thermal stability, low offset drift (without the use of servo circuitry), full complementary-symmetry topology, full d.c. coupling, a low noise floor, minimum feedback, high output current with very low output impedance, and the ability to drive a wide range of loads. That's quite a daunting list of requirements!

The T400's main power switch, a rocker-type circuit breaker, is at the lower right on the massive front panel. The input and output connections, on the rear panel, include balanced and unbalanced signal input connectors, a balanced/unbalanced toggle switch for each channel, a "Stereo/Mono" toggle switch, and two pair of five-way output binding posts for each channel. An a.c. line fuse and an IEC a.c. line-cord connector are also on the rear panel.

Looking under the hood of the T400, you'll find the construction quality and beauty expected of a Threshold product. Roughly half of the interior space is taken up by two potted toroidal power transformers, one mounted to the bottom and the other to the inside of the front panel. In the aft section of the internal space, four main filter capacitors are mounted to the bottom

plate. A p.c. board, mounted on the top of these filter capacitors, serves to interconnect various elements of the power-supply circuitry and to distribute power to the two amplifier channels. Two fuses per channel for the output stages are on this board. The two amplifier modules are mounted to the inside surfaces of the two heat-sinks. A 1½-inch-high cover over each heat-sink encloses the whole inside area of the sinks. Underneath these covers, a large p.c. board serves to interconnect the eight pairs of output devices and their associated gate-stopper and source resistors. Another p.c. board, mounted flush with the surface of the cover on each heat-sink, contains the bulk of the amplifier front-end and driver circuitry. The amplifier p.c. boards are populated with parts of appropriately high quality. A small p.c. board connects the two amplifier p.c. boards at the rear of the unit, and connects up with the input connectors, the balanced/unbalanced switches, and the "Stereo/Mono" switch. The overall visual effect of the cover plates and flush-mounted p.c. boards is quite striking. The T400's construction is about as good as it gets when it comes to a well-made piece of audio gear—which is not to say that a few other manufacturers don't do it as well.

SPECS

Power Output: Stereo, 150 watts into 8 ohms, 300 watts into 4 ohms; mono, 450 watts into 8 ohms, 900 watts into 4 ohms.

Frequency Response: 0 to 100 kHz.

THD: Less than 0.1%; typically less than 0.02%.

Gain: 28 dB.

Input Sensitivity: 1.4 V, unbalanced.

Input Impedance: Unbalanced, 50 kilohms; balanced, 2 kilohms.

Current Consumption: 400 watts at idle.

Dimensions: 18.3 in. W x 9.3 in. H x 19.4 in. D (46.4 cm x 23.6 cm x 49.2 cm).

Weight: 85 lbs. (38.6 kg).

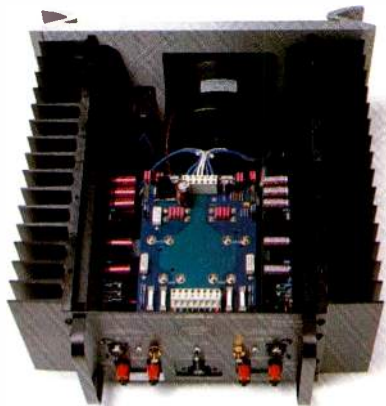
Price: \$5,250 in black or \$5,350 in pewter gray.

Company Address: 7325 Roseville Rd., Sacramento, Cal. 95842.

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Circuit Description

The input stage of the T400 is a complementary dual-differential amplifier utilizing low-noise junction FETs. Each input device is cascoded with a bipolar transistor. The two collector outputs of the input stage, one referenced to the positive supply-voltage rail and one referenced to the negative supply-voltage rail, are fed from transistor current sources that consist of two bipolar transistors for each output. These outputs are direct coupled into the emitters



**THE THRESHOLD T400'S
CONSTRUCTION QUALITY
IS ABOUT AS GOOD
AS IT GETS
FOR AUDIO GEAR.**

of bipolar transistors forming a complementary common-base last-voltage-amplifier (LVA) second stage. The collectors of the LVA are coupled together through a bias-spreading regulator and are connected to the gates of a pair of complementary MOS-FET transistors configured in common-source mode (i.e., as followers). This third stage functions as a buffer to present high impedance to the LVA stage and to provide drive current for the output stage.

The output stage consists of eight pairs of complementary insulated-gate bipolar transistor (IGBT) devices. These are a relatively new type of output device that combines a MOS-FET driver transistor with a bipolar output transistor in one common package. In this arrangement, the output drain of the MOS-FET is connected to the base of an opposite-polarity bipolar transistor. The bipolar's emitter is connected

to the supply-rail voltage. Then, 100% feedback is created by connecting the bipolar's collector back to the MOS-FET source. The net effect is to create a power MOS-FET follower. Negative feedback is taken from the output stage's output back to the inverting input of the input stage.

A switch selects balanced or unbalanced signals. In the unbalanced input mode, the bottom of the shunt feedback resistor is grounded, and the noninverting input signal from the RCA unbalanced connector is applied to the noninverting input of the input stage through a voltage divider. (The divider has an input impedance of 48 kilohms and a slight attenuation.) This noninverting input is also tied to pin 2 of the XLR balanced input connector. In the balanced mode, the negative-phase input signal from pin 3 of the XLR jack is connected to the bottom of the shunt feedback resistor, an additional resistor is connected from the negative phase signal to ground, and another resistor of the same value is connected to ground across the positive-phase signal from pin 2 of the XLR jack. This, then, presents a lower input impedance than the unbalanced input.

As mentioned, the T400 has two power transformers. As expected, each channel has its own power supply. In addition to the main rectifiers and filter capacitors for the output stages, a higher voltage from each transformer's secondary winding is separately rectified and filtered for each channel's front-end circuitry. The filter capacitors for these supplies are on the amplifier boards themselves and comprise an array of 18 470- μ F capacitors, nine for each supply polarity. Active, fully discrete regulators follow and supply the amplifier front-end circuitry.

The T400 has a protection circuit that monitors the output stage's power-supply fuses and the

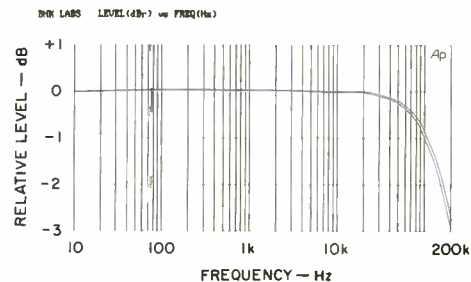


Fig. 1—Frequency response; see text.

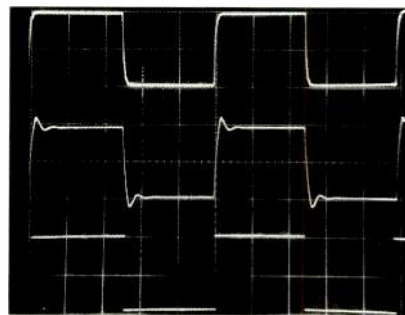


Fig. 2—Square-wave response for 10 kHz into 8 ohms (top), 10 kHz into 8 ohms paralleled by 2 μ F (middle), and 40 Hz into 8 ohms (bottom).

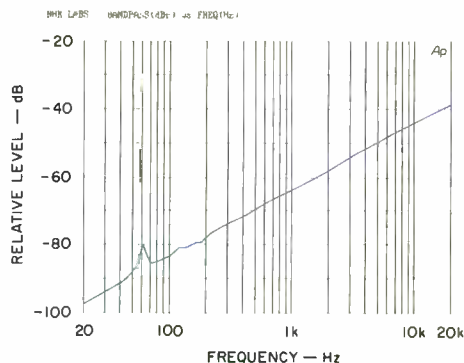


Fig. 3—Common-mode rejection.

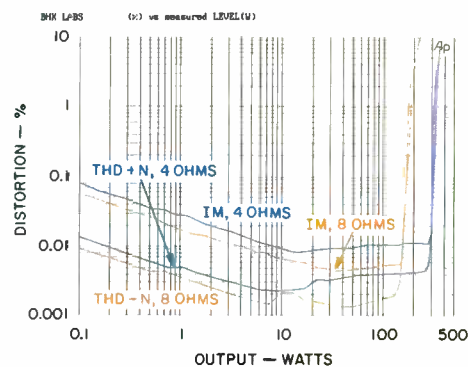


Fig. 4—THD + N at 1 kHz, and SMPT-IM distortion, vs. power.

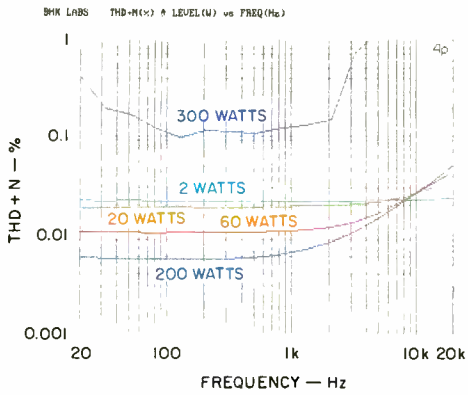


Fig. 5—THD + N vs. frequency.

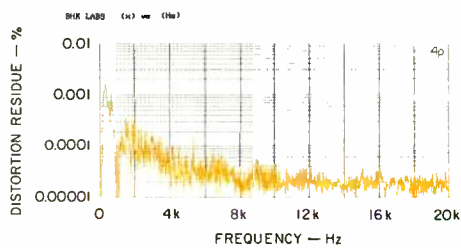


Fig. 6—Harmonic distortion residue at an output of 10 watts.

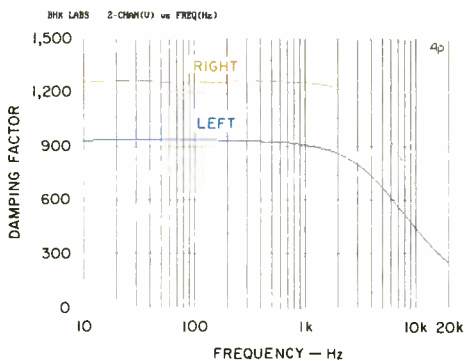


Fig. 7—Damping factor.



temperature of each heat-sink. If a rail fuse blows, the signal inputs are muted by relays that short the signal to ground. If either channel overheats, the inputs are muted and the output stage bias is shut off in both channels.

Measurements

It was interesting to watch the T400's a.c. line-current draw over time, since it mirrors the workings of the output stage's bias-current regulator. When first switched on, the T400 draws a bit more than 5 amperes, depending on how low the ambient temperature is. As the amp warms up, the current gradually decreases to about 3 amperes. This process takes about 30 minutes.

The T400's two channels were extraordinarily well matched for most of the measurements. Therefore, I will only present the data for the left channel unless otherwise noted.

For the unbalanced inputs, the gain was 28.06 dB and the IHF sensitivity was 111.8 mV, for each channel. For the balanced inputs, the gain was very slightly less, 28.02 dB, with a corresponding sensitivity of 112.3 mV.

Frequency response as a function of open-circuit, 8-, and 4-ohm loading is plotted in Fig. 1. As can be seen, the three curves virtually overlaid each other, indicating very low output impedance. The -3 dB point is 200 kHz. Rise- and fall-times—at an output level of 10 V, peak to peak, into an 8-ohm load—were 1.7 μ s; this correlates perfectly with the 200-kHz bandwidth. Square waves are shown in Fig. 2. In the top trace, for 10 kHz into 8 ohms, things are almost perfect, but some small anomalies appear where the transition merges into the steady state. Response with 2 μ F added across the 8-ohm load is well behaved, with minimal ringing and slowing of rise-time. In the bottom trace, for 40 Hz, no tilt is seen. This is

because the T400 is truly d.c. coupled, with the same d.c. gain as a.c. gain.

Common-mode rejection, as the name implies, is a measure of how well a signal applied to both phases of a balanced input is cancelled out by the input circuit. Figure 3 shows the T400's common-mode rejection versus frequency.

Both THD + N and SMPTE-IM distortion, for 8- and 4-ohm loading as a function of power output, are plotted in Fig. 4. As can be seen, there is little, if any, margin of power for the 4-ohm rating of 300 watts. Figure 5 shows THD + N versus frequency at different power levels for 4-ohm loading. The curve for 300 watts is clipping to some extent; the higher distortion above 2 kHz is due to the output's "sticking" during clipping, with consequent common-mode conduction in the output stage at these higher frequencies. For power levels below 300 watts, things are well behaved, with a modest rise in distortion as frequency increases.

**THE T400'S SOUND IS
WONDERFULLY DELICATE
AND REFINED, YET HAS
FINE BASS POWER
AND EXTENSION.**

A spectrum of the harmonic-distortion residue—for a 1-kHz, 10-watt signal into 8 ohms—is shown in Fig. 6. A minute amount of second harmonic, about 0.0005%, is just detectable. This is surely one of the cleanest distortion spectra I have seen for this test condition.

Crosstalk between channels was similar in nature for the unbalanced and balanced inputs. The balanced inputs had a bit less crosstalk, but more a.c. line harmonics appeared in the plot. Below 1 kHz, crosstalk ranged from -90 to -100 dB, depending on the choice of input and the direction of measurement. For each input and direction, however, crosstalk was constant from 20 Hz up to about 1 kHz, where it started to rise at 6 dB per octave. By 20 kHz, crosstalk had about -70 dB for all test conditions.

Damping factor (Fig. 7) is very high. For some reason, perhaps internal wiring differences or contact resistance, the right

TABLE I—Output noise levels. The IHF S/N ratios were 96.9 dB for the left channel and 93.5 dB for the right.

Bandwidth	Output Noise, μ V	
	LEFT	RIGHT
Wideband	130.1	153.2
22 Hz to 22 kHz	56.7	94.6
400 Hz to 22 kHz	46.6	66.2
A-Weighted	40.2	59.6

channel has lower output impedance and hence higher damping factor.

Output noise levels as a function of measurement bandwidth, along with IHF S/N ratio, are presented in Table I. Noise levels are very low in this design—among the lowest I have ever obtained.

The d.c. offset was very low. After a suitable warmup, I measured -1.5 and -6.5 mV for the left and right channels, respectively, with the T400 in its normal, horizontal, position. Interestingly, when I had the amp vertically oriented, with its front panel facing down, the change in heat distribution caused a much higher offset, more like 50 to 100 mV.

When I attempted to measure dynamic power, using my Audio Precision setup to provide the IHF tone burst, I ran into an unexpected difficulty. As the amplifier approached clipping, the measured channel would blow a power-supply fuse. I tried different groundings and other variations but obtained the same result. With my function generator as a signal source, everything worked okay. Dynamic power with 8-ohm loads was 169 watts over the whole 20-mS tone burst. This yields a dynamic headroom figure of 0.52 dB. With a 4-ohm load, the equivalent sine-wave power was 338 watts at the beginning of the burst and 325 watts at the burst's end, again yielding dynamic headroom of 0.52 dB. Steady-state clipping power was 165 watts for 8 ohms and 300 watts for 4 ohms, yielding clipping headroom figures of 0.4 and 0 dB, respectively. Into a 1-ohm load, a single channel of the T400 would put out about ± 48 V at the beginning of the burst and ± 44 V at the end of the 20-mS period.

Use and Listening Tests

Phono source equipment in my system during the review period included an Ora-

cle Audio turntable fitted with a Well Tempered Arm and Stanton 981HZS moving-magnet pickup. Counterpoint DA-11A and PS Audio Lambda CD transports drove a Sonic Frontiers SFD-2 and other, experimental, D/A converters. Other signal sources were Nakamichi's ST-7 FM tuner and 250 cassette recorder and a Technics open-reel recorder. Preamplifiers were a unit from Quicksilver Audio, Forsell tube

line drivers, a First Sound II passive model, and my own passive signal selector/attenuator. Other power amplifiers used were a Crown Macro Reference, Quicksilver M135s, and a pair of VAC PA160s. The loudspeakers were B & W 801 Matrix Series 3s, augmented in the range from 20 to 50 Hz by my subwoofer system, which uses one JBL 1400Nd driver in a 5-cubic-foot ported enclosure for each channel.

I must admit to a mild preconception about this amplifier: Somehow, I thought it was going to be a bit sterile, edgy, and unmusical. I was happy to find that this was not the case. The T400 is wonderfully delicate and refined in its presentation. Space and dimension were excellent, as were tonal balance, air, and resolution. Bass power and extension were also of high caliber. Edginess and irritation were low. All in all, a fine-sounding amp.

When I first received the T400, its left channel had full rail-voltage d.c. offset. After convincing myself that nothing was obviously wrong, such as blown internal power-supply fuses, I returned the amp to Threshold. They could find not a thing wrong and thus returned it to me. It has worked perfectly ever since. Once in a while, such mysterious things happen, and I want to emphasize that an occurrence like this would be unlikely with a customer's unit. These things usually happen to reviewer's samples, much to the manufacturers' chagrin. During the listening evaluation, the T400 worked flawlessly, with no glitches, pops, or other noises unbecoming to an amplifier of this class.

This is a piece of gear that will, in all likelihood, last a long, long time. I surely liked the way it sounded in my system. If you're looking for a good amp, I would recommend that you go out and audition the T400, if not Threshold's whole T line of amplifiers. A



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D. B. KEELE, JR.

PARADIGM ECLIPSE/BP SPEAKER



Having been favorably impressed by two previous models from the Canadian company Paradigm—the 8-inch two-way 7se (now the 7SeMK3), which I reviewed in the September 1989 issue, and the much larger Studio Monitor (still in the line) reviewed in April 1993—I looked forward to testing the new Eclipse/BP bipolar system. As this was the first bipolar system I have evaluated, I looked up the dictionary definition of bipolar, which read, “Relating to or having two poles.” I always get bipolar mixed up with dipolar, so I looked up the

second definition also: “A pair of . . . poles, of equal magnitude but of opposite sign or polarity.” Apparently both mean having two poles or ends, but dipolar implies that the two poles have opposite characteristics while bipolar can mean having two poles with the same properties.

The Eclipse/BP has the latter characteristics, with two identical sets of drivers—an 8-inch woofer and a 1-inch dome tweeter—on the front and rear, driven in the same polarity. With identical drivers identically driven front and rear, the speaker will sound the same whether listened to from

the front or rear! This makes bipolar speakers much more like omnidirectional speakers, which have equal coverage in all directions, than like conventional models.

Paradigm’s design goal with the Eclipse/BP was to provide increased spaciousness. This was accomplished by using the rear drivers to add reflected energy to the reverberant field in the room without increasing the system’s direct output. The Eclipse/BP’s front drivers provide the direct sound, which controls imaging, localization, and focus.

A side benefit of the bipolar configuration is its potential for much more constant directivity, or coverage, with frequency. Better control of directivity, coupled with flat on-axis response, means that the power, or total energy response, of the system is more uniform with frequency. This, in turn, improves the system’s tonal accuracy.

A drawback of the bipolar configuration is that the rear output interferes with the front output. This usually manifests itself in an on-axis dip (both front and rear) in the upper bass or lower midrange. This occurs

SPECS

Type: Two-way, floor-standing, bipolar vented-box system.

Drivers: Two 8¼-in. cone woofers and two 1-in. aluminum-dome tweeters.

Frequency Range: 28 Hz to 20 kHz.

Low-Frequency Extension: 18 Hz (including listening-room bass reinforcement).

Sensitivity, 2.83 V rms Applied: Anechoic, 86 dB at 1 meter; in room, 90 dB at 1 meter.

Crossover Frequency: 1.5 kHz.

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

Recommended Amplifier Power: 50 to 300 watts per channel.

Dimensions: 50½ in. H x 9¾ in. W x 17 in. D (128 cm x 24.8 cm x 43.2 cm).

Weight: 95 lbs. (43.1 kg) each.

Price: \$1,799 per pair in light oak, dark oak, black oak, walnut, or black gloss.

Company Address: c/o AudioStream, M.P.O. Box 2410, Niagara Falls, N.Y. 14302.

For literature, circle No. 92

at those frequencies whose wavelengths are about twice the path length around the cabinet, since the travel time around the cabinet will be just long enough to make the acoustic output from one side of the system 180° out of phase with (i.e., of opposite polarity from) the output from the system's other side. For the Eclipse BP cabinet, the total delayed path length is about 27 inches, which is the cabinet depth of 17 inches plus its approximate width of 10 inches. This creates a dip at 250 Hz. (The frequency of the dip is approximately equal to the velocity of sound divided by twice the path length. For the Eclipse/BP, it is 13,500 inches per second divided by 54 inches).

Many aspects of the Eclipse/BP's design resulted from measurements and research at Canada's National Research Council. (See "Testing at Canada's NRC," on page 75 of the September 1989 issue, for more information.) The NRC's research has shown that listeners prefer speaker systems having a flat midrange, a smooth total energy response, and low distortion. All of Paradigm's loudspeaker systems incorporate features that maximize these characteristics. (The company's design philosophy is covered in depth in an excellent 12-page brochure, "The Elements of Better Speaker Design," which is available free from Paradigm's U.S. office. I highly recommend it; I learned from it!)

Paradigm, which was organized in 1982, now has its own extensive production, engineering, and R&D facilities and no longer depends on the NRC. The company also manufactures all the parts that go into its speakers, including drivers, crossovers, and cabinets plus the electronics for its powered subwoofers. Currently, Paradigm manufactures more than 28 different loudspeaker models.

The Eclipse/BP is at the top of Paradigm's series of three bipolar speakers. (The other models are the Export/BP, at \$999 per pair, and the Esprit/BP, at \$1,299 per pair.) The Eclipse/BP's floor-standing cabinet is quite narrow, only 10 inches wide and 17 inches deep. The top and bottom panels of the system are supplied in solid (not veneered) wood, in a choice of four natural finishes or a very attractive high-gloss black. All four sides are covered with black grille cloth in the form of a "sock," which is pulled down over the cabinet. The remov-

able top and bottom panels hold the grille cloth to the cabinet. The top is held in place by four plastic projections, which mate with holes in the top panel; the bottom is held with screws. Supplied spikes can be screwed into the bottom.

The front and rear baffles are made of substantial, inch-thick, MDF. The baffles are identical except for an input-terminal cup and a single port (3 inches in diameter and 6 inches long, flared on both ends) at



the bottom of the rear panel. The rest of the cabinet is made of ¾-inch MDF. Internally, the cabinet is very well braced, using a construction technique Paradigm calls the "Cascade Enclosure." Four large full-perimeter shelf braces connect the front and rear panels to the sides. These braces, in turn, interlock solidly with a top-to-bottom vertical brace that connects the top and bottom to the sides. This assembly is quite rigid and strong.

The Eclipse's bass/midrange drivers incorporate a number of unusual features, including special external and internal heat-sinks and airflow ventilation to help cool the drivers. Paradigm sent me an unmagnetized BP woofer with a removable cone assembly so that I could look at the internal details. Very interesting! The cone is made from mineral-filled polypropylene for high stiffness, low mass, and high internal damping. The surround is made from a synthetic butyl material that is said to eliminate "edge-hole" distortion, where the surround vibrates out of phase with the cone. The dual magnet assembly uses symmetrical focused-field geometry with a long-throw, high-temperature voice-coil, 1½ inches in diameter and ¾ inch long.

The tweeter uses a 1-inch pure-aluminum dome with a treated-textile suspension and a high-temperature voice-coil with magnetic-fluid cooling. Diecast aluminum faceplates add rigidity and act as heat-sinks for greater power handling. Dual

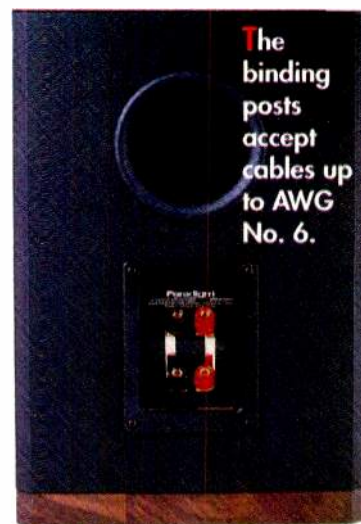
magnets are used for highest flux density in the voice-coil gap.

The Eclipse's crossover is on two small p.c. boards located on the rear of the input-connection cup. One board contains the low-frequency components, the other the high-frequency parts. Electrically, the parallel-connected woofers are driven by a second-order low-pass filter, with an inductor in series, and a series-connected capacitor and resistor in parallel with the woofer. The parallel-connected tweeters are driven by a second-order high-pass filter composed of a series capacitor with an inductor to ground. A resistor parallels the capacitor; a second resistor is in series with the tweeters.

The crossover contains a total of seven components (four resistors, two inductors, and three capacitors, with two of the caps in parallel and two of the resistors in parallel). An iron-core inductor and nonpolarized electrolytic capacitor are used in the woofer circuit, with film capacitors in the tweeter circuit. Connections between crossover and drivers use 18-gauge stranded wire with clip connectors. All drivers are connected in positive polarity. Input connections, which may be bi-wired, are via gold-plated, five-way binding posts. The posts can handle large cable, up to 0.2 inch in diameter (AWG No. 6 or smaller).

Measurements

I tested the Eclipse/BP's on-axis anechoic frequency response by taking measurements 2 meters from the front of the cabinet, at a height midway between woofer and tweeter. A signal at 5.66 V rms (equivalent to 5.3 watts into the rated impedance



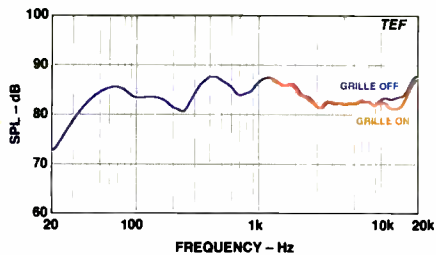


Fig. 1—One-meter, on-axis frequency response.

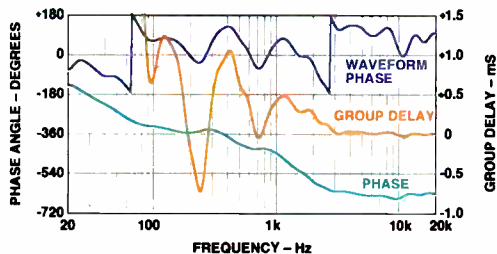


Fig. 2—On-axis phase response, group delay, and waveform phase.

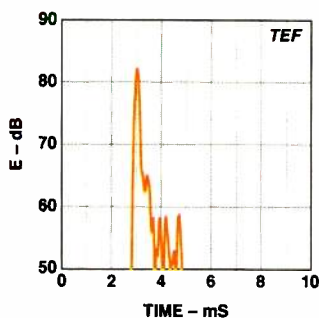


Fig. 3—Energy/time response.

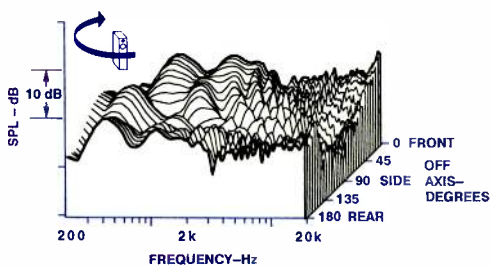


Fig. 4—Horizontal off-axis frequency responses.

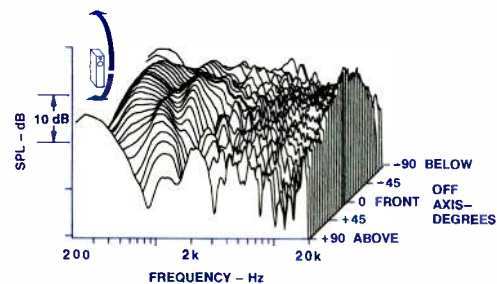


Fig. 5—Vertical off-axis frequency responses.

of 6 ohms) was applied and then referred back to 1 meter with a 2.83-V rms input (equivalent to 1 watt into the standard 8 ohms). I used a combination of ground-plane and elevated free-field measurements, and averaged the resultant curve with a 10th-octave filter.

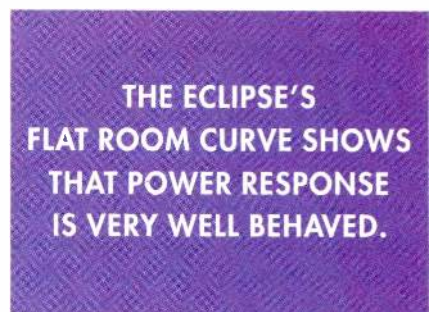
The on-axis response, seen in Fig. 1, has a hilly up/down shape and fits a somewhat tight, 7-dB window (+1, -6 dB, referenced to 1 kHz) over a wide bandwidth, 33 Hz to 20 kHz. Notable are the expected front/rear interference dip at 250 Hz, several peaks (at 65 Hz, 400 Hz, 1.2 kHz, and 20 kHz), and a broad depression in the high-frequency range between 3 and 15 kHz. The grille essentially affects response only above 10 kHz, where output is reduced by a maximum of 2 dB at 12.5 kHz.

Averaged from 250 Hz to 4 kHz, the sensitivity of this system measured a somewhat low 84.8 dB, only 1.2 dB below Paradigm's 86-dB rating. To assess right/left matching, I took four individual response curves on the right and left speakers, including both front and rear responses. These four curves fit within a 0.5-dB window below 2 kHz and a 1-dB window above 2 kHz. This represents a close match between the four sets of drivers.

Figure 2 shows the phase and group-delay responses of the Eclipse/BP, referenced to the tweeter's arrival time. Also shown is the waveform phase, which directly indicates whether waveshapes will be preserved in specific frequency ranges. The unwrapped phase curve is well behaved and decreases 205° between 1 and 10 kHz. An undulation between 150 and 300 Hz coincides in frequency with the dip in axial response. The group-delay curve indicates that the output of the woofer/midrange is delayed with respect to the tweeter by about 0.225 ms (determined by averaging the data between 600 and 2,000 Hz). This curve is dominated

by two dips, a large one at 250 Hz and a smaller one at 700 Hz. These are minimum-phase aberrations, due to the dips in the on-axis response at the same frequencies, and would go away if the on-axis response were equalized flat with a minimum-phase equalizer.

The curve of waveform phase, in Fig. 2, indicates that waveshapes will not be preserved in any frequency band, because the phase values vary all over the $\pm 180^\circ$ range. To reproduce waveshapes accurately and in correct positive polarity, the waveform phase must stay within about $\pm 10^\circ$ of 0°



over a significant frequency band. Waveform phase values at or near $\pm 180^\circ$ (within -170° to -190° or $+170^\circ$ to $+190^\circ$) indicate that the waveform will also be reproduced accurately, but inverted.

Figure 3 shows the Eclipse's energy/time response. The test parameters accentuate the response of the speaker between 1 and 10 kHz, which includes mostly tweeter output due to the low (nominally 1.5-kHz) crossover. The main arrival, at 3 ms, is quite compact but is followed by a slight peak that is down 18 dB and delayed by about 0.3 ms. Other delayed responses, down about 25 dB, are evident in the range from 0.6 to 1.8 ms after the main response.

Figure 4 shows the horizontal off-axis responses of the Eclipse/BP. The bold curve at the rear of the graph is the on-axis response, while the bold curve at the front is the rear response (on axis of the rear drivers). Note the close correspondence between the front and rear responses. Unlike a conventional forward-only design, whose high-frequency response reaches its minimum 180° off axis (the rear), the Eclipse's high-frequency response reaches a minimum at 90° off axis and then rises again, equalling the front output at 180°. In general, the coverage of the Paradigm is much broader than that of a typical forward-only radiating system. The undulating response

with angle, in the range between 200 and 800 Hz, is a direct result of the response interference between the front and rear woofers.

The vertical off-axis responses are shown in Fig. 5. At vertical angles beyond $\pm 20^\circ$, the response develops a hole in the crossover region, between 1 and 4 kHz. Within 15° of the axis, however, the curves are very uniform throughout the crossover region. This is a direct result of the system's in-phase crossover design. Acoustically, the outputs of the woofer and tweeter are essentially in phase with each other throughout the crossover's range, an ideal condition that minimizes lobing. I checked this by comparing the on-axis response of the Eclipse with the tweeters connected normally and in reverse, using the bi-wiring connections to effect the change. With polarity reversed, a 17-dB null appeared at 2 kHz, with some reductions in level at adjacent frequencies. The null indicated that the crossover frequency is effectively at 2 kHz rather than the rated 1.5 kHz.

The Eclipse's impedance versus frequency is shown in Fig. 6, extending down to 5 Hz. The impedance characteristic of vented boxes, two peaks straddling a dip, is evident below 100 Hz. The dip to 3.9 ohms at about 24 Hz indicates the approximate location of the vented-box tuning. The maximum impedance of 15.6 ohms occurs at 2.5 kHz; the minimum occurs at 150 Hz, where the impedance drops to 3.5 ohms.

The max/min impedance variation between 20 Hz and 20 kHz is a moderate 4.5 to 1 (15.6 divided by 3.5). Cable series resistance should be limited to a maximum of about 0.052 ohm to keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. For a typical run of about 10 feet, I recommend that you use 14-gauge (or larger), low-inductance cable.

Figure 7 shows the complex impedance over the range between 5 Hz and 30 kHz. It is well behaved and exhibits three loops: A large loop between 1.4 and 5.2 kHz, straddling the crossover; a medium loop just above box tuning in the bass range, and a small one below box tuning. The maximum phase (not shown) of $+40^\circ$ occurred at 1.44 kHz and a minimum of -22.4° at 64 Hz. The Eclipse/BP should be considered a 4-ohm system, but should not be a difficult load for any competent amplifier.

With a high-level, sine-wave sweep, the cabinet was quite rigid and inert except for some slight side-wall activity at 450 and 500 Hz. The speaker's 8-inch woofers have a fairly large travel capability of about 0.5 inch, peak to peak, and make no harsh sounds when overdriven. No dynamic offset distortion was evident.

The vented box works well and reduces the cone excursion at box resonance by a significant 60%, comparing behavior with the port open to that when I closed off the port. Minimum woofer excursion occurred at 24 Hz, the speaker's vented-box resonance. Port wind noise was very low.

Figure 8 shows the 3-meter room responses, with curves from both raw and sixth-octave smoothed data. If you exclude a dip at 320 Hz and a peak at 600 kHz, the averaged curve is fairly well behaved and fits a somewhat tight, 11-dB window. If you include this dip and peak, the curve fits a 13.2-dB window. The 250-Hz interference dip in the on-axis response, seen in several previous figures, is, happily, not seen in the room curve of Fig. 8 because the room's response fills in at that frequency. Between 2 and 15 kHz, the room curve is fairly flat and follows the axial curve, rising similarly above 15 kHz. The Eclipse's room curve is actually somewhat flatter than is suggested by its up/down curves (Fig. 5). This indicates that the speaker's power response is well behaved. Other models I've tested have flatter axial responses but poorer room responses.

Figure 9 shows the E_1 (41.2-Hz) harmonic distortion for the Eclipse, with input power ranging between 0.1 and 100 watts (24.5 V rms into the rated 6-ohm load). The second harmonic rises to 7.6% at full power, while the third rises to 25%. Fourth, fifth, and sixth harmonics rise to lower levels—7.6%,

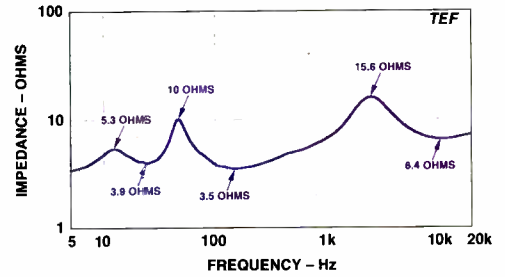


Fig. 6—Impedance.

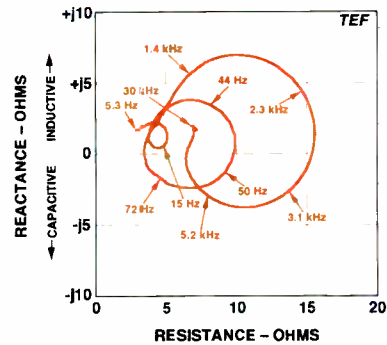


Fig. 7—Complex impedance.

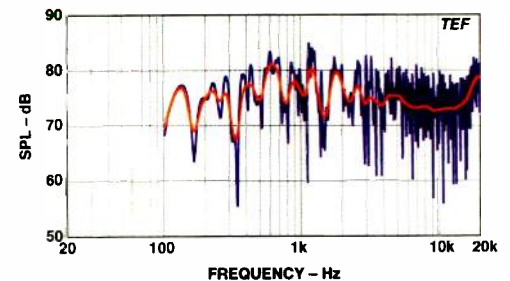


Fig. 8—Three-meter room responses.

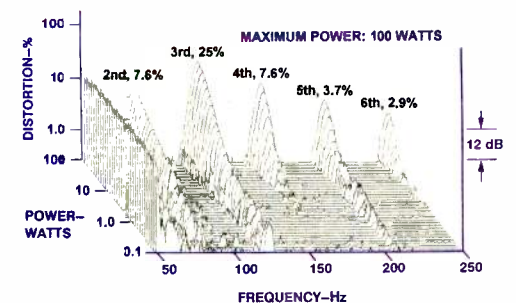


Fig. 9—Harmonic distortion for E_1 (41.2 Hz).

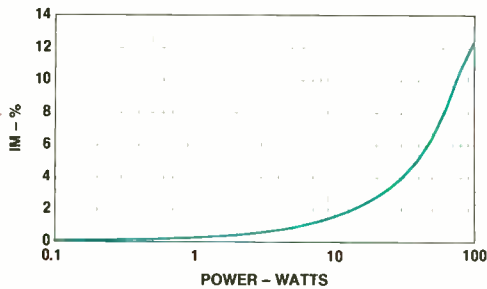


Fig. 10—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz) tones of equal power.

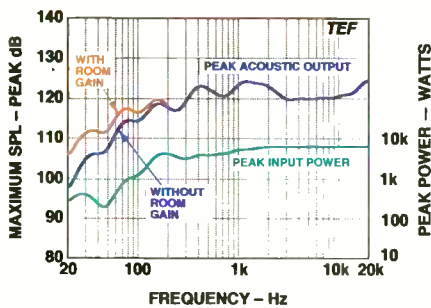


Fig. 11—Maximum peak input power and sound output.



The front and rear drivers are identical pairs.

3.7%, and 2.9%, respectively—at full power. The E_1 distortion is somewhat higher than in other large vented-box systems I have tested. This is because the Eclipse's 24-Hz tuning is significantly below the E_1 's frequency of 41.2 Hz—nearly 0.8 octave lower. The lower box tuning greatly reduces distortion at the lowest frequencies, but it raises distortion at higher bass frequencies.

The A_2 (110-Hz) distortion (not shown) rose to only 3.4% second harmonic at full power, with higher harmonics below the floor of my test setup. The A_4 (440-Hz) harmonic distortion (also not shown) was very low, reaching only 0.4% to 0.8% at full power.

The Paradigm's IM, seen in Fig. 10, rises to the moderately high level of 12.2% at full power. For a system that is reproducing both test tones from the same driver, this is a reasonable result.

Figure 11 shows the speaker's short-term peak-power input and output capabilities. The peak input power was calculated by assuming that the measured peak voltage was applied across the rated 6-ohm impedance. The peak input power starts quite high, at 250 watts at 20 Hz, rises to 360 watts between 25 and 32 Hz (near the box tuning frequency), drops to about 180 watts at 45 Hz, rises rapidly to 4.1 kW at 200 Hz, and, after dropping slightly, rises to 6 kW above 2 kHz. (Between 250 and 800 Hz, the system was limited by an output that turned triangular and sounded harsh and hollow. This may have been due to inductor-core saturation in the woofer crossover. Above 1 kHz, the output waveshape was undistorted, and it sounded clean).

With room gain, the maximum peak output starts at a healthy 106 dB at 20 Hz, and, after several undulations, rises quickly into the range between 120 and 125 dB above 300 Hz. The peak output crosses the 110-dB level at a low 27 Hz and reaches 115 dB at 60 Hz, but it doesn't cross the 120-dB level until 300 Hz. Based on the frequency at which the level rises above 110 dB, the Eclipse is only ninth down in terms of powerful bass among the models I have tested for *Audio*.

Use and Listening Tests

Use and Listening Tests

The Eclipse/BPs are packed in three boxes, with the bases and tops in a separate box. The base and top must be attached to each

speaker before it can be operated, because they secure the grille sock in place at the top and bottom of the cabinet and also provide attachment points for the spikes. The grille sock has attached cords that allow you to tighten it at the top and bottom of the cabinet.

When set up, the Eclipse/BPs look very attractive, with their black grille material around all four sides and the solid dark oak top and base. I was also sent a handsome set of high-gloss black tops and bases, which gave these systems a more modern look.

When placed on a carpet and without the spikes, the cabinets were somewhat laterally unstable because of their narrow width. A force of only about 3 pounds, applied to the top, can tip the speaker over! (*Editor's Note:* Those with young children should take particular notice.—*E.P.*)

The owner's manual is a well-written, letter-size booklet. Half of its six pages are in English and the other half in French. Much useful detail is provided on a number of topics, including listening room guidelines, speaker location and aiming, connections (including bi-wiring and both horizontal and vertical biamping), preventing speaker damage, and warranty.

Paradigm suggests positioning the Eclipses well away from the walls of the listening room, at least 12 inches in front of the back wall, and at a distance from side walls that is different from that to the back wall. According to the company, "Generally, the greater the distance, the more spacious and natural the sound will be." Paradigm also suggests that the speakers be separated by about two-thirds their distance from the listener and aimed in toward him.

Hookup of these systems was easy, due to the readily accessible terminals on the bottom rear. Most of my listening was done with the conventional (not bi-wired) hookup. I listened with gear that included Onkyo and Rotel CD players, Krell's KRC preamp and KSA250 power amp, Straight Wire's Maestro cabling, and B & W's 801 Matrix Series 3s as reference speakers.

I set up the Paradigm speakers far from the side walls in my listening room. I experimented with their placement, moving them somewhat closer together than my usual 8 feet, but preferred the wider arrangement. I sat on my sofa, which was 10 feet from the speakers; the Eclipses were

aimed in, toward me. They were about 6 feet from the rear wall, in my usual speaker locations.

At first I listened casually to the Eclipses with a varied selection of program material. In general, I was quite impressed with their sound and their ability to compete with my reference systems, especially in the bass range. They could play loudly and cleanly and presented a significantly deeper soundstage than the 801s. Their sound was quite spacious, and they added a welcome amount of room sound—and hence realism—to most symphonic material. Most material exhibited a stereo image that was higher and farther back than with the 801s;

**BASS WAS EXTENDED,
CLEAN, AND POWERFUL;
OUTPUT WAS HIGH,
AND SPACIOUSNESS AND
DEPTH WERE ENHANCED.**

this was quite evident on both male and female vocals. The Paradigms do slightly de-emphasize vocal sibilants as compared to the B & Ws, a not unwelcome attribute. There was no vocal harshness evident on the Paradigms.

The soundstage presented by the Eclipse/BPs is the opposite of that provided by the front speakers of a good home theater system, such as the M & K S-5000THX satellites I reviewed for the June 1994 issue. The THX models are intended to maximize the speakers' direct sound at the listener's position and minimize room effects. The Eclipse/BP does just the opposite. There was as much soundstage difference between the Paradigms and the B & Ws as there was between the B & Ws and the M & Ks. One downside to bipolar systems, such as the Eclipse/BPs, is that their sound is quite dependent on room acoustics and spacing from walls.

In the stand-up/sit-down test with pink noise, the Eclipses did extremely well, exhibiting very little tonal change when I stood up. They equalled the excellent performance of the 801s in evenness of vertical and horizontal coverage. Spectral balance on pink noise was not as good, however; I heard some tonality and slightly less highs.

Sensitivity was very close to that of the 801s, measuring only 1 dB less on the "A" scale of my sound-level meter.

On third-octave band-limited pink noise, the Eclipse/BPs did extremely well and were just about the equal of the 801s. Output in the 20- and 25-Hz bands was quite strong, with port-wind noise much lower than the 801s produce at these frequencies. From the 32-Hz bands up, the output of the Eclipses was quite robust, with lots of clean output.

On such program material as acoustic bass guitar, the low-frequency output, quality, and smoothness of the Paradigms were the equal of the B & Ws'. The Eclipses did extremely well on rock kick drum and other pop bass material, where they could be played loudly and cleanly. On demanding pipe organs, these speakers reproduced the pedal notes with much authority and clean, room-shaking bass. No dynamic offset was evident on any of the high-level bass material I played.

On symphonic music, such as John Williams playing the guitar in Vivaldi concertos (Sony Classical SK 46556), the added diffuseness and spaciousness of the Eclipse speakers added an element of realism that was missing when I used the 801s. On other material, which required a drier, up-front sound (such as video special effects), the Eclipses' added spaciousness was not as welcome. On wide-range Latin pop music, such as the late Selena's *Amor Prohibido* (EMI Latin 7243 8 28803, a well-done CD that has a lot of good material), the Paradigms performed particularly well—especially on bass and percussion—and presented a wide and deep soundstage. The dynamic sound fit the music quite well, and the speakers' added diffuseness was very welcome on the Latin-style horns in the introduction to track 9.

The Eclipse/BP has several very favorable traits. These include an extended, clean, and powerful bass response; the ability to play loudly and cleanly, and a capacity to greatly expand the depth and spaciousness of the soundstage. Although its tonal accuracy did not equal that of my reference speakers, its performance in all other areas was superb. If you are contemplating the purchase of a set of bipole-style loudspeaker systems, the Paradigm Eclipse/BP should be seriously considered.

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EDWARD M. LONG

GRADO LABS SR125 EARPHONES

My first encounter with Grado Labs was at a New York Hi-Fi show in the late 1950s. Joe Grado, the founder of the company, was using the "Buck Dance" track on Dick Shory's stereo album, *Bang, Baroom and Harp*, to demonstrate his latest moving-coil cartridge and tonearm. The sound was so spectacular I have never forgotten the impact it had on me. Grado had assembled a pair of custom loudspeaker systems that included an Ionophone ionic tweeter for the ultra-high frequencies, a Janszen electrostatic for the midrange and high frequencies, and an AR-1 for the low frequencies. (This combination soon became widely copied by audiophiles.) Two things impressed me then: The fabulous sound and the fact that Grado took the time and trouble to assemble a special system. It made me realize that he was willing to make the extra effort to achieve the highest possible sound quality. Because of his quest for the best sound, the Grado moving-coil cartridge was considered by most audiophiles to be the top of the class. Grado even designed and manufactured a tonearm (I have one in my "classics" collection) to achieve the best performance from his cartridges. I didn't realize that he was the inventor of the moving-coil cartridge until the '70s, when various companies started making them for the audiophile market. By



that time, Grado was making inexpensive moving-magnet cartridges of very high performance.

In recent years, Grado Labs has begun producing high-quality earphones. The initial offerings, the Signature series, were moderately priced, by today's standards, for the level of performance they achieved; the thrust of the newer Prestige series of earphones is to bring high performance at even lower prices. The SR125 earphones are in the middle of the five-model Prestige line, which ranges in price from \$69 to \$295. From what I have seen over the years, the goal of Grado Labs—from founder, Joe Grado, to Joe's nephew, John Grado—is to

design for the best sound possible and then make it affordable. Not a bad idea at all.

The physical design of the SR125 earphones combines simplicity and elegance. The simplicity can be found in the design of the headband and bails, while the elegance is seen in the raised silver lettering on the black molded earcups. The flat, spring-steel headband is covered with leatherette. Although there is no padding in the headband cover, the comfort level was, surprisingly, more than acceptable.

The ends of the headband are anchored in plastic pieces marked by large, raised silver letters that distinguish the left and right channels. The metal bails, which connect to the plastic yokes, also pass through the plastic anchors. The bails can slide up and down and also rotate in the anchors. The yokes have pins that hold the earcups and allow them to adjust to your ears; they also allow the earcups to lie flat, so they're easy to pack with a CD player, for instance. At the rear of the earcups is a perforated screen to allow the SR125s to be acoustically open. The front of each earcup has a perforated plate covered by a transparent scrim cloth to protect the transducer from dust or damage. The foam earpads, which fit around the periphery of the earcups, can be removed easily for cleaning or replacement. The cord is about

SPECS

Transducer Design: Dynamic.
Coupling to the Ear: Supra-aural.
Frequency Range: 20 Hz to 22 kHz.
Impedance: 32 ohms.
Sensitivity: 94.0 dB SPL for 0.32 V rms (3.0 mW).
Maximum Output: Not specified.
Weight: 9.2 oz. (260 grams).
Price: \$150.
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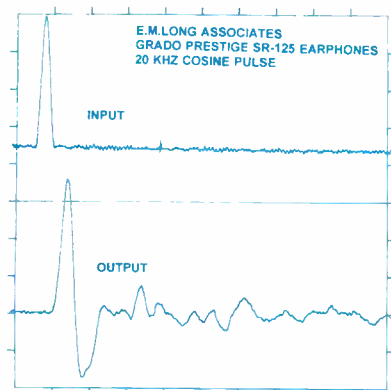


Fig. 1—Cosine-pulse test.

6 feet long, from the gold-plated stereo phone plug to a “Y”-shaped plastic part; from this point, two foot-long cords connect to the earcups. The total 7 feet of cord is reasonably long; if you want it longer, you can buy an extension cord at Radio Shack or a similar electronics store. The SR125s also have a short adaptor cord with a phone jack at one end and a stereo mini plug at the other; both are gold-plated.

The SR125s’ foam pads rest directly on your ears. Although I prefer circumaural earphones, which have earcushions completely encircling the pinnae (outer ears), I found I could use these ’phones for up to two hours without experiencing any real discomfort. The sliding bails and the swinging yokes allowed me to adjust the SR125s very easily. The side-to-side clamping pressure was just right for my head, and the earphones stayed in place even when I tried to dislodge them by vigorously shaking my head.

Before I had members of my listening panel audition the SR125s, I made a series of technical measurements. By doing so, I could make certain the earphones were performing properly, with no defects that would affect performance and invalidate the results.

Figure 1 shows the response of these ’phones to a 20-kHz cosine input pulse. The positive portion of the output pulse is almost identical to the input pulse, indicating that the high-frequency response easily extends to 20 kHz. The recovery, back to normal, of the negative portion of the signal is amazingly fast, which indicates that the bottom-end response extends to a very low frequency. I measured the amplitude versus

frequency response; these measurements confirmed the fact that the SR125s are, indeed, very wideband. However, the response was not perfectly flat. The SR125s were very flat up to 2 kHz, where the output rose to about +3 dB at 3 kHz, reaching a maximum of +5 dB at 5 kHz. The output remained at this level up to 10 kHz, where it rolled gently down (5 dB) to the reference level at 20 kHz. I didn’t measure above 20 kHz, but the pulse response of the SR125s indicated that they go well beyond this point.

I measured the left and right earphones; both of these tracked well except between 3 and 6 kHz. This could affect the presentation of sound images, so I looked for comments about this from the members of the listening panel; there were none. The Grado SR125s have a rated impedance of 32 ohms, which is lower than most earphones; I measured 33 ohms for both the left and right, which is very close to the specification. I also checked the SR125s with a variety of sources—receivers, cassette decks, and CD machines (including portable CD players)—and found that they were all capable of driving these ’phones to loud levels.

As a reference during the listening tests, I used the very high-quality electrostatic Stax Omega ear speakers with the Stax SRM-T1S driver amplifier (which has a vacuum-tube output stage). I utilized HeadRoom’s Supreme amplifier to drive the Grado SR125s directly and also to feed the signal

to the Stax amplifier. Hence, I could use the HeadRoom Supreme’s crossfeed circuit to achieve better results with multimed recordings that were optimized for listening through loudspeakers.

When I set up the earphones for the tests, I started by listening to the Stax Omegas. I played a new Sheffield CD (10050-2-F), *Sonic Detour*, featuring the Freeway Philharmonic, a group of four very talented

**GRADO LABS DESIGNS
FOR THE BEST SOUND,
THEN MAKES IT
AFFORDABLE.
NOT A BAD IDEA.**

musicians who write most of their own material. When I switched to the Grado SR125 earphones, I found myself enthralled by both these ’phones and the Freeway Philharmonic. This sort of thing doesn’t happen to me very often, and I listened all the way into track 11 before I was interrupted by the telephone. (No, I don’t want to switch phone companies! At that point, I just wanted to disconnect the one I have!) I not only enjoyed my experience with the SR125s and the Freeway Philharmonic but was pleased to know that I hadn’t become completely jaded and that listening could still be really fun! I then proceeded with the tests with my listening panel, all the while

EARPHONE EVALUATION

PARAMETER	RATING	COMMENTS
Overall Sound	Excellent	
Bass	Very good	“Tight strong,” “Solid,” and “Deep but not boomy”
Midrange	Excellent	“Clear and close in” and “Bright but not harsh”
Treble	Excellent	“Extended and detailed” and “Like live performance”
Overall Isolation	Low	
Bass	Low	“Low sounds easily heard”
Midrange	Low	“Conversation is easy”
Treble	Fair	“High sounds are very low”
Comfort	Very good	
Value	Excellent	

GENERAL COMMENTS: Excellent earphones. They put you right into the music. Compact and very easy to take with you. More forward-sounding than the reference earphones. Excellent value.

knowing I didn't really care what they thought; I loved the experience the SR125s had given me.

I asked each panel member to listen to a variety of CDs while comparing the sound of the Grado SR125 earphones to the Stax Omega earspeakers. After listening to the Freeway Philharmonic's performance of Aaron Copland's "Hoedown" (from *Rodeo*) on *Sonic Detour*, the panel members were unanimous in their praise of the SR125s. In comparison with the Stax earspeakers, panel members commented: "Bass seems to have more impact," "Bass is tight and strong," and "Bright but not harsh." For the "Bullfrog Rag" track on the same Sheffield CD, the comments were similar, with two additional ones: "Like a live performance in

**IN THE RANGE
OF \$300 AND UNDER,
THESE GRADO 'PHONES
HAVE NO PEER.**

your head!" and "Stax 'phones give a more distant perspective." Panel members then listened to "Miyake," by the Heartbeat Drummers of Japan on *Kodo* (Sheffield Lab 12222-2). The panel's comments indicated that the Stax earspeakers allowed more inner detail to be heard, while the Grado earphones had stronger bass impact. "Bass deep but not boomy" was one of the comments given. The harpsichord is always a difficult instrument to record and reproduce, but I used the excellent recording of the *Sonate in d-Moll für Cembalo*, by Benedetto Marcello, performed by Hans Ludwig Hirsch on *Sonatas for Harpsichord, Op. 1* (Jecklin-Disco JD 5001-2). This recording prompted the following comments: "The Grado SR125s put you at the keyboard; the Stax Omegas place you in the audience" and "Harpsichord is bright but not harsh on SR125s."

It was obvious to me that the panel members were very impressed by the Grado SR125 earphones. When I told them that they cost a very affordable \$150, they were truly amazed. If you have less than \$300 to spend on 'phones, the Grado Labs SR125s have no peer. A

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THIEL CS7 SPEAKER



Thiel's CS7 is one of the finest sounding loudspeakers that I have heard. It provides exceptional transient and spatial detail, has remarkably neutral timbre from around 30 Hz to beyond the range of hearing, and provides this performance consistently at every level of musical dynamics.

The CS7 sells for \$8,900 a pair, but its performance makes it stand

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out even among the superb speakers available at this price level. In fact, the CS7 outperforms even Thiel's improved CS5i, costing \$12,300 per pair. Also, because you can drive the CS7 with a single power amplifier of appropriate quality (and you have to—this speaker's input can't even be bi-wired), you save the additional cable and amplifier costs of bi-wiring or bi-amplification.

**A SLOPING BAFFLE
AND COAXIAL
TWEETER MOUNTING
IMPROVE THE CS7'S
TIME COHERENCE.**

Even more important, with the CS7 you get the design features and performance you pay for. One reason for this outstanding performance is that the CS7 builds on the success of its predecessors, the CS5i and CS3.6. It is similar to them in many ways, although there are new advances in some areas.

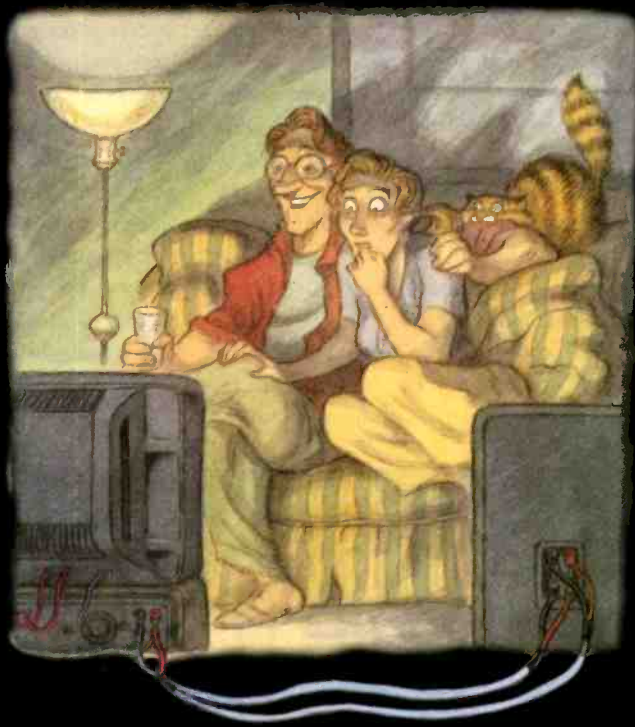
Like the CS3.6 and CS5i, the CS7 has a well-finished enclosure that is extremely heavy for its size—each speaker weighs a massive 201 pounds. The enclosure's walls are of inch-thick fiberboard. There's extensive internal bracing, and built-in spikes, or "stabilizer pins," anchor the CS7 to the floor. All of these design features reduce cabinet vibration, energy storage, and coloration.

The CS7 uses the same sloping baffle technique as the CS3.6 and CS5i to achieve proper time coordination. This baffle, up to 2½ inches thick, is made from 60 pounds of cast concrete, shaped to reduce the effects of cabinet-edge dispersion and speaker-cavity diffraction.

The CS7 is thus a big speaker as well as a heavy one. It measures 14 inches wide, 19 inches deep, and 55 inches high. It is well styled, however: Narrow in front, with a grille so well integrated into the speaker that you can keep it on without significantly degrading the CS7's acoustic performance.

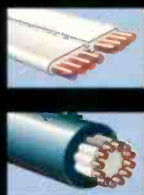
The driver complement consists of a 12-inch woofer with an aluminum cone and a 2½-inch voice-coil, a 6½-inch aluminum cone lower-midrange unit, a 4-inch aluminum midrange, and a 1-inch aluminum dome tweeter. The CS7 is the first dynamic loudspeaker I have heard that uses this many metal drivers.

Thiel says the aluminum in its driver diaphragms yields much higher stiffness and compressive strength than conventional materials.



Which scares you more, a horror film with the sound turned off, or a horror show on the radio? The answer is easy because it is the movie's soundtrack which carries the pathos and emotion. You can enjoy sound without pictures, but who wants pictures without sound?

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You won't see the cables and you won't see the sound – but you will experience the difference!

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The use of aluminum also allows Thiel to put the resonant frequency of the CS7's cone drivers about 2 kHz above their crossover frequencies, to reduce energy storage and ringing and to ensure that internal resonances cause no response irregularities. The tweeter's lowest diaphragm resonance occurs at 26 kHz—which, by most accepted audio standards, is well above audibility.

The woofer coil is about ½ inch shorter than the magnetic gap. This short-coil/long-gap design, also used in the two

midrange drivers, requires an exceptionally large magnet: The woofer has a 30-pound magnet structure with a 10-pound magnet. Thiel claims this technology lets the woofer drive enough air to produce up to twice the output of conventional woofers. The woofer magnet system also employs a heavy copper ring around the center pole, and a specially shaped pole piece, to make the magnetic field more constant.

The lower-midrange driver is filled with a sonically inert piece of polystyrene to further reduce speaker-cavity diffraction, and



the tweeter is coaxially mounted with the midrange driver. Thiel feels that coaxial mounting of the tweeter and midrange has several advantages. The CS7 already emphasizes time coherence by mounting the drivers at the proper angle in a sloping baffle and placing them in a vertical line. Coaxial mounting of the tweeter and midrange further improves the alignment of these two drivers, and it reduces the error in arrival time above 2 kHz caused by non-ideal listener height. Additionally, this design avoids reflections and horn-loading from the cone walls, a potential problem when the tweeter is mounted at the base of the woofer cone. Thiel also mounts a waveguide on the midrange diaphragm to avoid presenting a horn-shaped surface to the tweeter.

The drivers in the CS7 cross over at 200 Hz, 1 kHz, and 3 kHz. The first-order crossover used is exceptionally complex and expensive. For example, it has 45 elements and 75 high-quality components; all inductors are air-core types using low-oxygen copper. Jim Thiel feels this attention to crossover design, and use of a first-order crossover, pays off in accurate phase response and in phase- and amplitude-accurate transitions between drivers.

The manufacturer claims that the response of the CS7 only varies by ±1.5 dB from 25 Hz to 17 kHz. It also claims that the average on-axis response is flat within

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± 0.5 dB from 25 Hz to 13 kHz. I could scarcely verify these specifications by simply listening to the CS7, but it was remarkably free of apparent resonances, roll-offs, and frequency anomalies, and it sounded extraordinarily smooth and neutral.

Average frequency response at 30° off axis is claimed to be virtually identical to on-axis response. This may help explain why the CS7 sounded virtually the same over a relatively wide range of listening positions as it did at the ideal location.

Phase response is specified at $\pm 10^\circ$, and time error is claimed to be less than 0.5 ms above 300 Hz. These may help explain the CS7's apparent combination of speed, integration, and driver-to-driver coherence. The CS7 rivalled the best electrostatics I have heard in these respects, yet was coherent over a much wider listening area than any electrostatic I have heard to date. (However, you need to be at least 7 feet away from the CS7 to hear it at its best.)

The one area where I have to temper my praise for the CS7 is its impedance. It averages 5 ohms below 40 Hz and 2 ohms from 60 Hz to around 2 kHz, then gradually rises to about 4 ohms at 25 kHz. Most modern amplifiers claim to perform well with

**THIEL'S CS7 SPEAKER
HELPS DEFINE
THE CURRENT
STATE OF THE ART
IN HIGH-END SOUND.**

low-impedance loads. In practice, many tube amplifiers cannot provide enough bass control and low-frequency extension, and many transistor amplifiers make the bass and upper midrange sound a bit lean. Most 100-watt amplifiers may also lack the power to show off the CS7's dynamic range, and some may make its sound seem a bit compressed.

The new Classé Audio C-400 amplifier, and several Krell amps I tried, performed well with the CS7; some other tube and transistor amplifiers gave only mediocre results. I suggest you look for a high-current d.c.-coupled amplifier. If the CS7 sounds a little bass-shy, less than dynamic, or lacking in openness and transparency,

you should first assume it's an amplifier problem before you worry about the speaker.

The Thiel CS7 did a superb job of reproducing virtually every recording I treasure or use as a reference, and proved to be a great tool for auditioning the differences between D/A converters and various CD recording processes. It may not provide all the "openness" of bipolar designs, but you do get a speaker that has the midrange clarity of the best electrostatics. The CS7 has clean, sweet treble; superb bass, and an

excellent soundstage that is stable and coherent over a wide listening area.

The CS7 is the most musical Thiel speaker I have heard to date, plus it is one of the few speakers with outstanding performance in virtually every important parameter. Its overall timbre was flat, without the level of upper-midrange and treble energy that has made some Thiel speakers seem a bit thin when reproducing close-miked recordings having strong treble. With the right amp, the CS7 reached down

Continued on page 66

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VAC PA160 MONO AMPLIFIER



In 1990, the Valve Amplification Company introduced its PA series of tube power amplifiers. These amps struck me as truly beautiful, and, presumably, they were well executed. I am also considerably impressed with company president Kevin Hayes' knowledge of vacuum-tube design.

The PA160, one of the newest products from VAC, has a variety of user adjustments that should enable it to satisfy a wide range of musical tastes. For starters, there is a three-position rotary switch for triode, Ultra-Linear, or pentode (beam-power) output-tube operation. Another three-position switch selects bias range and B+ voltage for three families of output tubes, and a six-position switch allows you to vary the amount of negative feedback. Output tubes associated with the three bias/B+ switch positions

are "6L6/KT66," "EL34/KT77," and "6550/KT88." (That last position will also accommodate KT90s, according to VAC.)

**THANKS TO ITS VARIETY
OF USER ADJUSTMENTS,
THE PA160 SHOULD
SATISFY A WIDE RANGE
OF MUSICAL TASTES.**

The amps are normally supplied with Golden Dragon KT88s, from China, which VAC feels possess a nice combination of image size, tonal weight, and openness. With the supplied KT88s, power output is a healthy 160 watts in pentode mode and a very usable 80 watts or so in triode mode.

The aforementioned controls are on the top surface of the amplifier chassis, as is the rotary power switch plus four green LEDs and four access holes for bias adjustment. Also atop the chassis, just up from the rear panel, are four binding posts for matching loads of 1 to 2, 2 to 4, or 4 to 8 ohms—ranges chosen to let you select a tap to match a speaker's nominal or minimum impedance. (VAC suggests putting a 4-ohm speaker on the "4-8" tap for maximum power.) A small, two-position toggle switch can be used to bypass the chassis connection to the a.c. third-wire ground via a paralleled resistor and capacitor. The bypass breaks d.c. ground loops that could cause hum and noise. On the rear panel are a combination fuse-holder and IEC power-cord socket, plus RCA and XLR connectors for unbalanced and balanced signals.

Taking off the bottom plate of the all-aluminum chassis reveals an interesting wiring technique not often seen in audio products. A large fiberglass board, about 1/8 inch thick, covers the internal area of the chassis and is spaced away from the chassis by perhaps another 1/8 inch. This board carries all the top-mounted chassis components except the transformers, but does not connect them. All connections are hard-wired, via turret terminals staked to this board. (The only actual p.c. board is small and holds the bias pots and LED-indicator circuitry; it is mounted to the main board.) Teflon-insulated wire is used; the general appearance and neatness of the wiring are nothing to write home about, but VAC says this wiring arrangement is deliberate, to avoid the stray couplings that can occur with wires paralleled in neat bundles. Parts quality looked to be appropriate, with a number of metal-film resistors and bypassed specialty film capacitors in the signal path. The main chassis piece is bent to form the top and sides. Front and rear panels are separate pieces, bolted to corner brackets that tie everything together. Half-inch lips at the bottom of the main chassis piece are lined with Pemm nuts for bolting on the bottom plate.

Circuit Description

A 6SN7 octal-based dual triode, known to be a linear and good-sounding tube, is used in both the first and second stages of the PA160. The first stage is configured as

Photos: Michael Groen

what is known as a floating paraphase phase inverter. In this arrangement, the input signal is applied to the grid of a triode acting as a common-cathode amplifier, which provides one phase of the stage's output signal. This output is resistively coupled to a point that I shall call "point x." The other triode's plate, also resistively coupled to point x, provides the other phase of the stage's output. A coupling capacitor from point x drives the grid of the second triode. In



actuality, this amounts to a stage that provides one output phase directly and couples that output to another stage, which has 100% inverting feedback, to provide the other output phase. From a circuit purist's standpoint, this scheme has the disadvantage that the second generated phase goes through one more tube than the first generated phase. Further, the output impedance of the two phases is likely to be quite different.

The two output phases of the phase-inverter first stage are capacitively coupled into the grids of the second stage. This stage acts as a short-tailed push-pull amplifier with cathodes returning to ground through a common, unbypassed cathode resistor; the plate outputs of this second stage are capacitor-coupled to the output tube grids. According to VAC, the modest differential function of this stage helps to offset any imbalances from the paraphase inverter.

All four output tubes have potentiometers to provide adjustable negative grid bias in two ranges, as controlled by the tube-type switch. Each output tube's cathode returns to ground through a 10-ohm sampling resistor. In an arrangement used successfully in a number of other tube power amplifiers, the voltage drop across each cathode sampling resistor is compared, in a quad comparator, to a reference that represents the correct cathode current. The outputs of each comparator drive the appropriate LED indicator. Correct bias for each output tube is obtained at the adjustment point where the LED just goes out. The overall negative feedback, which is taken from the "4-8" output tap, goes to the feedback switch. At this switch, adjustable feedback resistors are selected and applied to the cathode of the signal input tube of the first stage.

Two power transformers are used in the PA160. One is for the high-voltage supply, and the other provides tube heater power, bias voltage, and power for the output tubes' bias-setting circuitry. The output of the high-voltage supply transformer is rectified by a full-wave bridge; it is then applied to four 330- μ F, 450-V filter capacitors in a series-parallel arrangement. This arrangement yields the

SPECS

Power Output into 4 Ohms: With KT88 output tubes, 160 watts in pentode mode, 152 watts in Ultra-Linear mode, or 79 watts in triode mode; with other tubes, in pentode mode, 125 watts with KT77s, 150 watts with EL34s, or 100 watts with 6L6GCs.

THD: At full rated power, less than 2%; at 10 watts, typically 0.23% at 1 kHz, less than 1% from 20 Hz to 20 kHz.

Power Bandwidth, Ultra-Linear Mode, with KT88s: 12 Hz to 42 kHz, +0, -0.5 dB; 8.5 Hz to 75 kHz, +0, -3 dB.

Frequency Response at 1 Watt: 5 Hz to 48 kHz, +0, -0.5 dB; 3 Hz to 82 kHz, +0, -3 dB.

S/N: Greater than 88 dB.

Output Noise: Less than 1 mV.

Sensitivity: 0.34-V input for full output, with KT88 tubes, Ultra-Linear mode, and feedback setting "D."

Power Consumption: At idle, 288 watts; at full power, 528 watts.

Dimensions: 11 $\frac{1}{4}$ in. W x 20 $\frac{1}{2}$ in. D x 8 $\frac{1}{2}$ in. H (29.9 cm x 52.1 cm x 21.6 cm).

Weight: 53 lbs. (24 kg) each.

Price: \$4,990 per pair.

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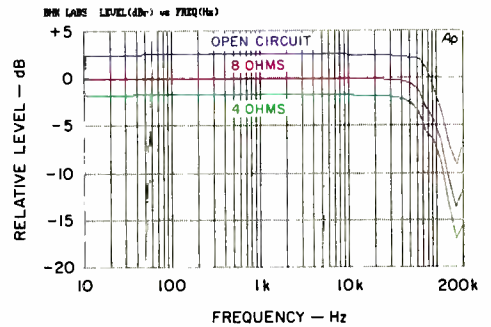


Fig. 1—Frequency response at "4-8" output tap.

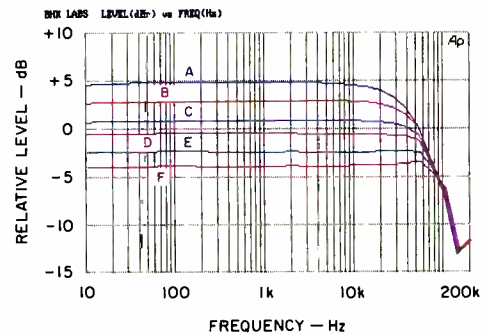


Fig. 2—Frequency response vs. feedback setting, 4-ohm load on "4-8" tap.

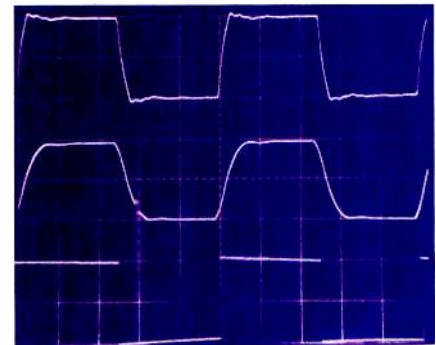


Fig. 3—Square-wave response for 10 kHz into 8 ohms (top), 10 kHz into 8 ohms paralleled by 2 μ F (middle), and 40 Hz into 8 ohms (bottom).

Two power transformers are used in the PA160. One is for the high-voltage supply, and the other provides tube heater power, bias voltage, and power for the output tubes' bias-setting circuitry.

The output of the high-voltage supply transformer is rectified by a full-wave bridge; it is then applied to four 330- μ F, 450-V filter capacitors in a series-parallel arrangement. This arrangement yields the

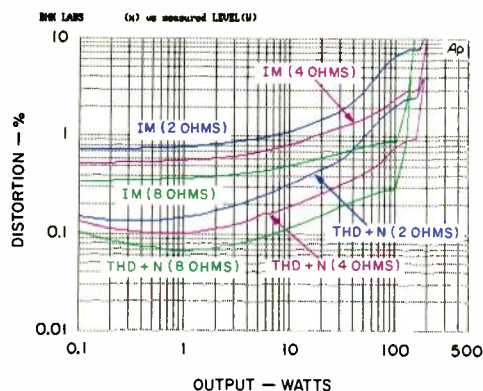


Fig. 4—THD + N at 1 kHz, and SMPTE-IM distortion, vs. power.

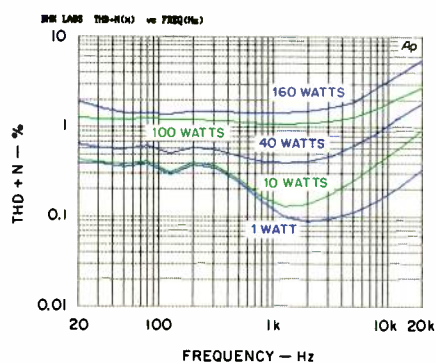


Fig. 5—THD + N vs. frequency.

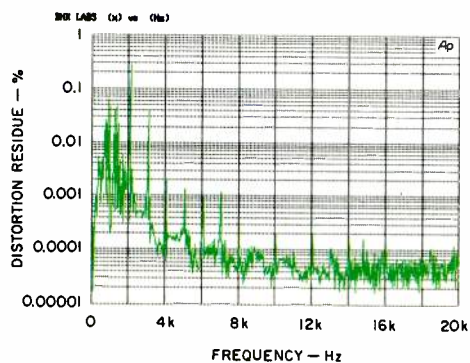


Fig. 6—Harmonics for 1-kHz test signal.

equivalent of a 330- μ F, 900-V capacitor, which can withstand the operating B+ of over 500 V. The secondary voltage applied to the rectifier and filter system is controlled by the three-position tube-type selector. The highest voltage is for the “6550/KT88” position, with successively lower voltages applied to the “EL34/KT77” and “6L6/KT66” positions.

Supply voltage to the second stage is developed through a resistor connected to the

main B+, and is bypassed with another 330- μ F, 450-V capacitor. In a similar fashion, the supply to the first stage is derived from the second stage’s supply point through a resistor and a final 330- μ F, 450-V bypass capacitor.

One aspect of the PA160’s circuit bothered me. The balanced input, which I assumed was balanced because of the XLR input connector, is actually not balanced at all. Pin 2 of the XLR is tied to the hot pin of the unbalanced RCA input connector. Pin 1 is tied to circuit common. Pin 3, which would be the negative phase of an incoming balanced signal, is not utilized at all and is merely terminated with a resistor to ground. Blasphemy! While VAC never explicitly claims this is a balanced input (the owner’s manual only says it’s “for compatibility with balanced . . . sources”), I think that they should clearly and explicitly state in the manual what was done. According to Kevin Hayes, however, “The XLR jack merely provides a place to plug a [balanced] source in without a clumsy adaptor, and provides a balanced load to each phase of the source.”

Measurements

Since there were so many operative combinations available with the PA160s, I selected the following as the nominal condition for my testing: Ultra-Linear operation, feedback at position “D,” the supplied KT88 output tubes, and loading on the “4-8” output taps.

The voltage gain of the PA160 amplifiers is somewhat higher than normal. This can cause such system

problems as audible noise from preamp output stages or preamp volume controls restricted to just the first few degrees of travel. The manufacturer realizes this, and a modification will be available in the near future to lower the overall gain if needed. (Kevin Hayes says that, in many instances, higher overall gain can result in superior sound quality.) Voltage gain and related input sensitivity are presented in Table I for the three operating modes, with feedback

set to position “A” (no feedback) and to position “D.”

Frequency response in the Ultra-Linear mode—as a function of open-circuit, 8-, and 4-ohm loading on the “4-8” tap—is plotted in Fig. 1. As can be seen, response is well behaved to beyond 100 kHz. The spacing between the curves is uniform (suggesting uniform output impedance with frequency); the amount of spacing suggests a fairly high output impedance (no surprise for tube amplifiers, especially those with low negative feedback). Figure 2 shows how gain and frequency response change with different feedback settings. For the pentode mode (not shown), the open- and closed-loop gains were higher; the curves were thus more widely spread between maximum and minimum gain, and the curves for higher amounts of feedback had some high-frequency peaking. In the triode mode (also not shown), the gains were the lowest and the curves were more closely spaced than in Fig. 2.

Rise- and fall-times for an output of ± 5 V into 8 ohms on the “4-8” tap were 4.3 μ s. Figure 3 is a scope photo of square-wave response. The top trace, for 10 kHz into an 8-ohm load on the “4-8” tap, is fast and well damped. In the middle trace, with a 2- μ F capacitor paralleled across the 8-ohm load, the damping is superb, with rise- and fall-times of perhaps 8 to 10 μ s. This amp would do well with electrostatic speaker loads. Tilt, or pulse droop, at 40 Hz (bottom trace) is quite low, indicating extended response below the audio band. Square-wave

THE SQUARE-WAVE TEST SHOWS THE PA160 WOULD DO WELL WITH ELECTROSTATIC LOADS.

response in the pentode mode did have some overshoot and ringing at the higher feedback settings, whereas the responses for triode mode were a bit slower than seen in the photo but otherwise very well behaved.

The THD + N at 1 kHz, and SMPTE-IM distortion, are shown in Fig. 4 as a function of power output and load on the “4-8” tap. The curves for the triode and pentode



**THE POWERFUL
AND WELL-DAMPED BASS
SHOWS THAT THE PA160s
CAN DEFINITELY
KICK BUTT!**

modes were, surprisingly, very similar in magnitude and shape to the Ultra-Linear curves shown, save that the clipping point was lower in triode mode. In Fig. 5, THD + N versus frequency and power for 4-ohm loading on the "4-8" tap, we see some unusual behavior below about 1 kHz. This is evident as a distortion increase that is most noticeable at lower power levels. It turns out that there is some 120-Hz power-supply ripple modulating the distortion. Figure 6 is a spectrum of the harmonic-distortion residue for a 1-kHz signal at 10 watts into 4 ohms on the "4-8" output tap. While the actual harmonics fall off with order in a desirably rapid manner, you can see the aforementioned 120-Hz sidebands on each side of the gap where the 1-kHz fundamental frequency has been nulled out.

Amplifier output noise, as a function of bandwidth and operating mode, is listed in Table II. For wideband measurements and those taken over the range from 22 Hz to 22 kHz, the readings are mostly hum, a mixture of 60 and 120 Hz. This amount of hum is a bit much and, as I later found, was sometimes audible when I was near the speakers.

Damping factor in the Ultra-Linear mode on the "4-8" tap was about 3, referred to an 8-ohm load, and was very flat with

frequency. In pentode mode, the PA160 had a damping factor of about 2 and was similarly flat with frequency. In triode mode, the damping factor was the highest, at 4.2, but fell off slightly above 2 to 3 kHz.

Dynamic power in the Ultra-Linear mode was about 116 watts into an 8-ohm load on the "4-8" tap. With a 4-ohm load, the equivalent sine-wave power at the visual onset of clipping was 171 watts at the beginning of the burst and 162 watts at its end. For 2-ohm loading, power at the beginning and end of the burst was 182 and 163 watts, respectively. With 4 ohms as a reference load and the manufacturer's spec of 152 watts, the dynamic headroom worked out to 1.0 dB at the beginning of the burst and 0.55 at its end. Clipping power (steady-state power at the visual onset of clipping) was 115 watts for 8 ohms, 158 watts for 4 ohms, and 145 watts for 2 ohms. The readings for a.c. line current were 3.0, 3.9, and 4.8 amperes for the same loads. At idle, a.c. line draw was 2.4 amperes. With the 4-ohm load as a reference, clipping headroom was 0.34 dB.

Use and

Listening Tests

Record-playing equipment used in my system during the review period included an Oracle turntable fitted with a Well Tempered Arm and Stanton's 981HZS moving-magnet pickup, feeding either a

Quicksilver Audio preamp or my own preamp (a tube phono stage with a passive selector and volume control). For CDs, I used Counterpoint's DA-11A and PS Audio's Lambda transports to drive a Sonic Frontiers SFD-2, a Resolution Audio Reference 20, and other (experimental) D/A converters. Additional signal sources

Table I—Gain and IHF sensitivity. Position "A" is for operation with no feedback.

	Gain, dB		IHF Sensitivity, mV	
	LEFT	RIGHT	LEFT	RIGHT
Feedback at "D"				
Triode Mode	36.3	36.2	42.1	43.7
Ultra-Linear Mode	39.2	39.1	31.1	31.4
Pentode Mode	42.1	42.0	22.2	22.4
Feedback at "A"				
Triode Mode	39.8	39.6	28.9	29.5
Ultra-Linear Mode	44.4	44.3	17.0	17.3
Pentode Mode	50.9	50.7	8.0	8.2

Table II—Output noise levels.

Mode and Bandwidth	Output Noise, mV	
	LEFT	RIGHT
PENTODE MODE		
Wideband	3.17	2.36
22 Hz to 22 kHz	2.88	2.14
400 Hz to 22 kHz	0.243	0.175
A-Weighted	0.430	0.341
ULTRA-LINEAR MODE		
Wideband	2.26	1.63
22 Hz to 22 kHz	2.19	1.54
400 Hz to 22 kHz	0.183	0.128
A-Weighted	0.323	0.242
TRIODE MODE		
Wideband	1.77	1.32
22 Hz to 22 kHz	1.74	1.26
400 Hz to 22 kHz	0.123	0.103
A-Weighted	0.245	0.199

Table III—IHF S/N ratios.

	S/N, dB	
	LEFT	RIGHT
Pentode Mode	76.4	78.4
Ultra-Linear Mode	78.8	81.3
Triode Mode	81.3	83.1

were Nakamichi's ST-7 FM tuner and 250 cassette recorder and a Technics open-reel recorder. Preamplifiers included a DGX Audio DDP-1, a Quicksilver Audio model, Forssell tube line drivers, a First Sound II passive unit, and the passive selector and attenuator sections of my preamp. Power amplifiers on hand for comparison were a Crown Macro Reference, Quicksilver Audio M135s, and a pair of Cary Audio Designs CAD-805 single-ended triode tube amps. The speakers hooked up in my reference system were B & W 801 Matrix Series 3s, augmented from 20 to 50 Hz by my two subwoofer systems, each using a JBL 1400Nd driver in a 5-cubic-foot ported enclosure.

The owner's manual for the PA160s is very informative. It covers the expected sound, reliability, and various types and manufacturers of tubes. The manual encourages you to experiment with the amp's various settings to get the best sound in your system. One item deserves special mention: VAC indicates that the "initial break-in time of high-resolution equipment is infuriatingly long. The PA160 will continue to season for at least 200 hours." When I first tried out these amps, I left them in the factory-set mode of Ultra-Linear operation, with the feedback switch at position "D." Initially, I thought the amps produced a gutsy rendition of the lower midrange in louder orchestral passages, but there was a noticeable glare and irritation that bothered me. After loaning the units to a friend and beating up on them in the lab, I returned them to my system for more listening. Soon afterward, I got the feeling that these puppies were beginning to break in and mellow out a bit. The glare and irritation were now greatly reduced, and I wasn't even close to 200 hours of operation.

Experimenting with the various operating modes and amounts of feedback, I settled on the pentode mode, with feedback in the "D" or "E" position. Now I was getting somewhere! These amps had a presentation

that was slightly more up front than is my usual preference. However, the sound was very realistic, with great dynamics and dimensional properties. Bass was powerful and well damped. The PA160s can most definitely kick butt! Ambient sounds, such as audience and performer noises, were rendered with great clarity.



THE SOUND OF THE PA160s IS VERY REALISTIC, WITH GREAT DYNAMICS AND DIMENSIONALITY.

I then tried a new set of Shuguang Chinese EL34 tubes, from a set of 12 that Kevin Hayes had kindly given me at a CES for my Quicksilver M135s. After letting these output tubes break in for a while, I went through the operating modes and quickly settled in on the triode mode, with no feedback. These amps sounded *wonderful* this way! The sound was more refined than with the KT88s, more like my Quicksilver M135s. Bass had excellent lift and punch, and resolution, space, and delicacy were of a high order.

In using these amplifiers, I did have some problems with their extra-high gain. For instance, when I used my preamp, which is active only in its phono stage, I was frequently operating at the lowest two positions of its passive volume control. One position was too low in volume, and the next one up was too high. Using a preamp with line-stage gain would be most problematic in this regard. Also, any line-stage output noise might be audible. In fact, I could hear some hiss coming from the speakers when using the Forssell balanced line stage with the Sonic Frontiers D/A converter. I could also hear some 120-Hz amplifier hum from the speakers, mostly in the pentode mode. The bias adjustment did drift with time and a.c. line voltage, and I found myself doing a lot of tweaking of the bias pots—more so with the KT88s than with the EL34s. But, hey, what do you expect? I am a tweak, and the VAC amps are really bias-stable enough.

In conclusion, I think the PA160s are damn good amplifiers, and I definitely recommend a serious listen. **A**

THIEL, *continued from page 61*

close to 20 Hz yet never lost definition and control or the ability to move the room at loud volumes. Its sheer bass power and deep bass extension were not quite up to the super-subwoofer level, but I have yet to hear a subwoofer more musically realistic and accurate. Upper bass and midrange were excellent in virtually every respect. I detected no significant tonal variations not attributable to my listening room. Detail, transparency, and timbre in this frequency range were as good as anything I've heard, but it did require the right amp to get the proper warmth.

The upper midrange was *really* excellent! It was musically natural; it had the air and resolution that were once the province of electrostatics, combined with a musical "life" just short of the best ribbon speakers. The treble was sweet and natural, with outstanding resolution; it was fun to listen to, not simply an exercise in technology.

Only a few of the larger (and more expensive) ribbon/subwoofer combinations have better dynamics than the CS7. This Thiel speaker could handle both low-level and large-scale dynamics with excellent definition and without shifts in sound character and timbre. The CS7 handled rapid musical transients equally well. I got every nuance of the differences in transient response, and only a few ribbon drivers sound "faster."

The CS7's transparency, harmonic naturalness, and detail really demonstrated how good dynamic speakers have become: Both accurate and musical. The soundstage was stable over a wide listening area. Width and depth were very faithful to the content of my reference recordings; there were no surprises, shifts, contractions, or exaggerations. Soundstage detail was better than that of any other dynamic speaker I have heard to date, and the focus was much closer to that of a point source than in any other large dynamic speaker I know of. The imaging focus was possibly the best in both width and depth I have heard from any cone speaker, and was stable over a relatively wide listening area.

The CS7 is definitely a reference-quality speaker whose only major drawbacks are price and amplifier sensitivity. It helps define the current state of the art in high-end sound. A real pleasure to review! **A**



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SONIC FRONTIERS ULTRAJITTERBUG JITTER REDUCER



Sonic Frontiers' UltraJitterbug (\$699) is one of the first of a new generation of anti-jitter components. These devices are designed to reduce the effects of jitter in the data stream between a digital signal source and an external D/A converter.

Jitter, as you may be aware, is the disparity between the moment a digital signal's edge transition is supposed to occur and the moment it actually does occur. Jitter is usual-

ly measured in such units of time as picoseconds (pS) or nanoseconds (nS), either rms or peak to peak. However, the time measure of jitter doesn't tell you about its frequency-related properties, such as the frequency content or randomness versus regularity or periodicity. These properties of jitter can be looked at in the frequency domain with a spectrum analyzer.

In a CD playback system comprising a CD transport and a sepa-

rate D/A converter, jitter can be generated in the CD transport, in the cabling between the transport and the D/A converter, in the input receiver of the D/A converter, and/or in the circuitry between the input receiver's decoded outputs and the input to the DAC (the actual digital-to-analog conversion circuit within the box we call the D/A converter). Of the signals that feed the DAC—the master clock, the bit clock, the digital audio data itself, and the left/right clock—it is in the left/right clock that jitter can affect the converted audio signal. Jitter on this clock causes error in the timing of the conversion, which in turn causes an error in the audio output amplitude for that particular sample time. This is similar in its effect on the recovered audio to error in the amplitude of the digital words themselves. It seems obvious that it takes an input receiver with low intrinsic jitter generation and an ability to reject the effects of incoming jitter, along with careful circuit design and layout in the circuitry after the input receiver, to deliver a jitter-free signal to the DAC.

To a great extent, this is what Sonic Frontiers has done in the UltraJitterbug. Signal input is applied to an ultralow-jitter UltraAnalog AES 21 input receiver. This receiver has a secondary phase-locked loop with a jitter transfer-function cutoff frequency of about 1 kHz. The recovered clock and data signals at the output of the AES 21 input receiver

are first coupled into a Crystal CS8402 data transmitter, where they are reconstituted and put out as S/P DIF and AES/EBU signals to feed a

following D/A converter. Interposing the UltraJitterbug device in the S/P DIF or AES/EBU digital data stream, between the source and the

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Continued on page 73

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KEN KESSLER

TDL STUDIO 1m SPEAKER



Don'tcha just love loyalty? In a world where the practitioners of transmission-line loudspeaker design can be counted on one hand, it's nice to know that such diehards exist, unshakable in their devotion. And that's after years of

insults from reviewers who have decried the design's tendency toward "one-note" bass, lower-register lumpiness, and the occasional dosage of boom. So how do supporters of the transmission line defend themselves? Easy: Transmission-line loading remains one of the most effective ways of extracting deep bass from a small box. The reason why it's not more popular has more to do with the disappearing skills of carpenters able to produce extra-complex cabinetry than with

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the cost of manufacture or the particular demands the design places on a system.

TDL Electronics is a British company whose history with the transmission line (TL, for short) goes back further than most, to 1975, having supplied drivers to American transmission-line speaker-maker IMF. Using a number of popular-in-the-'60s designs, including the hefty Reference and Studio Monitor models, TDL carried on and refined TL theory and practice, updating it when necessary. While it's easy to trace TDL's lineage back to specific designs of two or three decades ago, it should be noted that the company is also one of the pioneers of metal-driver technology: TDL was one of the first to employ metal-dome tweeters, while the model I auditioned, the Studio 1m, extends the metallizing process to the woofer. So look past the logo, the catalog illustrations, and even the style of the text in the instructions—all of which hark back to the '70s—and welcome what is most defiantly a modern design.

Standing 31½ inches tall, with an extra 3½ inches for its optional (\$50) steel stands and spikes, the Studio 1m takes up no more floor space than a small two-way speaker on its mandatory 24-inch pillars would. Because the Studio 1m is narrow but deep, at 9 x 14 inches, it's hardly obtrusive. What's more, this speaker is so visually undistinguished that you could easily overlook its presence despite the space it occupies; we're talking featureless to a degree that makes the Monolith in 2001 look like it was decorated by Hieronymus Bosch. The front is fully covered by the cocoa-brown grille cloth (no cabinet edges show), while the baffle, top, sides, and rear all wear the same superb veneer of real walnut. And that's it. Aside from the TDL badge, there's absolutely nothing to suggest that the cabinet designer spent any more time working on the speaker's looks than was absolutely necessary. Maybe it's just a

Photograph: Michael Groen

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Alan Parsons & Stephen Court

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case of form following function: This is a box, and nothing more. The only aesthetic choices to be made are the option of black ash veneer with black grille and the use of spikes directly fitted to threaded holes in the Studio 1m's underside, thereby omitting the stands and lowering the speaker a trace.

Still, TDL does provide a couple of operational choices: The rear sports gold-plated terminals that allow single or bi-wiring, or full bi-amplification. And you can—if you're brave—dispense with the protective mesh grilles supplied for the tweeter, gaining a small but noticeable increase in treble clarity. The grilles are held in place by the drivers' magnetic fields.

Remove the grille, and you'll see just what the mesh protects. At the top of each baffle is a 1-inch, suspended, black-anodized aluminum-dome tweeter, Ferrofluid-damped and incorporating its own rear chamber. It's no more fragile than any other tweeter, so the need for a protective mesh is neither greater nor less than for any drive unit, whatever the make, shape, material, size, or political affiliation. The difference here is that TDL—like Tannoy, Sonus Faber, and a bunch of other manufacturers—provides the option to remove the mesh for unmistakable sonic gains (versus a drop in peace of mind).

Directly below this dome is the 6½-inch bass unit, also black-anodized and fashioned from aluminum. At the center is a bullet-like phase plug, while behind is a Kapton voice-coil former, for high power handling, and a vented-pole magnet residing in a cast alloy chassis. This driver's rear output fires into the transmission-line tunnel, which runs down the back of the cabinet to the bottom, where it then curves up toward the center of the baffle (just below the woofer), finally firing downward again. It ends in openings consisting of two foam-filled rectangles per speaker, at the base of each baffle. The entire tunnel is lined with textured foam for appropriate damping and resonance control, and the Studio 1m is free of the wind-rushing whoosh I remember from some earlier TL designs.

Mounted behind the rear panel, and directly behind the bass driver to minimize internal cable length, is the crossover network. It's a 12-element design, providing this two-way system with a fourth-order crossover at 2 kHz. TDL specifies the Studio 1m as operating over the range from 28 Hz to 20 kHz, probably ± 3 dB, with a nominal impedance of 8 ohms and a sensitivity in the "medium" category, at 86 dB for 1 watt at 1 meter. TDL recommends amplifiers rated between 30 and 120 watts per channel. The more watts, the merrier, I'd say.

TDL's attention to detail is quite impressive; few companies bother to veneer their speakers' baffles to the same standards as the visible parts of the cabinet. You can assume, however, that TDL anticipates a number of its customers will use the speakers sans grilles, because they've even added a TDL badge to the baffle. Pretty though the two drivers might be because they're anodized in matching shades of black, they're not that way merely for looks; the anodizing adds to the drivers' stiffness, raising the breakup resonances beyond the audible frequency range. All of the compo-

nents mounted on the crossover's circuit board are top quality.

Adding the metal woofers to tweeters made from the same material eliminates a potential discontinuity, the sort that is prevalent (or poten-

tially so) in loudspeakers with drivers made of different materials. It's possible, too, that TDL's designers are especially sensitive to the matter of top-to-bottom coherence, because transmission-line technology almost forces a signature sound onto a speaker design; it's arguable that the drive units have to fight the enclosure itself. But TDL's long experience with transmission-line design has resulted in extended lower-octave performance virtually free of the thumping, one-note sound that characterizes less successful TL offerings.

Much is made of the big-sound-from-a-small-box nature of TL systems by TDL, suggesting that the Studio 1m might work well even in a smallish room. Although my studio is no vast cavern, its 15 x 24 feet is

slightly above the British average, so the speakers weren't suffering from claustrophobia. As TDL recommends, I installed them with a bit of toe-in, aimed at the hot seat. The triangle this positioning created resulted in the systems being 7 feet apart, with the listening seat 8 feet from the line of the speakers. Although TDL delights in saying that TL speakers are not the least bit room-fussy, I had to position each Studio 1m 40 inches from the rear wall to avoid room interactions.

A variety of sources fed the review system, mainly a Primare 204 CD player, Krell's MD-20 CD transport and Reference 64 D/A converter, and a Michell Gyrodec turntable with an SME Series IV arm and a Lyra Clavis cartridge. Preamps included the Classé Audio DR-4 and Krell KRC solid-state designs and Audio Research's LS7 tube unit. Power amplifiers, chosen for their various power outputs and topologies, were an Audio Research VT60 (50 watts/channel), a pair of Unison Research Smart 845s (26-watt, single-ended, triode monoblocks), and Krell's MDA-300 monoblocks (300 watts).

My last experience of a TDL speaker was some years back, with the Studio 0.5, then the company's smallest transmission-line design and some 30% smaller than the Studio 1m. While the Studio 0.5 wore a metal tweeter, its woofer was a composite. Therefore, I wasn't quite prepared for the Studio 1m's gains in overall coherence, however much it appears to be a traditional TDL product. Bass was unmistakably "transmission-line," and I mean that in neither a pejorative nor a complimentary way. It's just that bass from a TL system is so distinctive that I know people who can, with eyes closed and ears open, pick out a transmission-line system from any group of speakers you may care to demonstrate to them. (This isn't so odd. I know guys who'll run screaming if polarity needs inverting, if silver wire is in use, if tubes need biasing, or whatever. That's why they're called "golden ears.")

This is why you buy TL designs in the first place: You want lots of rich, deep, unconstrained bass from a box having a small footprint and whose appetite for wattage is fairly small. And that most certainly describes the Studio 1m, which sounds—by virtue of the power and weight of its lower

**THESE SPEAKERS ARE
TOO DAMNED GOOD
FOR HALF-DEAF STUDIO
DENIZENS WHO PREFER
DECIBELS OVER QUALITY.**

registers—like a speaker of perhaps twice its cubic volume.

Because most people, especially audio-philosophers, know there's no such thing as a free lunch, you must expect that there's some price to pay for this lower-octave largesse. You do detect vestiges of boom, trace elements of one-note performance, and a smidgen of lumpiness. So you have to weigh the options: Lots of bass with minor imperfections from a speaker that's easy to drive, or a top-quality mini for the same money, with no low-end anomalies (and, really, no low end to speak of), or a big-bucks, big system needing a big amp.

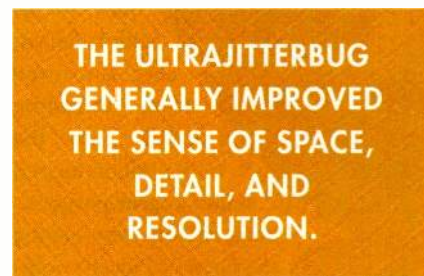
Just so you don't think that the Studio 1m is a total compromise or, worse, presents choices so difficult they're on a par with sacrificing your firstborn, note that its top-to-bottom coherence rivals that of even certain full-range, single-driver panel systems. Note, too, that the Studio 1m gives you bass without the cost levied by many woofers: The mid-band and treble regions suffer neither smearing nor imaging debilitation. If anything, the Studio 1m has an eerie ability to sound—in the mid and treble—like a hot mini-monitor, so three-dimensional and precise is its recreation of the soundstage. But the bass lets you know this ain't no loaf-of-bread-size British dwarf.

Using Donna Summer's recent "greatest hits" package, the new four-CD ABBA box set, and anything else I could think of that would torture-test the Studio 1m for both lower-register ailments and metal-driver nasties, I was staggered to hear such big-speaker behavior regardless of source or material. And that's without any of the anticipated tweeter sizzle I dread with some metal-tweetered systems, or the heightened bass transients I feared the new woofers would produce. This was neither the discomfiting of an overdamped, constipated acoustic-suspension mini nor the kick-in-your-chest pro-monitor style. Forget TDL's fascination with the terms "studio" and "monitor"; these speakers are too damned good for half-deaf studio denizens who prefer decibels over quality every time. Best of all, these hardly huge Studio 1m speakers—not outrageously expensive at \$2,000 per pair—prove in spades that the British are not afraid of bass. Or incapable of delivering it. A

SONIC FRONTIERS, from page 68
D/A converter, can greatly reduce the jitter generated by the source and in the cable between the source and the UltraJitterbug's input.

The UltraJitterbug is a small box, some 9½ inches wide x 7 inches deep x 2 inches high. The UltraJitterbug is self-contained, with its power supply built in, unlike the Audio Alchemy DTI•PRO (reviewed in the February issue and a descendant of Audio Alchemy's Digital Transmission Interface, which started the trend in anti-jitter devices). Signal input provisions on the rear panel include Toslink optical, AES/EBU (XLR), and S/P DIF coaxial (RCA female). Signal output is via coax and/or AES/EBU connectors. An IEC a.c. cord connector completes the rear-panel lineup. I would have liked an AT&T glass-fiber connection, at least on the output.

On the front panel is a three-position toggle switch for input source selection.



There are also four LED indicators. The first three are in red and indicate which input is selected; the fourth LED, which is green, indicates successful signal lock.

The UltraJitterbug's construction is simple but executed with beauty and precision. Inside, high-quality parts abound—notably the pair of coupling transformers between the input and output circuitry. These transformers are of a new type that offers considerably more extended bandwidth (especially in the low frequencies) than the more commonly used, smaller and cheaper ones. We can't have a jitter-reduction device whose transformer-bandwidth limitations induce jitter!

I have recently developed new tests to demonstrate some of the effects of jitter on the recovered analog output of a D/A converter. Using a JM-1 jitter modulator (kindly loaned by PrismSound), I can in-

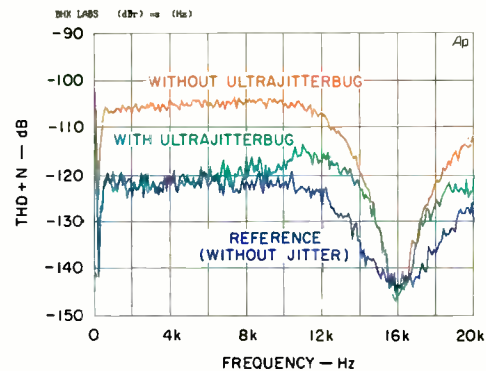


Fig. 1—THD + N spectrum, showing effects of injecting 5-nS (peak to peak) jitter and effect of UltraJitterbug.

ject controlled amounts of various kinds of jitter into the data stream, between a digital source and a D/A converter. This arrangement made it easy to measure the effects of inserting the Sonic Frontiers UltraJitterbug into the data stream. The D/A converter I used was a Crystal CDB4328 development board, utilizing the very popular CS8412 input receiver and a CS4328 one-bit DAC.

Figure 1 shows the results of one of my tests. A spectrum of the THD + N residue is shown for a full-scale 16-kHz tone. (The dip in response around the 16-kHz signal frequency is an artifact of the rejection notch of the THD analyzer.) Any harmonic distortion component generated by ordinary nonlinear distortion is outside the passband. An internal broadband noise signal in the JM-1 was set for a jitter level of 5 nS, peak to peak. The top curve shows the noise floor when the jitter is injected, and the bottom (reference) curve shows the noise floor when the additional jitter is not present. The middle curve shows the effect of adding the UltraJitterbug before the D/A converter. As can be seen, a good portion of the jitter's effects have been removed.

What about the sonic effect of using the UltraJitterbug? In my setup, with Counterpoint DA-11A and PS Audio Lambda CD transports feeding a Sonic Frontiers SFD-2 and other (experimental) D/A converters, putting the UltraJitterbug on line generally improved the sense of space, resolution, and detail. The effect would likely be greater with lesser grade CD transports. I recommend going out and auditioning one of these jitter-reducing bugs to find out what all the jitterbugging is about. A

CLASSICAL RECORDINGS



In their way, these four CDs comprise an excellent and fascinating cross-section of Henry Purcell's music.

In this "Purcell Year" (November 1995 will mark the 300th anniversary of his death), we doubtless will see many more. All of the present recordings are, within reason, "authentic" in performance style and in the instruments on which they are played. All are well recorded in quite live spaces but with sufficient care to keep the reverberance from intruding unduly into the music. All, moreover, reflect cogent programming choices from among the finest of Purcell's voluminous output. And all evince a fine fluency of musicianship. But they are not all equally successful.

The best of the lot is unquestionably William Christie's reading of

Dido—which, as the best known work here, is bound to be most music lovers' first choice among the present group. The performance is a truly superb example of how imagination and sensibility can bring an authentic performance vividly to life, so that the niceties of ornamentation and instrumental timbre remain delicious details, not gross musicological muscle-flexing. Indeed, the handling of the witches treads perilously close to high camp, but it manages to work magnificently. One remembers, too, that the piece was written to be performed by a girls' school, and the cackled giggles of the witches as they gleefully plot *Dido's* downfall are worthy of Saint Trinian's.

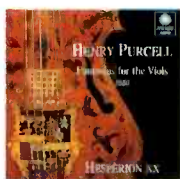
If the remaining offerings are a bit of a letdown by comparison, it is not that they are in any way substandard. The rather mysteriously named Tragicomedia has collected several relatively obscure, but nonetheless excellent, vocal *pièces d'occasion*. The group performs them with as much authority, if not with as much imagination or polish, as Les Arts Florissants. Provenance is listed for all of the instruments (a mixture of 18th-century antiques and modern copies), but, curiously, I find no indication of where the recording was made.

Purcell: Dido and Aeneas
Les Arts Florissants, William Christie
 ERATO 4509-98477-2
 CD; DDD; 51:54

Purcell: Songs of Welcome and Farewell
Tragicomedia, Stephen Stubbs and Erin Headley
 TELDEC (DAS ALTE WERK)
 4509-95068-2, CD; DDD; 76:20

Purcell: Fantasias for the Viols, 1680
Hespèrion XX
 ASTRÉE E 8536, CD; AD; 54:11

Purcell: Ten Sonata's [sic] in Four Parts
The Locke Consort
 CHANNEL CLASSICS CCS 7295
 CD; DDD; 65:00



JOHANNES BRAHMS

The Complete Piano Variations

Ian Hobson, piano
 ARABESQUE Z6654-2
 Two CDs; 2:17:05

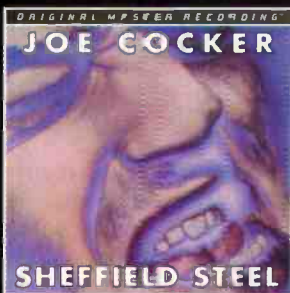
Brahms had a way with the variations form, and it's nice to have *all* of the piano examples under one roof, so to speak. Because of the unanimity of style, I suspect that the Claude Hobson credited with the other two hands in

the four-hand pieces is actually Ian's alter ego, created by the magic of multidubbing. You'll find more authoritative, more clearly individualized readings of the Handel or Paganini Variations elsewhere, but Hobson's interpretations are solid and some of these pieces are relative rarities. All are very well recorded by Arabesque on a Hamburg Steinway in the Foellinger Great Hall in Urbana, Illinois.



Robert Long

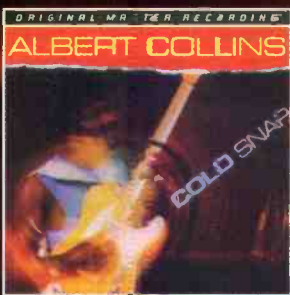
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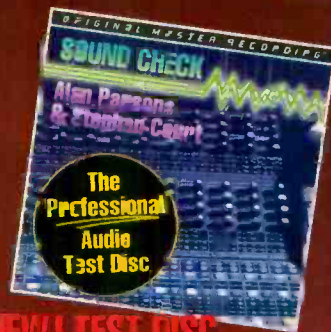
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The fantasia had been an accepted form since the Elizabethans, but Purcell was the last composer of note to use the basically polyphonic form. When Peter Warlock first published these pieces in 1927, they were considered an astonishing find. They still are. Good as Hespèrion XX's performances are, they are just fussy enough to distract somewhat from the music. Frankly, I prefer modern strings to this collection of viols, whose rather astringent sound undercuts the rich vein of passion within the fantasias, but I guess I'm a hopeless case in this era of authenticity. The recording, made in a Catalan castle—on analog equipment, it seems—is exemplary.

A little brighter and edgier in sound (as captured in a small Dutch church), but no less authentic in instrumentation, is the combination of baroque violins, viola da gamba, and theorbo (a plucked instrument resembling a lute on growth hormones) used by The Locke Consort for the "Sonata's." (The apostrophe evidently quotes the first edition.) These are very different from the fantasias, being contrapuntal in texture and based on Italian models. If the fantasias look backward to, say, Dowland, the sonatas anticipate Bach and Vivaldi to some extent.

Worthy jobs, all. But be sure to listen to that outstanding *Dido*.
Robert Long

Krommer: Clarinet Concertos in E Flat and E Minor; Sinfonia Concertante in E Flat for Flute, Clarinet, and Violin

Paul Meyer, clarinet; Jean-Pierre Rampal, flute; Janos Rolla, violin;
Franz Liszt Chamber Orchestra, Rampal
DENON CO 756355, CD; 76:07

Who? Krommer? Born three years after Mozart, died three years after Beethoven, Franz Krommer was actually named Frantisek Vincenc Kramár, from the fringes of the Austrian empire. (A solidly German name went over better in the musical capital, Vienna: Hence, Krommer.) A minor composer, yes, but not *that* minor. The big piece on this CD, and decidedly worth the listening, is the last: The Sinfonia Concertante, Op. 70, of about 1808—very late for that transitory format and indeed quite a unique piece for its day.

The "concertante," as it is often called, was simply a concerto for a group of solo instruments (from two to perhaps five), the happy successor to the old baroque concerto grosso. Some surprisingly rigid traditions grew up around the form. For instance, almost all concertantes are in E flat, perhaps originally to favor brass instruments. And all are relatively long, sprawling, relaxed—even Mozart's. In addition, solo color is always emphasized against a full-size orchestra of the period. Some 30 years after Mozart, Krommer has all this down to perfection, in a somewhat early-Romantic vein but actually not so different from its models.

The solo group (clarinet, flute, and violin) is ideal for recorded sonics and is beautifully handled in the Denon recording. The famous Jean-Pierre Rampal, glory of France, is balanced impeccably with Paul Meyer, the young clarinetist, and an almost anonymous (but nonetheless excellent) violinist, Janos Rolla; this group of three, in turn, is ideally balanced against the Beethoven-like orchestra. The booklet cover, however, is pure public relations: Jean-Pierre, large as life, out in front, with Meyer—youthfully longhaired—standing right behind him.

Actually, in the first two works, Jean-Pierre does not play, but is only the modest conductor. These two are worth playing first for the extraordinary virtuosity of the clarinet part—and keep in mind that the original instrument would have had mostly finger holes, like other instruments of the time. The Op. 30 concerto (1803) is overly reminiscent of the much earlier pre-Mozart banalities in the *galant* style, though the clarinet melodies are nice. The "second concerto," marked Op. 86, is apparently not even by



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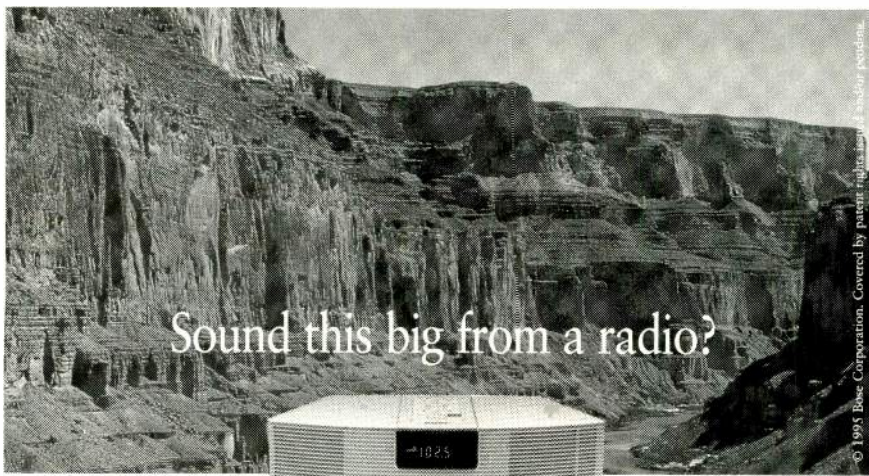
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Krommer. It seems to be a sort of arrangement by him—call it Krommer-Kramar-Kuffner, musical scrambled eggs. Competently written but somewhat coarse and loud.

Thus, when you get to the Concertante, things are much more lively—you will immediately hear how much more powerful and expressive this music is. Surely it was the inspiration for the whole CD, and no doubt Jean-Pierre's own choice. Its uniqueness is an almost folksy quality; it seems based throughout on dance-like or folkish tunes, elegantly dressed up in the manner of the time. This, as well as the superb recording, accounts for a lot of its charm.

Edward Tatnall Canby

**Smetana: String Quartets Nos. 1 and 2;
 Debussy: String Quartet**

Medici String Quartet

NIMBUS NI 5389, CD; DDD; 71:09

Powerful, passionate readings of all three works, captured in lushly reverberant space, with a wide soundstage in which each instrument can be pinpointed during every moment. It would be a truly outstanding CD but for two considerations: The sound is perhaps a little *too*



lush, and, much more important, the passion frequently induces the Medici to lose sight of basic technique. I'd willingly dispense with a little of the emotion if it could buy better ensemble and intonation. But listen for yourself; you may not mind the lapse at all, and there is much here to admire.

Robert Long

**Villa-Lobos: Piano Trio No. 1;
 Ravel: Piano Trio in A Minor**

The Ahn Trio

CHESKY CD 124, CD; DDD; 52:00

Youth is adaptable—wherever it may do its learning. This is one of the finest chamber performances—violin, cello, and piano—that I ever hope to hear, and it comes from The



Ahn Trio, three sisters out of South Korea, polished at the Juilliard School in New York. The cover art makes them look about 19, but they have been in the business since 1980, arriving here after thorough training in their home territory.

The Ahn Trio's playing, for this old hand at Romantic music, is breathtaking. How many hundreds of others, following the composers' score or their teachers' admonitions, miserably fail to grasp the reality! It is enormously

perishable, this sense for Romantic playing, so prized among the Romantics themselves. It is easily lost. But it can be born again.

I began with the Ravel. That high-tension, semi-impressionistic, yet always modern Ravel manner is realized here to perfection. I could hardly believe it. Such marvelously long-breathed pacing of the typical Ravel extremes, rising to great, sulky, pounding climaxes that fade ever so slowly to drawn-out stillnesses. It is all there. As an early work (1913), this is one of Ravel's best, and never better played.

As for the Villa-Lobos, a few years earlier and his first major publication, it is surprising for its lack of Brazilian influence. Just a big, genial whamslammer of a Romantic warhorse, lengthy but relaxed, well written and full of good tunes. Again the three players understand, and make the listening pleasant and lively.

The sound is superb, ideal for subwoofers, thanks to Steinway's biggest. And 128-times oversampling—phew! I would have preferred a bit more distance for violin and cello, but with such enormous piano sound, where could you put them? *Edward Tatnall Canby*

**Charles Tomlinson Griffes:
The Kairn of Koridwen**

Ensemble M, Emil de Cou

KOCH INTERNATIONAL CLASSICS
3-7216-2, CD; DDD; 51:42

No, not a new sword-and-sorcery novel or a computer game: This is the first recording ever of a lovely chamber piece for eight instruments by the "American Debussy," Charles Tomlinson Griffes. "Kairn" means sanctuary, and "Koridwen" is the moon goddess in this druid legend. The dance-drama, created for an avant-garde theater in New York in 1917, was, for all practical purposes, lost until now.

Griffes deserves more concert hall and disc attention than he has received. He was the first American-born composer to be linked to the international music scene—and not just Germany. The music of Debussy, Scriabin, Stravinsky, and others are alluded to, though not actually quoted, in *The Kairn of Koridwen*.

There are 17 short sections, which flow into one another, in two scenes. While their titles can be of interest to match up with the music—"Dance of Joy," "Fury of the Priestesses," et al.—the symphonically conceived score makes sense simply as a fresh and evocative abstract musical experience. The unusual combination of instruments (flute, two clarinets, two horns, harp, celesta, and piano)



provides many unexpected timbres and tone colors, to which you can attach all the personal fantasies you desire. Producer Michael Fine has expertly captured a perfect balance of instrument placement and natural hall acoustics.

John Sunier

John Tavener: Akathist of Thanksgiving

Soloists, BBC Singers, Westminster Abbey Choir; BBC Symphony Orchestra, Martin Neary

SONY CLASSICAL SK 64446
CD; DDD; 77:31

Sound: B+, Performance: A-

John Tavener is a British composer, but his soul is centered in the Russian Orthodox Church, to which he converted many years ago. It's that spirituality that informs "Akathist of Thanksgiving," a massive choral work based on a Russian Orthodox hymn of thanksgiving written in the 1940s by Archpriest Gregory Petrov.



Tavener has placed Petrov's hymns amidst a choir of basses and countertenors. He creates soaring refrains and an uncanny vocal continuum that underscores most of the work like lost spirits. The BBC Symphony Orchestra is only called in a few times, to uplift a few of the "Amens" that conclude each section and to create a roiling counterpoint to Petrov's hymns to God's glory, despite the turmoil He may make us endure.

Gregorian chants, and the work of composers such as Arvo Pärt, have their spirituality couched in Latin, making it abstract, ambiguous, and, hence, approachable for non-devotees. Tavener, however, puts his religion on the line, voicing the hymns in English. His path to transcendence is no less evident, although it is much less open to interpretation. The fact that Petrov died in a Siberian prison camp only makes "Akathist of Thanksgiving" all the more resonant.

John Diliberto

The American Clarinet (Copland, Bernstein, Gershwin, Gould)

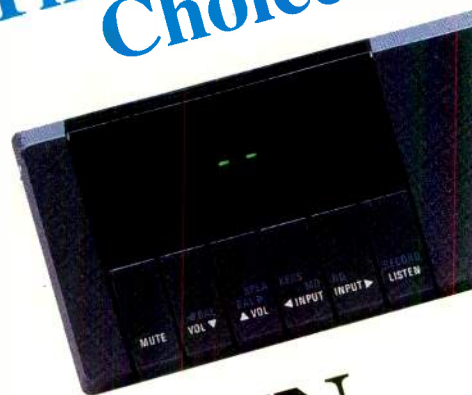
Larry Combs, clarinet; Bradley Opland, double bass; Deborah Sobol, piano
SUMMIT DCD 172, CD; 49:15

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John Sunier, Audio 12/94
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mature best. Then came our times, and the clarinet was into unheard-of new sounds—jazz, Benny Goodman, and all that. Plus, it is a superb instrument for recorded reproduction in any form, thanks to its intense, every-other-harmonic coloration.

At one time I deplored the wild, edgy sound of contemporary clarinet, having been brought up on the suave playing of the late Romantic period. No longer. The new clarinet sound relates both to the jazz innovations of Benny Goodman (who also played classical) and to my discovery (via records) of the "period" sound of the early clarinet, very much like Goodman! In Beethoven, even Mozart, I realized, the Goodman sound would have been entirely appropriate. A startling thought. Today—and on this CD—that sound is normal for younger clarinet players of every sort.

Larry Combs will instantly appeal to every ear on these terms. His tone can rise into the stridently expressive upper range, but his breath control, without vibrato, is astonishing and the sensitivity of his performance remarkable. His piano helper is excellent too, along with the string bass in the jazzier items.

Best of all is the program—the two most versatile of the early in-between composers, Copland and Bernstein, oddly close in this juxtaposition; then from the other side of music, useful arrangements of Gershwin, nicely styled for clarinet. (Remember "Rhapsody in Blue"?) And finally, active through the entire period, highly gifted but always of a commercial mind, Morton Gould. He was never better than in these brief works from 1962, written for Benny Goodman. My respect for Gould has gone way up. *Edward Tatnall Canby*

**Bach: Suite in E, BWV 1006a;
Fugue in G Minor, BWV 1000;
Suite in C Minor, BWV 997; Prelude,
Fugue, and Allegro in E Flat, BWV 998;
Suite in E Minor, BWV 996
("Aufs Lautenwerck")**

Kim Heindel, lautenwerk (lute-harpsichord)
DORIAN DIS-80126, CD; DDD; 57:42

Kim Heindel's first lautenwerk CD (Bach, Dowland, Duphy, Scarlatti, and Weiss, on Gasparo GSCD-275) slipped past me. Not wanting to get caught napping twice, I made sure to familiarize myself with this one. I discovered not only an expert performer but also a delightful, almost totally forgotten baroque instrument.

Briefly put, the lautenwerk looks like a harpsichord (Kim Heindel's has two keyboard manuals), but it has gut strings instead of



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Die Orgel Tanzt (The Organ Dances)

Rainer Selle and Nicol Matt,
organ; Hilger Honauer and
Jochen Ille, percussion
BAYER RECORDS BR 150 009
CD; 55:42



If you're one of those music lovers who associate the pipe organ with funerals and musty liturgical moods, try this disc on for size! Its nine short selections have the King of Instruments shaking a leg or two. Saint-Saëns' "Danse macabre" and Ravel's "Bolero" are so complex, they require the services of both organ-

ists and both of the percussionists.

The other tracks are less familiar, swinging solo-organ encore pieces except for one percussion duet. The sonics are superbly wide-range, with a fine feeling of cathedral acoustics yet without smearing the faster moving passages. A terrific demo disc. Pick this one up *Mach schnell!*
John Sunier

metal, and no dampers. Thus, it has a lute's unaggressive, sustained voice combined with all the mechanical speed the performer's 10 fingers can muster.

BWV 996 aside, none of these pieces was specifically designated for performance on the lautenwerk—and the designation of BWV 996 is not in Bach's hand. Rather, they are from the "lute" group in the Bach catalog. However, since Bach played the lautenwerk but not the lute, we need harbor no qualms about instrumental authenticity.

The innumerable fans of such plucked instruments as the guitar and lute will find this disc a delightful discovery, and the quality of the music chosen speaks for itself. In addition, this CD boasts luscious instrumental sound, captured in radiantly resonant sonics by Christopher Greenleaf.
Paul Moor



Brahms: Serenade No. 1; Elgar: In the South, Op. 50

Orchestra Filarmonica della Scala,
Riccardo Muti

SONY CLASSICAL SK 57973, CD; 71:05

Two northern composers, better known for their later works, and a tutto-Italiano performance! Here's a CD that flouts all the rules about playing German-style Romantic music. Though it defies my own best-thought-out Romantic principles, I loved it—especially, of course, the Brahms. Such is the pleasure and surprise of record reviewing!

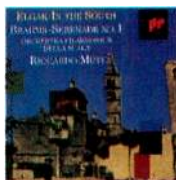
Both works are impeccable technically. Brahms was 24 when the gist of his music was composed in a different form, 27 when it appeared, revised and enlarged, as a first essay toward the Romantic symphony (along with Serenade No. 2). Elgar was in his 40s at the

time of his concert overture but still somewhat of a British beginner, just bursting upon the English scene as—at last!—a rival to the continent's best. Both works are fresh and new-sounding. But the Elgar, inspired by a stay at Alassio in sunny Italy, is—well, try it and see: You will think you have the wrong piece. It is pure Richard Strauss! Not slavish but all-out indeed. I could hardly believe it.

To be sure, after about seven minutes, Elgar suddenly sounds out. The Enigma Variations? Not for long. Sorry, but I found most of this music listenable only when I could manage to stay awake. Age or no, and despite its technical mastery, it is a kind of student piece.

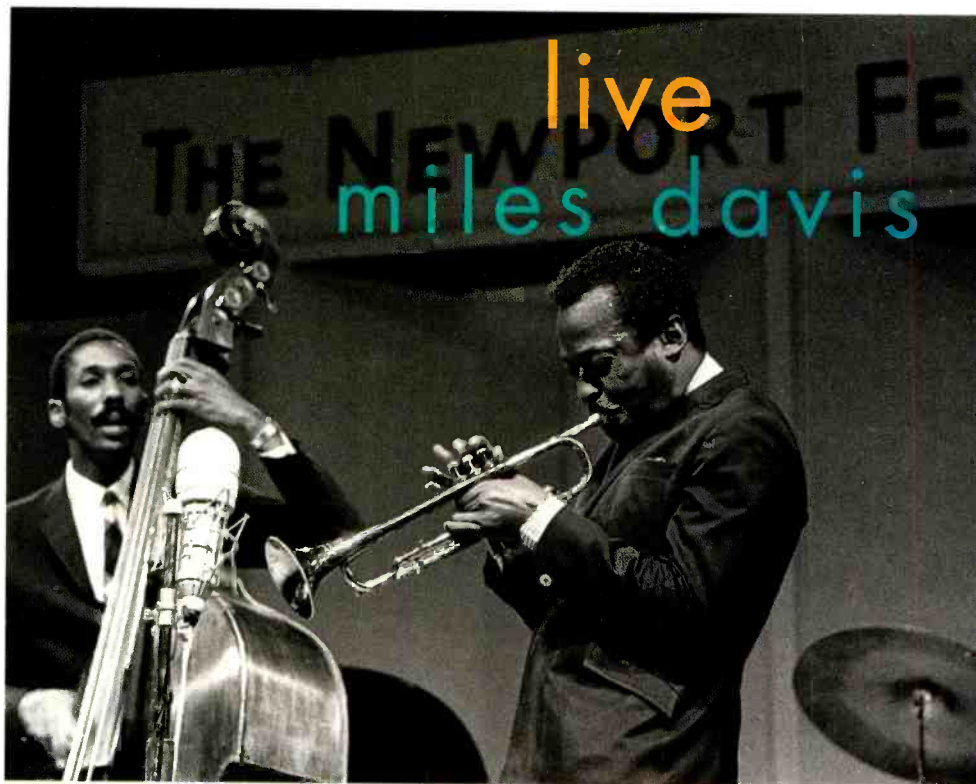
Turn then to Brahms, and a pioneering work that is at its depth a serenade in the Mozart-Haydn mold—six movements including two scherzi and a minuet and trio—yet clearly on the way to being a symphony. For the modern listener it has everything from dance-like folk rhythms to bits of the deep Black Forest, all beautifully worked on a symphonic scale. It is the very best of this composer when he was young, slim, and beardless (or maybe just sprouting).

The all-Italian playing? A nearly rigid, always rapid tempo, strikingly unlike the older



Northern performances of Brahms and surely utterly different from those in Brahms' own day. I kept seeing one of today's youthful joggers: Easily rhythmic, pausing yet never letting up on the beat. It should be wrong, such a rhythm—but it works. The beat is balanced by a superb sense for the softest, most delicate pianissimo, all that Brahms could have hoped for. So doze pleasantly through the Elgar (it comes second), then go back, reprogram your player, and thrill to the Brahms.
Edward Tatnall Canby

JAZZ-BLUES RECORDINGS



Photograph: Joe Alper/Frank Driggs Collection

The Complete Live at the Plugged Nickel, 1965

Miles Davis

COLUMBIA CXK-066955

Eight CDs, 7:11:22

Sound: B-, Performance: A



Let's get one thing straight: Despite what an eight-CD box set implies, this particular Miles Davis Quintet gig at Chicago's Plugged Nickel was no monumental event. Davis

wasn't unveiling any new concepts, and judging from the din in the background, the audience wasn't especially reverential. Apparently this was an average two-night stand in 1965, in a club where the Quintet had played before and would play again. Even the fact that Teo Macero was recording them wasn't unusual, for he often casually captured Davis live. But it's this casualness that makes the present recordings, released for

the first time in their entirety, extraordinary: Rarely has a band explored so freely while accomplishing at such a high level. It's easy to understand why Tony Williams, Ron Carter, Herbie Hancock, and Wayne Shorter were considered the definitive Miles Davis unit.

For this band, songs were launching pads for improvisation and exploration. When Davis and drummer Tony Williams shift the accents of "If I Were a Bell," refocusing the song from wide angle to macro, you can hear Davis engineering intricate changes of rhythm and dynamics. The moments when he and saxophonist Shorter engage in intertwined exchanges, slip-sliding over each other, resemble an orchestrated ballet. Shorter energizes the second track, "No Blues," with a knotty, sideways solo.

Bassist Ron Carter, like his counterpart in John Coltrane's group, Jimmy Garrison, was a space naviga-

tor—pushing, probing, and finding gaps in the fabric. As with every member of this quintet, he was a strong individualist but thrived in the group environment.

Jazz critics, especially in the '50s and '60s, liked to compare Davis' playing to Hemingway's fiction; it had a stripped-to-the-bone style that got to the essence of an emotion without muss or fuss. But a better analogy might be found in Latin-American writers such as Jorge Luis Borges or Gabriel García Marquez. Like them, Davis played with shadows and light, giving brief, often ambiguous glimpses into an interior life. The rendition of "Round Midnight" on this CD set could serve as a soundtrack for one of their stories—it's full of hidden corners and dark dreams, with a loose grip on reality.

And while critics often considered Miles Davis' technique limited, here

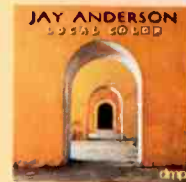
LOCAL COLOR

Jay Anderson

dmp CD-507, 55:09

Sound: C+, Performance: B-

On his latest release, bassist Jay Anderson uses his solid, meaty lines to thread together some disparate elements, with mixed results. The title track floats along gently, buoyed by Arto Tunçboyacıyan's vocals and percussion, and "Down Time" offers a funky showcase for trumpeter Tim Hagans' pungent sound. But a cover version of Marvin Gaye's "What's Going On" lacks the requisite soul, despite all the best ef-



orts of harmonica ace Toots Thielemans. "At Sundown" sounds like a desperate attempt to impersonate Bill Frisell, and while "Go Figure" features some artful improvisation, its flirtation with hip-hop is so insulated that it doesn't even own a view of the street. Also, though dmp's 20-bit recording technology may indeed add some fibrous texture to each of Anderson's plucks, the overall sound lacks vibrancy. Instead, it's squeaky-clean, and *Local Color* lost something in the wash.

Larry Blumenfeld

Beggars and Saints

Jai Uttal

TRILOKA 7208-2, 66:55
Sound: A, Performance: B+

Jai Uttal's third exploration of East/West melding is a tribute to the passionate street singers of India. Uttal's own passionate voice predominates, but it's the blending of trombone and oud, saxophone and gubgubbi, electric guitar and sarod, dunbek and backbeat that makes *Beggars and Saints* so successful.



A connection to Peter Gabriel's experiments in cross-fertilization is apparent on the album's lone English-language tracks, "Be with You" and "Conductor," the latter featuring Uttal's Appalachian-style banjo playing against

dunbek accompaniment. Elsewhere, Uttal and his Pagar Love Orchestra weave highly original world-beat tapestries that groove as well as intrigue. Perhaps the most successful of these is "Radhe Radhe," which combines Peter Apfelbaum's tenor sax and Jeff Cressman's trombone and flugelhorn with soulful non-tempered Indian vocals. Apfelbaum

also gets to blow against a mesmerizing groove on "Lake of Exploits, Pt. 2." Uttal, who plays guitar in Apfelbaum's Bay Area-based Hieroglyphics Ensemble, seems to exploit the trombone's non-tempered quality throughout the album, often writing snaky unison lines that combine Cressman with sarod or violin.

This is spiritual music with pop undertones and an undeniable groove. It's multi-culti on the goodfoot. *Bill Milkowski*

he offers some evidence to the contrary, uncorking pyrotechnics on the barn-burner "Walkin'." With the freer rhythmic structures of "Agitation," you can hear Davis developing the clarion call that would serve him well some years later with the echo-plexed version, on *Bitches Brew*.

Not every moment of *Live at the Plugged Nickel* is unalloyed brilliance. The first version of "No Blues" occasionally falls more into slumber than nuance, and it takes Shorter a while to get going at times. But this set remains a tantalizing glimpse into the collective unconscious of a group bent on discovering itself. *John Diliberto*

Friday Afternoon in the Universe

Medeski, Martin and Wood
GRAMAVISION 79503, 57:06
Sound: B, Performance: B+

Medeski, Martin and Wood's acclaimed 1993 debut, *It's a Jungle in Here*, was a grand production that featured horn sections and guest guitarist Marc Ribot. But their followup captures what the trio truly does best: Infectious grooves with audacious solos on top. It's a provocative blend of James Brown-flavored dance rhythms and Sun Ra-influenced improvisation—a brilliant marriage of body, mind, and spirit.

Essentially an organ trio, the group is often billed as an acid-jazz band, although they're more experimental than most ensembles working under that banner. Though John Medeski's earthy Hammond and Wurlitzer organ work, as well as his funky clavinet, are rooted in the late '60s Blue Note traditions of Big John Patton and Lonnie Smith, his subver-

sive tendencies eventually rise to the surface. Drummer Billy Martin provides a Clyde Stubblefield backbeat, while Chris Wood's huge-toned acoustic bass adds a hip-hop anchor.

Groove is the essence but not the final word to Medeski, Martin and Wood's approach. These boys love to take their music all the way out, as they do on several of *Friday Afternoon's* free-form interludes, e.g., "Paper Bass," "Clams," and "Tool Box." Theirs is an unabashedly avant-garde aesthetic—enough to puzzle most acid-jazzers looking for something to dance to—but that's what separates them from the flock. *Bill Milkowski*

JC on the Set

James Carter
DIW/COLUMBIA CK 66149, 65:27
Sound: A, Performance: B+

Not one but *two* people told me to check out *JC on the Set*, Detroit native James Carter's first session as a leader. It's understandable why. Working in quartet with three other Motowners—pianist Craig Taborn, bassist Jaribu Shahid, and drummer Tani Tabbal—the 25-year-old multiple-reed player comes at you like a relentless powerhouse. The opening title track and its follower, "Baby Girl Blues," are both screamers, and Carter's sound is the "growl" and the "big tenor" rolled into something up-to-the-minute.

But despite his talent, judgment must be reserved. Is Carter another 20-something with chops, or is this nifty young lion—who plays baritone on his reading of Duke Ellington's



PART THREE – EXTRA CREDIT

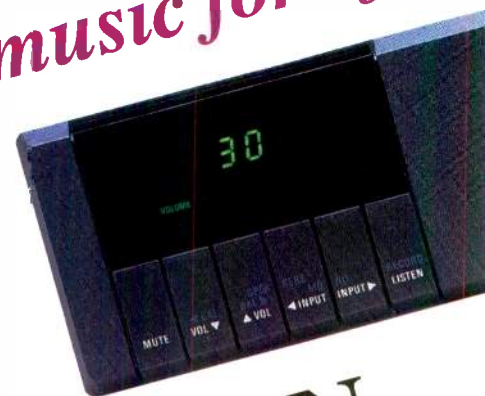
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See Part I of the exam on page 79 and
Part II on page 81..

"Caravan"—the real deal? He will be, when he learns to be less overwhelming and escapes his tendency to overplay.

Carter sounds like a cross between Arnett Cobb, Von Freeman, and David Murray, and it's quite clear he's paid close attention to all. By covering Sun Ra's obscure but beautiful ballad "Hour of Parting," he establishes his awareness of the great breadth of music available to him. But that awareness needs to expand. There's no doubt that JC is on the set, and his exuberance won't go unnoticed. But we need him to take more frequent pauses for the cause—just so we, if not he, can occasionally catch our breath.

Jon W. Poses

Nice View

Tim Berne's *Caos Totale*

JMT 314 514 013-2, 77:08

Sound: A, Performance: A-

If song titles like "The Third Rail" and "Impacted Wisdom" aren't fair warning, brace yourself; *Nice View's* three cuts are intimidating in more than just words, with one track clocking in at nearly 40 minutes. Perhaps it's because each composition is more like a sonic universe than a song, requiring ample time to create a world. Once within, you realize that the alternative realities of alto saxophonist Tim Berne are not really "Caos Totale"—

which is to say, there's a craggy sense of order at work.

"It Could Have Been Worse" builds from shards of noise created by Marc Ducret's guitar into swells of sound and tight ensemble interplay featuring some of Berne's most lucid soloing to date. "The Third Rail" begins as just a current through Berne's alto, developing into the charged polyphony of Herb Robertson's trumpet and Steve Swell's trombone.

Overall, the album succeeds as the aural equivalent of a good collage, using various instrumental textures (among them Django Bates' Peck horn and Mark Dresser's bass). Had *Nice View* not been so carefully engineered, the whole enterprise might have fallen flat; happily, it doesn't, and it's worth more than a passing glance.

Larry Blumenfeld

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FAST TRACKS

Black, Brown and Beige: Duke Ellington and His Orchestra, Featuring Mahalia Jackson (Columbia/Legacy CK-64274, 35:32). A prime example of Ellington's genius, with Mahalia Jackson's glorious voice playing a vital role. Conceived and written by Ellington as a musical impression of the African-American experience, it's as close to perfect as a jazz-classical hybrid can get. Plus, it's richness and depth, along with wide dynamic and frequency range, are audible on even modest equipment. **J.S.**

Michel Plays Legrand: Michel Legrand (Laserlight 12 306, 68:00). This bargain-price gem is an audiophile-quality session, recorded two years ago with an extraordinarily talented group of musicians. Legrand's spontaneity is what makes this one tick—no arrangements or charts were used. It's an excellent showcase for his talents as pianist, singer, and, especially, songwriter. **J.S.**

The Music of Pat Metheny and Lyle Mays: Bob Curnow's L.A. Big Band (The MAMA Foundation MMF 1009, 73:02). Curnow, a trombonist, arranger, and composer for Stan Kenton's Orchestra, has long been inspired by Pat Metheny. It was only natural that he arrange a dozen compositions by Metheny and Lyle Mays (Metheny's writing partner) for his own group, L.A. Big Band. The result evokes the Kenton band's colors, timbres, and wide dynamic ranges without overemphasizing the brass. This recording should increase mutual appreciation between the L.A. Big Band and Metheny camps. (Available from The MAMA Foundation, 555 East Easy Street, Simi Valley, Cal. 93065.) **J.S.**

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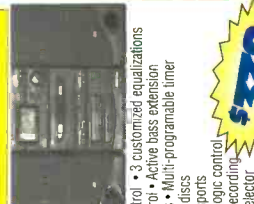
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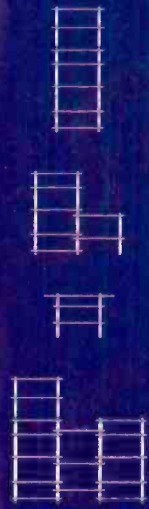
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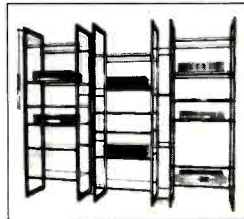
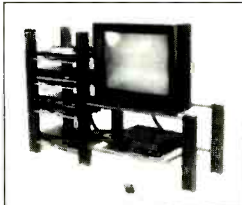
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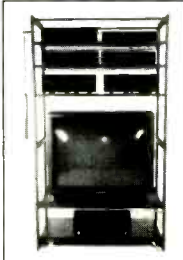


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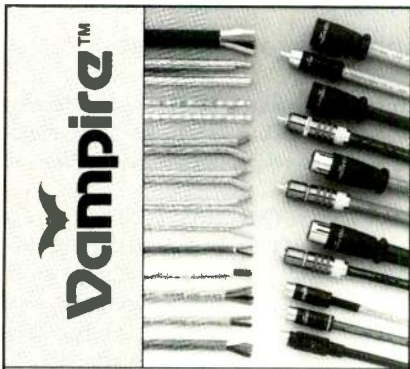
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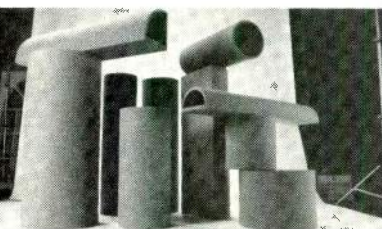
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AUDIO, August 1995, Volume 79, Number 8. **AUDIO** (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by Hachette Filipacchi Magazines, Inc., a wholly owned subsidiary of Hachette Filipacchi USA, Inc., at 1633 Broadway, New York, N.Y. 10019. Printed in U.S.A. at Dyersburg, Tenn. Distributed by Warner Publisher Services Inc. Second class postage paid at New York, N.Y. 10019 and additional mailing offices. Subscriptions in the United States, \$24.00 for one year, \$42.00 for two years, \$58.00 for three years; other countries except Canada, add \$8.00 per year; in Canada, \$32.00 for one year (includes 7% GST; Canadian GST registration number 126018209).

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PlayBack

SANUS SYSTEMS

Ultimate Foundations Speaker Stands

What difference can good stands make? Lots. For one thing, they can set your speakers at the optimum listening height, following the manufacturer's recommendations. Top of the line for Sanus Systems are the Ultimate Foundations series of stands. These stands feature three steel pillars, which can be filled with sand and/or lead shot. Self-adhesive rubber bumpers and removable spikes are supplied for both the bottom base and the top plate.

In my system, the 28-inch stands worked wonders with the little Lineaum LFX speakers, extending and firming up the bass and giving the overall sound presentation greater clarity and focus. (Cheap, flimsy stands just take away clarity and focus.) What's more, the Sanus Ultimate Foundations are among the most attractive stands I've come across; they don't look like something from the hardware store!

The 16-inch-high stands are \$329.99 per pair, the 20- and 24-inch stands are \$339.99, and the 28-inch stands are \$349.95. Comparable-quality imported

GRADE: A+

stands can cost nearly double, so the pricing is Sanus . . . I mean, sane. From every standpoint—sound, value, and looks—these Ultimate Foundations stands are certainly worth every penny! S.T.

For literature, circle No. 120

"PlayBack" mini-reviews are the result of short, sweet, and sometimes deadly testing by our all-too-experienced editors and writers. These hands-and-ears-only write-ups may look like new product announcements, but the grades and text reflect what the reviewer thought after less than an afternoon's "honeymoon."—E.P.

GEORGE KAYE AUDIO LABS

Small-Signal Tube Checker

Although a renaissance in tube hi-fi products seems to be underway, new tubes are not as plentiful as they were 30 or 40 years ago. Thus, audiophiles have to rely on used tubes, new old stock, or foreign-made tubes—all of varying quality.

That's where the \$549 Small-Signal Tube Checker (SSTC) from George Kaye Audio Labs comes in. In the tradition of the tube checkers of yore, this handy-dandy, portable a.c.-powered checker can easily test most of the small-signal audio tubes ever made (12AX7, 6DJ8, 7199, etc.), ensuring that your precious amp or preamp is getting the best audio from available tubes. Tube suppliers tell me that this is the only tube checker currently manufactured.

The well-built, wood-cased unit can handle noise, gain, and output and distortion tests to let you know exactly how a tube is performing. Many of the test results can be read on the built-in analog meter. A built-in speaker and headphone jack allow listening for noise and microphonics, and help confirm output. There are also jacks to feed 'scopes or other meters. An instructional manual and cassette accompany the SSTC.

By the way, in my tests, the SSTC revealed how similarly some Chinese-made tubes perform—even though some are sold at three to five times others' prices.

John Gatski

For literature, circle No. 121



GRADE: A-

Z-SYSTEMS

z-link+ Digital Sampling-Rate Converter

Just when I thought I had seen most of the players in the jitter wars, along comes the z-link+ from Z-Systems Audio Engineering. The z-link+ is really a sampling-rate converter utilizing Analog Devices' AD1890 asynchronous sampling-rate converter chip. Capable of handling a broad variety of digital interfacing problems, it is very good at reducing or eliminating some of the effects of jitter in the data stream between a digital source and a D/A converter. The z-link+ accepts digital audio inputs at any sampling rate between 25 and 55 kHz and outputs digital audio at either 44.1 or 48 kHz and in either professional (AES/EBU) or consumer (S/P DIF) mode. Additionally, the unit can be synchronized to an external AES/EBU or S/P DIF reference signal. The z-link+ has a suggested retail price of \$549. The z-link, a simpler version that does not have the external sync capability, has a suggested retail price of \$379, making it one of the least expensive devices for effectively removing jitter.

I tested the z-link+ in my lab, and it came out just about as good as the best I've tested. In my listening room, the results were as I have perceived with other jitter-reducing devices: Increased sense of space, resolution, and detail in the reproduced sound.

B.H.K.

For literature, call 904/371-0990



GRADE: A



"The HCA-2200" has all the features and flexibility any audiophile could want..." notes Stereophile.

Sure, it's nice to be hailed as a "benchmark." But what, exactly, does that mean? Well, let's read the quote in context:

"While the HCA-2200" has virtually unlimited brute power, it has enough finesse to let the music come through largely unscathed. Over the last six months it has proven, with a variety of speakers in both my listening rooms, that it's a benchmark

product against which other amplifiers can be measured. If an amp of equal or greater price isn't at least as good as the HCA-2200", it doesn't cut it."

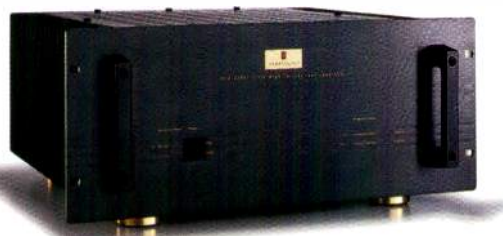
It's clear that Mr. Stone has discovered the virtues of our amplifier. And while we're pleased he found the process so enjoyable, we aren't surprised. It's all part of our design philosophy, whose essence he captures nicely when he says, *"...a middle-class audiophile like myself no longer has to take out a second mortgage on his house to afford a musically satisfying amplifier."*

“...A BENCHMARK PRODUCT AGAINST WHICH OTHER AMPLIFIERS CAN BE MEASURED.”

— STEVEN STONE, STEREOPHILE, VOL. 17 NO. 3, MARCH 1994

But what did surprise us, as well as flatter us, was being thrown into the ring with \$12,000 monoblock behemoths. The result of this apparently absurd comparison? Not carnage, but rather: *"...the Parasound HCA-2200" gives them all a run for the money, and even beats 'em in flexibility and price."* He continues, *"...a pair of HCA-2200"s performed with Apogee full-ranges on a par with a pair of Boulder 250 AEs and four VTL Deluxe 300 amps. Dynamic impact and attack were excellent...Compared to the VTL300, the HCA-2200" had a greater sense of extension..."*

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