Audio®

THE RECORDABLE CD
PROMISES & PROBLEMS

JUNE 1992 • US $2.95 • UK £1.95 • CAN $3.50

3,000 WATT MONSTER!!!
CROWN'S *NEW*
MACRO REFERENCE AMP

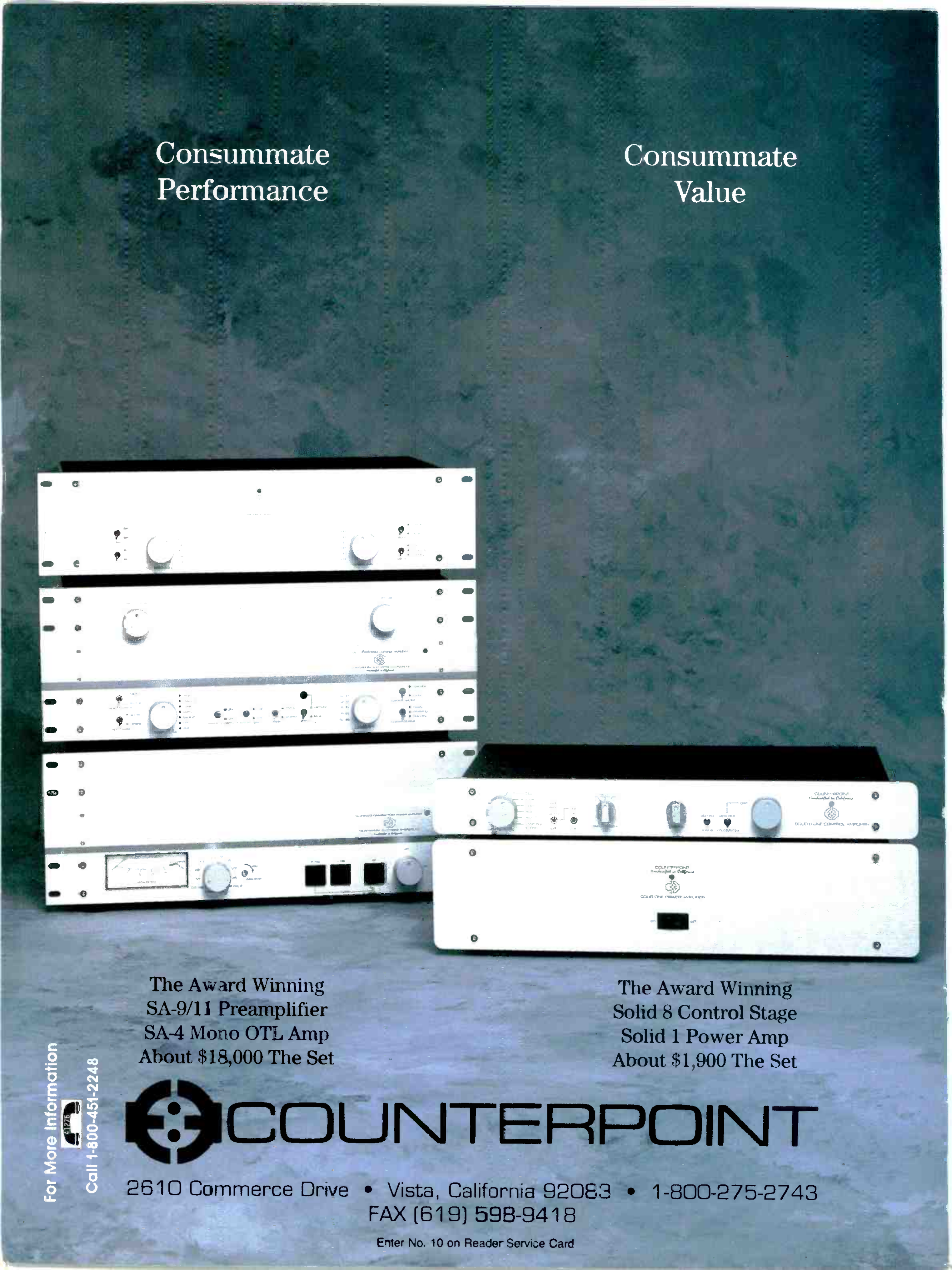
DESIGN BRIEF
A NEW TYPE OF SPEAKER

TESTED
VANDERSTEEN SPEAKER
ARCAM DIGITAL PREAMP

06

06030

0 70321 7


Consummate
Performance
Consummate
Value
The Award Winning
SA-9/11 Preamplifier
SA-4 Mono OTL Amp
About $18,000 The Set
The Award Winning
Solid 8 Control Stage
Solid 1 Power Amp
About $1,900 The Set
COUNTERPOINT
2610 Commerce Drive • Vista, California 92083 • 1-800-275-2743
FAX (619) 598-9418
Enter No. 10 on Reader Service Card
For More Information
Call 1-800-451-2248

STANDING OVATION

SELDOM is a loudspeaker sculpted so soundly for the home environment as to suggest perfect harmony. **JAMO SILHOUETTE** is a three-way bass reflex floor standing speaker with two independent 5 1/2" bass drivers complemented by a 1" dome tweeter. Comfortable with power input up to 120 watts, **SILHOUETTE** is soothing to the eye while indulging to the ears with a truly dynamic range of sound. In black or white finishes. Bravo! Jamo!

jamo

FORGET EVERYTHING YOU'VE HEARD TILL NOW.

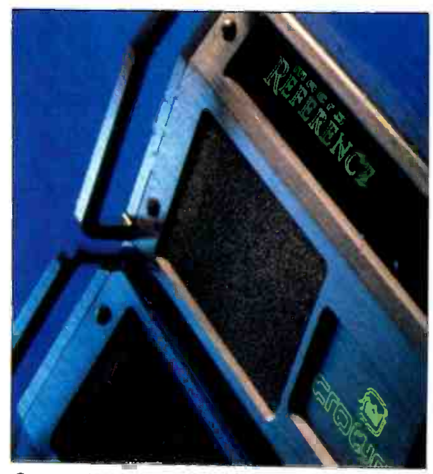
Enter No. 17 on Reader Service Card

Audio

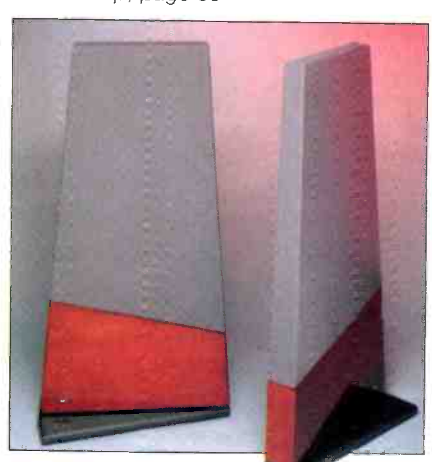
JUNE 1992 VOL. 76, NO. 6

Recordable CD, page 28

Currents, page 22



Crown Amp, page 38



Melior Speaker, page 34

FEATURES

EQUIPMENT PROFILES

MUSIC REVIEWS

DEPARTMENTS

The Cover Equipment: Crown Macro Reference amp
The Cover Photographer: Bill Kouirinis Studio

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

Subscription Inquiries, (800) 274-8808; in Canada or other foreign countries, (303) 447-9330

MPA

The Audit Bureau

Nº 30

REFERENCE DIGITAL PROCESSOR

PRIDE IN THE DETAILS . . .

Mark Levinson® components have earned a reputation for their rugged reliability, uncompromising fit and finish and, above all, superior sonics. We at Madrigal Audio Laboratories are understandably proud of this reputation.

The presence of "high technology" in our society has, for some, come to mean the absence of craftsmanship. Mass-produced look-alikes are everywhere, even in the realm of so-called high-end audio. The quality that you see and hear in a Mark Levinson component is not the result of automated mass production—rather, it is the result of painstaking attention to the details of design, and of pride in the art of craftsmanship.

Mark Levinson components are handcrafted in limited quantities and to exacting specifications. All who participate in their production share the feeling of pride that comes from knowing that they contribute to a product that defines quality.

It is with great pride, then, that we introduce the Mark Levinson Nº 30 Reference Digital Processor. Five years of exhaustive research into digital audio yielded a processor worth waiting for, deserving of the Levinson marque.

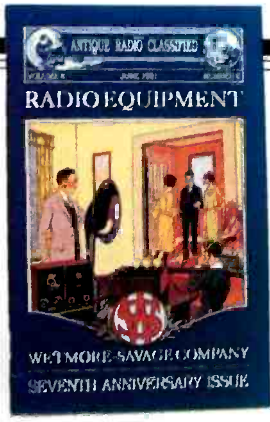
The Nº 30 is a true reference: it neither adds to nor subtracts from the music. It brings to your home the accuracy as well as the essence of the performance. Finally, the promise of digital audio is fulfilled.

The Nº 30 is proof that state-of-the-art digital *and* analog technology can coexist with craftsmanship. The subject here, however, ultimately is music, and the heart of music is in the listening. To fully appreciate the quality of the Nº 30, we recommend that you visit your Mark Levinson dealer for a full audition.

mark levinson®

Mark Levinson® products are designed and manufactured by
MADRIGAL AUDIO LABORATORIES P.O. Box 781, Middletown, CT 06457 FAX (203) 346-1540

SIGNALS & NOISE



Reading, Writing, and Radios

Dear Editor:

I very much enjoyed "Tuning in to Yesterday" in your January 1992 issue. I want you to be aware of my publication, *Antique Radio Classified*, a monthly magazine with over 7,000 subscribers that is devoted to the antique radio collecting community. A typical issue contains about 90 pages, and includes 600 classified ads, ads for services and hard-to-find repair parts, auction prices, flea market and collector club information, plus 20 pages of articles. As well as covering early radio, *Antique Radio Classified* covers art deco '40s and '50s radios, collectible transistor radios, early television and telegraph, early amateur equipment, and books on all these subjects.

Being the largest publication worldwide devoted to the antique radio community, we respond to over 500 inquiries each month with a free sample copy of our publication. Address requests to:

Antique Radio Classified
P.O. Box 2-V42
Carlisle, Mass. 01741

John V. Terrey
Publisher & Editor

Finer "Tuning"

Dear Editor:

We enjoyed the nice photos and captions of Jon R. Sank's "Tuning in to Yesterday—Vintage Sets from the Golden Age of Broadcasting" in the January issue. We would like to point out, however, that the caption for Harry Houck's amateur set contains errors:

A spark was *created* when the key was *depressed*, causing an *undamped*—not continuous wave (cw)—wavetrain. In those days, cw and Morse code were not synonymous words, as they are today. Also, the sound of such signals in the headphones was not clicks, but raucous buzzing sounds corresponding to dots and dashes of Morse code. It is interesting to note that Harry Houck was Major Armstrong's assistant in the invention of the superheterodyne receiving circuit.

The RCA Radiola 60 did not use a doublet antenna such as the Atwater Kent Model D shown with it. Doublet antennas were brought out in about 1933 to provide noise-free short-wave reception on "all wave" home radios which were becoming popular that year.

Thomas M. Turner
Watervliet, Mich.

Addendum

Following are some notes on impedance considerations for the First Sound Reference II Passive Preamp (reviewed in January) inspired by comments I received from a reader.

The attenuator impedance and consequent input impedance of the First Sound preamp is 20 kilohms. This is on the low side of what most tube circuitry will happily drive. The most noticeable effect will be a possible premature low-frequency roll-off due to the size of the output coupling capacitors used in typical tube circuitry. Correspond with the manufacturer to get advice on their product driving 20 kilohms. Most, if not all, solid-state circuitry will drive 20 kilohms with no problem.

Driving low-impedance loads, such as power amplifiers with input impedances in the range of 10 kilohms, isn't really a problem except when the attenuator is turned up to full rotation. Then the amplifier's input impedance is in parallel with the attenuator impedance, making the overall input impedance to the source come down to about 6.7 kilohms. This would not be recommended for tube sources but, again, would be okay for solid-state sources. Another consequence of a low-impedance power amplifier load on the attenuator is that the attenuation steps near fully clockwise will be coarser, whereas the attenuation steps down in the lower range of the control's rotation will be less affected.

Bascom H. King

AUDIO, June 1992, Volume 76, Number 6.
AUDIO (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by Hachette Magazines, Inc., a wholly owned subsidiary of Hachette Publications, 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. 10001 and additional mailing offices. Subscriptions in the U.S., $24.00 for one year, $42.00 for two years, $58.00 for three years; other countries, add $8.00 per year.

Subscription Service: Forms 3579 and all subscription correspondence must be addressed to AUDIO, P.O. Box 52548, Boulder, Colo. 80321-2548. Allow 8 weeks for change of address. Include both old and new address and a recent address label. If you have a subscription problem, please write to the above address or call (800) 274-8808; in Canada or other foreign countries, (303) 447-9330. Canadian GST Number 126018209. **Back Issues:** For information, write to P.O. Box 7085, Brick, N.J. 08723.

The Mitsubishi CS-35X7 35 inch TV features a unique digital ghost reduction circuit, a dual conversion tuner, an invar shadow mask, finer phosphor pitch and the industry's first true three dimensional comb filter.

JOSEPH GIOVANELLI

Four Speakers on One Amp

Q. When specs for a power amplifier say "two sets of speaker terminals," does this mean the amplifier has four channels? And when four speakers are connected at once, does the power to each speaker stay the same or is it cut in half?—Kevin Blackwell, Topeka, Kans.

A. All that the statement means is that the amplifier can power more than one loudspeaker per channel, unless the literature specifically says the amplifier in question is a four-channel unit. Many stereo amplifiers have double speaker terminals, usually with switches that let you select either pair and, often, both at once. One pair of speakers may be in the main listening room, and a second pair located elsewhere.

When an amplifier channel drives two speakers at once, the load it sees is lower than either speaker's impedance. Two 8-ohm speakers become a 4-ohm load, which is usually no problem; two 4-ohm speakers become a 2-ohm load, which many amplifiers cannot handle safely. Don't try to drive such a load unless the manufacturer states specifically that the amp can handle it.

If both speakers have the same impedance, each will receive half the available power; if their impedances differ, the one with the lower impedance will receive more power than the other speaker. However, when both speakers are connected, the available power will usually go up, because most solid-state amplifiers deliver more power into lower impedances. Some amps deliver twice as much power into 4 ohms as into 8-ohm loads, some deliver about 50% more, and others deliver about the same into both impedances. So when you hook two pairs of speakers up at once (assuming their impedances are equal), each speaker may get just as much power as a single speaker would, or half as much, or something in between.

DAT or VCR

Q. I have been contemplating buying a DAT recorder but am wondering if an 8-mm video deck with PCM is comparable in performance to a DAT. I have read that the 8-mm format uses a 32-kHz sampling rate, which is the same as a DAT running in the 4-hour mode. Some 8-mm decks allow audio-only recording, with recording times ranging from 8 to 24 hours on a single cassette.

What is your opinion about using a VHS Hi-Fi deck for audio recording in the 2- or 6-hour mode?—John F. Beasley, Augusta, Mich.

A. When samples are taken at 48 kHz, we can expect the resultant frequency response to be flat to 20 kHz. When the sampling rate is reduced to 32 kHz, frequency response is not likely to be flat very much above 12 kHz, with highs absolutely limited to 15 kHz.

How bad is this 32-kHz sampling rate? Most of our TV signals are sent via satellite at a 32-kHz sampling rate. Surprisingly good sound is possible.

The DAT system employs a 16-bit "word." The 8-mm system uses an eight-bit data "word," which should limit the S/N ratio to 48 dB. However, my 8-mm machines do better than that, because the system uses compression to improve its S/N.

From a theoretical standpoint, therefore, we can readily see that the DAT machine has some clear advantages. One such advantage of the DAT system over 8-mm is that the protection against lost data is better.

Another advantage of DAT machines over any VCR that I know of—8-mm or VHS—lies in the manner by which the "Pause" mode is handled. In any video system it is absolutely necessary to maintain sync; there cannot be a blank part of the tape on which no sync is written. The VCRs that I know of maintain sync by moving the tape backwards a couple of frames (or about 1/15 S), so that there will be sync pulses to lock onto when you start recording again. Thus, we have to anticipate this by waiting a short time after the last desired data has been recorded before pressing the "Pause" button. Otherwise the last note of music or the last word of a speech recording may be clipped off.

The DAT system is better thought out. When "Pause" is pressed, recording is immediately muted, but the tape continues forward for a frame or two. Then it moves backward to the exact point it occupied when the button was pressed. Thus, you don't lose data and are ready to begin recording at just the right place.

Cassettes used for 8-mm machines are less expensive than those for DAT machines. The 8-mm tapes can, with some systems, hold more than can be accommodated on a DAT, making the price of the 8-mm tapes even more attractive.

The VHS Hi-Fi format works well, with S/N ratios of 80 dB and better and with frequency response flat to 20 kHz. Tapes are often less expensive for VHS than for DAT or 8-mm, and they can hold up to 6 hours of recording. There are tapes designed for 8 hours of recording, but I do not recommend these for VHS Hi-Fi use.

The error protection with VHS tapes is not good. Any tape edge damage will result in mistracking, which causes a fluttering background. At times you can compensate for this by adjusting the deck's tracking controls.

Long-Distance AM

Regarding Juan Ferry's question concerning the reception of distant, AM broadcast signals (April 1991), my recent experience might be helpful. For many years I have relied on an old "boat anchor," the Hammarlund HQ129X receiver—reasonably sensitive, quite selective, and also useful for holding things in place in the San Francisco Bay area, where nature often tends to move the S-meter needle as much as a strong local signal does.

I found a unique device selling for less than $50, with which virtually any AM receiver that incorporates a built-in ferrite antenna can outperform the HQ129X on the broadcast band, even if that venerable receiver were hooked up to hundreds of feet of wire. It's called a "Select-A-Tenna." It requires no power and is about 11 inches in diameter and 2 inches thick. No wire connections to the receiver are needed; signal transfer is by induction.

Operation is simple. After tuning the receiver to the desired frequency, the knob on the Select-A-Tenna dial scale is set to about the same frequency. Without having time yet to make mea-

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. Please enclose a stamped, self-addressed envelope.

Q. CAN YOU FIND THE HIDDEN PLEASURE IN REFRESHING SEAGRAM'S GIN?

Power isolation strips may protect your equipment from line-voltage surges, filter out noise, or both.

surements, I would believe the gain to be 25 to 30 dB. Rotating either the Select-A-Tenna, the receiver, or both provides excellent rejection of interfering signals where differences in transmitter direction exist. It can not only reduce adjacent-channel interference but identical-frequency "QRM" as well.

Mr. Ferry might also want to consider the Sangean ATS-803A receiver, which provides dual-conservation AM coverage from 150 kHz to 29.99 MHz, as well as the FM band. This sells for about $200.

Both products are available from the C. Crane Company in Fortuna, Cal. (800-522-8863). Bob Crane and his crew provide something sadly missing in many retail operations today—at any price—service!—Lee Neidow, Kentwood, Mich.

A. The C. Crane Company offers a modification for the Select-A-Tenna so that direct wire connections can be made to receivers having external AM antenna terminals. Mr. Crane tells me that this hookup should be used for receivers whose AM antennas are not accessible or cannot readily be rotated—in other cases, the inductively coupled version will do a better job.

Definitions, Please!

Q. I have a few unrelated questions for which I would like clarification: What is a power isolation strip? What is an intermittent tweeter? What are imaging and soundstage?—Jimi Phillips, Jr., Detroit, Mich.

A. A power isolation strip is a plug strip (a box containing a row of a.c. outlets, hooked to a single power cord) with extra protective circuitry. Its circuits may be designed to keep sudden line-voltage surges from getting through to the equipment plugged into the outlets, to filter out noise, or both.

An intermittent condition is a problem that comes and goes; an intermittent tweeter would be one that failed some of the time.

Imaging refers to the ability of the equipment and recording to let listeners hear precisely where the instruments and performers were during the recording session, just as they would have heard had they been there. The soundstage is the space where the performers were; it is to the ear what a theater stage is to the eye.

TAPE GUIDE

HERMAN BURSTEIN

Pleasant Playback Equalization

Q. My cassette deck is several years old and has three equalization settings: CrO_2, "LH," and FeCr. When playing CrO_2 tapes, the only ones I use, and switching to "LH," I notice that the highs are boosted and that my VU meters give a higher reading. There seems to be more information on the tape than in the CrO_2 position. Also, the recording sounds louder. Why? Is there less tape noise in the CrO_2 position? (I don't worry about noise because I use an outboard dbx noise-reduction unit.)—Gary Guarneri, Danville, Cal.

A. In the CrO_2 playback position, the deck provides very substantial bass boost, starting (up 3 dB) at 2,274 Hz. In the "LH" position, it provides somewhat less bass boost, starting at 1,326 Hz. Looking at this conversely, treble is depressed more in the CrO_2 position than in the "LH" one. Accordingly, when you play your tapes in the "LH" position, you get more treble than in the CrO_2 position. Normally, for flattest response with CrO_2 tape, you should use CrO_2 playback equalization. But if the sound is more pleasing to you with "LH," there is no law that you should deny yourself.

The increased treble with "LH" accounts, at least in part, for the increase in loudness and the higher VU reading. It may also be that the equalization circuits in your deck are such as to produce an overall increase in output in the "LH" position.

When using CrO_2 playback equalization, you not only depress treble more, but you also reduce noise more. However, if you find that noise is not a factor in your listening pleasure, you should simply use the playback equalization that sounds best to your ears. (However, in recording be sure to switch the tape selector to CrO_2 when using CrO_2 tape or equivalent, Type II tapes.)

Head Longevity

Q. Please compare the longevity, in hours, of audio cassette heads, VCR heads, DAT heads, etc.—Ronald B. Freeman, Freehold, N.J.

A. I do not have sufficient information to answer your question specifically. Also, I doubt that specific answers are possible. In the case of heads for audio cassette decks, the materials of which the heads are made are chosen not only with respect to head life but also with respect to distortion and the ease of machining them to achieve fine, sharp gaps. Therefore, a manufacturer may elect to use heads with, say, a life of 10,000 use-hours instead of others having a life of 20,000 hours but with inferior characteristics with respect to distortion, etc.

Another factor in head life is tension of the tape against the heads. In most cassette decks, tape-to-head contact is achieved by a pressure pad within the cassette shell, whereas in others (such as Nakamichi decks), a finger is used to push the pressure pad away and the torque applied to the take-up and supply hubs keeps the tape properly snug against the heads. Eliminating the pad's pressure tends to increase head life.

As a rough guess, well-made heads in a quality cassette deck operating at the standard speed of 1⅞ ips tend to have a useful life of about 10,000 hours. However, the meaning of "useful" is open to question. If the gap of a playback or record/playback head widens so that response beyond, say, 13 kHz declines sharply, is this head no longer useful? For an adult whose hearing extends only to 12 kHz, this head may still be okay. It may also be okay for a teenager who suffers profound hearing loss owing to excessive hours at loud rock sessions.

VCR heads tend to have appreciably shorter life than audio cassette heads because the relative speed between the tape and heads is much greater in the case of VCR. As a *very rough* guess: 1,000 to 2,000 hours at standard videotape speed. Life is extended by using the long-play (LP) and extra-long play (EP or SLP) speeds.

Like VCRs, DAT recorders also have their heads on rotating wheels, which increase tape-to-head speeds. So DAT heads might have roughly similar lifespans even though the tape speeds, tape-to-head speeds, and head designs are different.

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

EDWARD TATNALL CANBY

CABLE FABLE

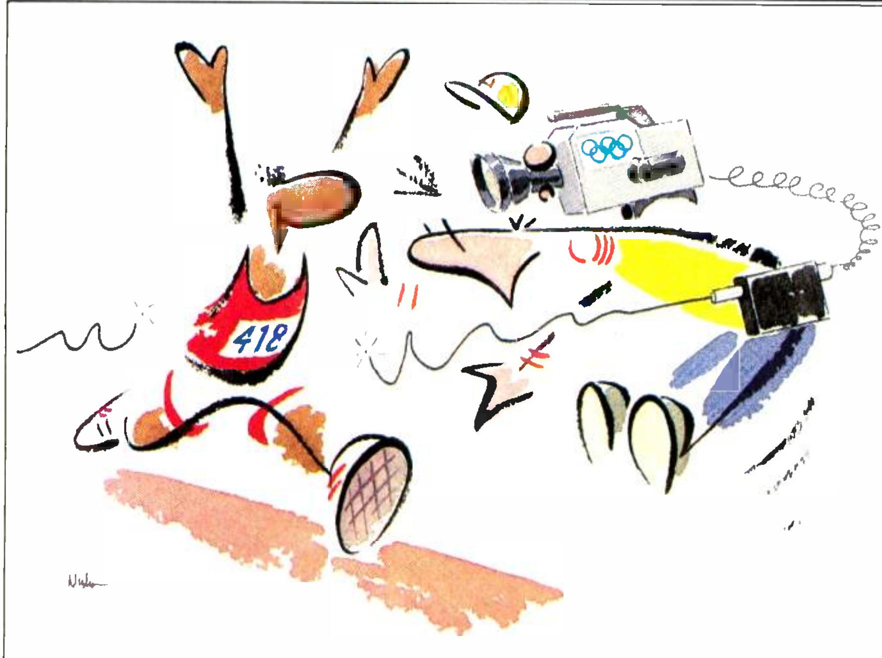


Illustration: Nishan Akgulian

In January I enthused over a fabulous fiber-optic development, the erbium light amplifier, which seemed to me so incredible, even improbable, that for a while after I sent in my copy I had the dreadful feeling it might be a hoax. Had I been trapped? Was *Scientific American* emulating *Audio*'s well-known line of Lirpa products, persuasive but improbable?

If this *was* a hoax, I thought uneasily, then it would have been done exactly as that magazine did it, complete with the improbable element erbium, which sounded entirely too much like a concoction of herbs, and a weird picture of a stretch of optical cable wound into a loose circle and emitting a garish green light. It could so easily have been set up in the Lirpa manner! Honestly, I was worried. After all, my 45-year-old reputation was at stake.

Well, sighs of relief, though they came too late for the January issue (publishing delay, as usual, with a handy assist from the post office). Many readers have seen a second and much expanded piece on the erbium amp in the same magazine, published many months after the first news report, and this time a feature article. It even has the garish-green photo, enlarged in size, and the subject is laid out in far greater detail with updates. You will find it in the January 1992 *Scientific American*. Evidently the editors over there did the same double take on their own earlier news item (March 1991) as I did—that is, suddenly they realized the significance of a simple, repeatable, flexible light amplifier for the entire huge world of communications, in just about any area you can imagine. And so, months later, they promoted the news item into the big time.

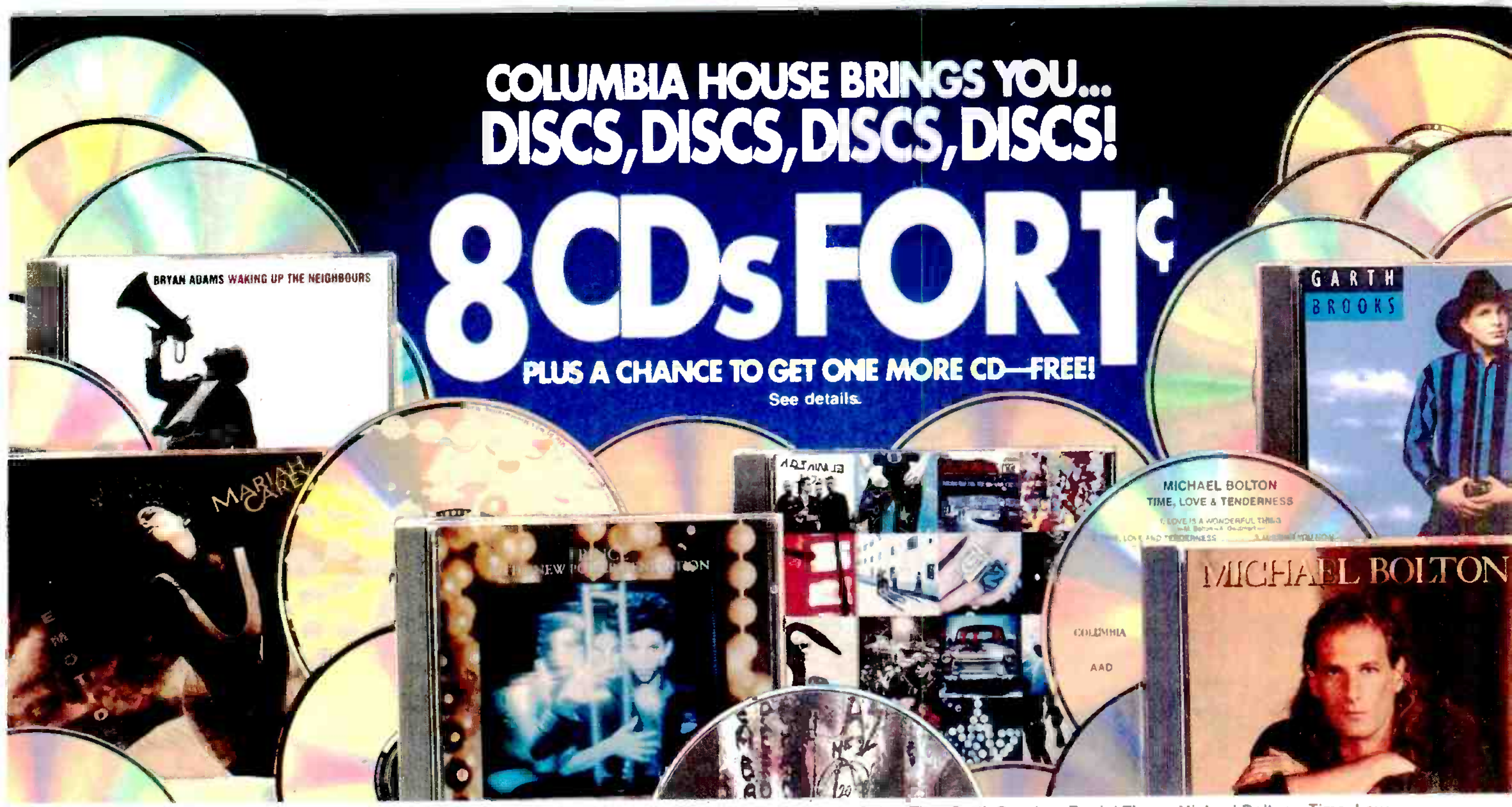
If *this* one is a hoax, then it is one of the biggest in history. If it is merely the scientific truth, then, just as I thought, we have a development as important as the vacuum tube (valve) and, because of its nature, of far greater potential towards revolutionary changes in our own area as well as in numerous others.

I cannot imagine that light will entirely replace electrons (and holes) in the audio world. It is the combination of the two that will be vital in audio and its spouse, video. The first audio example I ran into, the use of a light circuit not for length of cable or for bandwidth but to avoid cross-effects between low-level systems, is symbolic for what's to come. This, and the enormous potential bandwidth in what I still think we should call optonics, are the first considerations in the audio field. The propagation of zillions of signals over thousands of miles via optical cables is peripheral to our business, even if intimately linked at the ends.

How incredibly fast things are moving! I still sit here in my Connecticut small-town home without access to video cable because the local franchise people say it costs too much. Not enough houses. True, true. But the phone company has had lines to all our houses since the '20s, and since the mid-'30s those cumbersome and easily damaged electric power lines have also reached every house in town, and elsewhere worldwide. What will happen when, in almost literally months, optical cable becomes practicable for cable's distribution? With erbium for the longer lines? It just seems absurd at this point that cable people are grumbling about the enormous cost of cable extension via existing standards. Well, I'm not in the business and it's easy enough for me to say. These people have, after all, a huge vested interest in billions of dollars of present cable network, this multiplied everywhere into the biggest force in present entertainment, non-live, as we all know. But glass cable is *here*—and erbium. And will not be denied.

I know, I know, all the talk now is about "interactive." I'll go out on a limb, or a transmission tower crossbar, and say I'm not that impressed. Novelty, gadgetry. We'll be buried in it in no time. And at every level. I recently saw and heard the first big application of this system for classical music, *Mozart Interaktiv*, demonstrated at Lincoln Center in New York. On a single 12-inch LaserDisc was stored enough information on that composer, plus bits of music as well, to keep you busy for weeks. You control what you want (i.e., interact) by the familiar finger-to-screen method, touching either a menu of some sort or even a section of a picture. There are, so to speak, wheels within wheels, subjects, sub-subjects, and even more to choose, like a video zoom into areas large and small, down to the finest detail.

It sounds wonderful. The technique is intriguing, if already basically familiar via computers. But the content, I thought, was spotty, even occasionally amateurish. Dare I say it? The short bits of music, with video, were shabbily treated, ending with a click, a thump, or a too-short switch-off instead of end-



Bryan Adams—Waking Up The Neighbours. *Can't Stop This Thing We Started;* etc. (A&M) 429•779

Mariah Carey—Emotions. Title cut plus; *Can't Let Go;* more. (Columbia) 428•029

Prince And The N.P.G.-Diamonds And Pearls. (Paisley Park) 427•419

U2—Achtung Baby. *The Fly; Mysterious Ways;* etc. (Island) 431•213

Garth Brooks—Ropin' The Wind. *What She's Doing Now;* more. (Liberty) 428•862

Michael Bolton—Time, Love & Tenderness. *Missing You Now;* etc. (Columbia) 415•711

Eric Clapton—Rush (Reprise) 433•714

Pet Shop Boys—Complete Singles (EMI) 433•425

Jean-Pierre Rampal—Great Flute Concertos (Sony Classical) 432•971/392•977

Yo Yo Ma & Bobby McFerrin—Hush (Sony Master) 432•930

The Temptations—Milestone (Motown) 432•740

Rod Stewart—Downtown Train/Selections From The Storyteller Anthology (Warner Bros.) 425•322

Hammer—Too Legit To Quit (Capitol) 433•094

George Strait—Ten Strait Hits (MCA) 432•617

Tevin Campbell—T.E.V.I.N. (Qwest/Warner Bros.) 431•585

Various Artists—New York Rock & Soul Revue (Giant) 431•411

Murray Perahia—Brahms (Sony Classical) 431•379

The Spielberg/Williams Collaboration—John Williams, conductor (Sony Classical) 431•254

Steppenwolf—Born To Be Wild (MCA) 430•678/390•674

Neil Young & Crazy Horse—Weld (Reprise) 430•645/390•641

The Very Best Of The Platters (Mercury) 430•611

Erasure—Chorus (Sire/Reprise) 430•546

"Juice" Orig. Sndtrk. (S.O.U.L.) 433•243

The Allman Brothers Band—A Decade Of Hits 1969-79 (Polydor) 430•439

Frank Sinatra—Sinatra Reprise/The Very Good Years (Reprise) 430•363

INXS—Live Baby Live (Atlantic) 430•298

Eric Clapton—24 Nights (Reprise) 430•249/390•245

PM Dawn—The Utopian Experience (Gee Street/Island) 430•207

New Edition—Grt. Hits. Vol. 1 (MCA) 480•066

Israel Phil. Orch. Welcomes Berliner Phil. Mehta cond. (Sony Class.) 430•041

"The Commitments" (Sndtrk) (MCA) 429•753

Pixies—Tromp Le Monde (4AD Ltd./Elektra) 429•571

The Ocean Blue—Cerulean (Reprise/Sire) 429•431

Pearl Jam—Ten (Epic/Associated) 428•433

The Cult—Ceremony (Sire/Reprise) 428•300

Soundgarden—Badmotorfinger (A&M) 428•250

Ozzy Osbourne—No More Tears (Epic/Associated) 428•128

Public Enemy—Apocalypse 91 (Def Jam/Columbia) 428•003

Simple Minds—Real Life (A&M/Virgin) 427•203

The Byrds—20 Essential Tracks (Columbia/Legacy) 426•940

The Robert Cray Band—Strong Persuader (Mercury) 426•189

John Williams—I Love A Parade (Sony Classical) 422•717

Trisha Yearwood (MCA) 426•148

Clivilles & Cole—Greatest Remixes, Vol. 1 (Columbia) 431•783

Poison—Swallow This (Capitol) 433•128/393•124

Seal (Sire/Warner Bros.) 425•827

The Best Of Stevie Nicks (Modern) 425•694

Robyn Hitchcock & The Egyptians—Perspex Island (A&M) 425•645

James Brown—CD Of JB (Polydor) 425•025

Sting—The Soul Cages (A&M) 424•440

"Phantom Of The Opera"—Highlights (Orig. London Cast) (Polydor) 424•333

Roger Waters—The Wall/Berlin 1990 (Mercury) 423•855/393•850

Tears For Fears—Songs From The Big Chair (Mercury) 423•848

"Saturday Night Fever" (Sndtrk.) (Polydor) 423•806/393•801

Rush—Chronicles (Mercury) 423•780/393•785

The Very Best Of The Righteous Brothers—Unchained Melody (Verve) 423•772

The Moody Blues—Grt. Hits (Polydor) 423•756

Blind Faith (Polydor) 423•673

Bachman-Turner Overdrive—Greatest Hits (Mercury) 423•657

Scorpions—Crazy World (Mercury) 423•608

John Mellencamp—American Fool (Riva) 423•566

C & C Music Factory—Gonna Make You Sweat (Columbia) 416•933

Eric Clapton—Time Pieces (Polydor) 423•467

Jon Bon Jovi—Blaze Of Glory (Mercury) 423•400

Crowded House—Woodface (Capitol) 422•253

Bette Midler—"For The Boys." Orig. Motion Pic. Sndtrk. (Atlantic) 430•876

Richard Marx—Rush Street (Capitol) 433•110

Skid Row—Slave To The Grind (Atlantic) 422•220

The Allman Brothers Band—Shades Of Two Worlds (Epic) 422•212

Bad English—Backlash (Epic) 422•170

Travis Tritt—It's All About To Change (Warner Bros.) 422•113

The Psychedelic Furs—World Outside (Columbia) 422•055

Marc Cohn (Atlantic) 421•552

EMF—Schubert Dip (EMI) 421•487

Midori—Live At Carnegie Hall (Sony Class.) 420•570

Another Bad Creation—Coolin' At The Playground Ya' Know! (Motown) 419•903

Lenny Kravitz—Mama Said (Virgin) 418•814

Yes—Union (Arista) 417•824

Paul McCartney—Tripping The Live Fantastic/Highlights (Capitol) 417•477

David Lee Roth—A Little Ain't Enough (Warner Bros.) 416•610

Gloria Estefan—Into The Light (Epic) 415•943

Big Audio Dynamite II—The Globe (Columbia) 414•649

Madonna—Immaculate Collection (Warner Bros./Sire) 414•557

The Traveling Wilburys—Vol. 3 (Warner Bros./Wilbury) 413•872

Paul Simon—The Rhythm Of The Saints (Warner Bros.) 412•809

David Bowie—Changesbowie (Rykodisc) 412•247

Whitney Houston—I'm Your Baby Tonight (Arista) 411•710

John Mellencamp—Whenever We Wanted (Mercury) 430•231

Enya—Shepherd Moons (Reprise) 431•718

Warrant—Cherry Pie (Columbia) 411•389

Toto—Past To Present 1977-1990 (Columbia) 411•371

The Vaughan Brothers—Family Style (Epic/Associated) 411•306

George Michael—Listen Without Prejudice, Vol. 1 (Columbia) 411•181

L.L. Cool J—Mama Said Knock You Out (Def Jam/Columbia) 411•165

AC/DC—The Razors' Edge (ATCO) 410•662

Hollies—Epic Anthology (Epic) 409•730

Extreme—Pornograffitti (A&M) 409•003

Jane's Addiction—Ritual De Lo Habitual (Warner Bros.) 407•098

Wilson Phillips (SBK) 406•793

Harry Connick, Jr.—We Are In Love (Columbia) 406•645

Vladimir Horowitz—The Last Recording (Sony Classical) 405•985

Damn Yankees (Warner Bros.) 405•886

Depeche Mode—Violator (Sire/Reprise) 405•423

"Pretty Woman" (Sndtrk) (EMI) 405•407

M.C. Hammer—Please Hammer Don't Hurt 'Em (Capitol) 403•477

Eddie Money—Grt. Hits Sound Of Money (Columbia) 403•428

Nine Inch Nails—Pretty Hate Machine (TVT) 402•438

Kenny G—Live (Arista) 401•505

Robert Palmer—Addictions Vol. 1 (Island) 400•937

Eric Clapton—Journeyman (Reprise) 400•457

Reba McEntire—For My Broken Heart (MCA) 430•090

Jodeci—Forever My Lady (MCA) 430•959

Linda Ronstadt—Cry Like A Rainstorm-Howl Like The Wind (Elektra) 389•874

Janet Jackson—Rhythm Nation 1814 (A&M) 388•918

Bernstein Songbook—From "West Side Story" (CBS) 371•088

Michael Bolton—Soul Provider (Columbia) 383•083

Billy Joel—Storm Front (Columbia) 387•902

Mötley Crüe—Decade Of Decadence '81-'91 (Elektra) 429•316

Chris Isaak—Heart Shaped World (Reprise) 386•144

Tom Petty—Full Moon Fever (MCA) 382•184

Lynyrd Skynyrd Band—Skynyrd's Innyrds/Their Grt. Hits (MCA) 381•129

"Beaches" (Sndtrk.) (Atlantic) 379•669

Roy Orbison—The All-Time Hits, Vols. 1 & 2 (CSP) 377•945

The Who—Who's Better Who's Best (MCA) 376•657

Fleetwood Mac—Grt. Hits (Warner Bros.) 375•782

Journey's Greatest Hits (Columbia) 375•279

Van Halen—OU812 (Warner Bros.) 369•371

Marvin Gaye—Greatest Hits (Motown) 367•565

Tom Petty & The Heartbreakers—Into The Great Wide Open (MCA) 429•795

COLUMBIA HOUSE

Entertaining America...One Person at a Time.

MORE SELECTIONS

It seems absurd at this point that the cable people are still grumbling about the enormous cost of cable extension.

ing gracefully. The performances were middling, if, needless to say, by well-known opera pros and big-name orchestral groupings. Worse, I thought, was the blatant inconsistency between video and audio, though this is a matter both of taste and familiarity. Still, would you enjoy hearing a Mozart singer at stage distance in a big ambience while simultaneously looking at her nearby tonsils?

And the "interactive" locations: You want to see where Mozart was on December 29, 1768? Touch, and there's a street. Like almost any old street, 18th-century style. How about the next musical tour? Another street. Maybe you can zoom in on a house where Mozart slept. It's just another house. And so it goes, with a conventional announcer's voice spieling away short accounts of whatever. (Some were "Englished," though a lot still were in the German original out of Austria.)

A big job, years of work, enormous research, and tons of technical operation to get these mountains of Mozart miscellany onto a disc of admittedly very large capacity. (But aren't we used to that, by this time?) It is a worthy and dedicated beginning, this particular high-level interactive. But a single picture book of Mozart, illustrated in color, could do 90% of the same in much simpler and *faster* communication—also at far greater length. Why *must* we listen to an optically stored soundtrack when we can so easily read the printed word at speed?

Interactive may be the coming buzz, but I think there are more momentous developments to come, encompassing both interactive, otherwise known as two-way, and the "Read Only" facilities of radio, standard TV, the audio CD, and so on. More on this later; what has to concern us now is, rather, the huge battle that looms between the titans of broadcasting, cable, and the phone companies. For these last are the people who want in!

If light-wave communications make so much possible, then these big forces, notably cable and telephone, are equally able in the engineering sense to enter our homes with anything and everything. Bandwidth to spare, and then more.

From where I now sit, I can see through the window the line that powers me, stretching across a field and through woods to the main road, to a big transformer on the near pole. Below, via ancient cooperation, runs the thin wire that is my phone. Glass fiber is not exactly ready to conduct power yet, or ever, but I can imagine a glass cable replacing the phone line out there, and it could be soon. Who will bring it to me? Phone company or cable? Why both? Unless for ruinous competition and redundancy, over the vast spectrum that soon will be possible whether interactive or not.

In-between stands that perplexed monolith, the Government. National, mainly, but also state and local. I would hate to be on *that* firing line! Broadcasting, even by satellite, may fade further or mainly cease, but phone and cable represent two enormous and implacable forces ready to invade each other's territory, government willing. Phew, what a future!

Meanwhile, we have a relatively minor technical development, HDTV, in several incompatible systems. We left ourselves out of this in the United States. Europe and Japan forged ahead, differently but in analog, for video "hi-fi." Now we belatedly think we might catch up via digital, if and when. But, digital excepted, this new high fidelity is already in hand and ongoing. Did you realize that the entire 1992 Winter Olympics were televised by cameras in the new HD-MAC all-Europe (most of it) HDTV system, every picture you saw? Did some of that super quality remain when HD-MAC's 1,250 lines were converted to our 525-line system? I figured yes, somehow or other. The pictures were gorgeous, even non-HDTV.

But there was more. Every picture you saw in those days and days of winter broadcasting (and will see this summer) came through a fiber-optic connection from the cameras on site to a central editing facility. No erbium yet, I assume, but all glass. Not an electron anywhere. Yes, audio too came through the glass.

Hey, it's getting dark outside, pouring rain, thunderclaps booming. What is that silvery sheen I see stretching between the telephone poles? Somebody snuck in a glass cable when I wasn't looking?

Could be. But if so, whodunit? **A**

BERT WHYTE

COMPRESSION IMPRESSION

Illustration: Mary Jo Mazzella

To apply the term "high fidelity" to the reproduction of recorded music implies that the sound is a completely faithful image of the live musical event. Since the beginning of the hi-fi era, audiophiles have pursued the elusive goal of achieving true high-fidelity sound. They have employed the most extraordinary measures to extend response at both extremes of the audio spectrum, reduce all forms of distortion to insignificance, achieve flat frequency response, and, in every way, preserve the integrity of music signals. Over the years, advances in recording technology were matched by improvements in playback equipment. The vinyl LP record was the principal music storage medium, while the more affluent favored music on prerecorded open-reel tape. As technology progressed, there was a transition from tube electronics to solid-state designs. The advent of Dolby noise reduction was a most significant development, both for professional recording and for its contribution towards making cassette tape a respectable source of recorded music. With the introduction of the Compact Disc, digital audio became the cutting edge of the art.

Once these technological advances demonstrated their value in bringing us closer to musical reality, they earned the support of audiophiles and were integrated into the audio scene. For more than 40 years, steady incremental improvements towards true high-fidelity music reproduction have brought the art to its present level of sophistication. Having achieved this, the audiophile fraternity zealously guards against any idea or technology that would subvert or degrade these hard-won standards. Among many of the "top gun" audiophiles, signal processing and manipulation of any kind have been anathema. These people are disdainful of any kind of equalization, reverberant processing, and even noise reduction. Quite often, they are avowed digiphobes. (Of course, we all occasionally agree on the deleterious effects of things like Copy-Code!)

All the foregoing is significant in light of several new developments in digital technology which could seriously compromise some cherished audio tenets as well as cause divisiveness and controversy among audiophiles. By now, most readers are aware of the Philips Digital Compact Cassette (DCC) and Sony Mini Disc (MD) formats. Both use data compression techniques, which are not used in the CD format. To sonic purists, psychoacoustics and masking are dirty words. Since the DCC and MD data compression techniques involve these phenomena, many audiophiles simply dismiss DCC and MD as unworthy of consideration.

With the old adage of "Ain't science wonderful?" in mind, it appears that progress has been so rapid in digital audio engineering, the much-maligned concept of data compression has gained new respectability. This is especially true in regard to DCC. Unlike rotary-head R-DAT, DCC uses thin-film head technology to record and play back digital data. A bit-rate reduction system is used, employing what Philips calls Precision Adaptive Sub-band Coding (PASC). It is a very efficient coding system, needing less than a quarter of the bit rate of CD.

Barry Fox, one of Britain's most erudite and perceptive audio journalists, provided a particularly lucid and detailed description of how PASC works for *Hi-Fi News & Record Review* (March 1992):

> The audio frequency range is split, by digital filtering, into 32 sub-bands of equal width. The PASC signal processor models the aural characteristics of the spiral cochlea inside the ear, taking the threshold of hearing (of the most sensitive human ear) as its basic reference. As the sound is registered, the signal processor continuously adapts to the dynamic variations of the threshold. Efficiency is increased since only sounds above this dynamic threshold, and thus audible, are accepted for coding. Every sub-band is allocated the bit capacity it needs. The bits not required by particular sub-bands are re-allocated, adaptively, to other sub-bands to achieve the highest possible coding accuracy over the entire audio frequency range. Hence, PASC coding takes the behaviour of the ear as the reference model, and uses the chip technology of the 1990s to emulate that model.
>
> The coded information for all the sub-bands is multiplexed into an 8-channel data stream, into which error detection and correction codes are inserted. The distribution of the block codes over the 8 data channels achieves an effect similar to interleaving. A ninth channel, carrying the control and display auxiliary channel, is added. 8-10 modulation, to optimize the data format for recording on tape, then completes the signal processing.

"These hair-trigger pistols once saved the owner of The Glenlivet® from a band of cutthroats."

– Sandy Milne,
our Resident Sage.

Sandy Milne holding forth on the pistols.

The men, a brutish lot, were clearly intent on dirty doings.

The scene was the desolate inn at Cock Bridge, in the Highlands. George Smith, maker of The Glenlivet single malt Scotch, was on his way home from a sale of his much prized whisky, his money belt stuffed with gold sovereigns.

Also at George's belt, fortunately, were a pair of hair-trigger pistols, given him by the laird of Aberlour. Before the men could jump him, he cocked one of the pistols and fired into the peat fire. A cloud of white ash filled the room. By the time it had cleared, George was on his horse and well away.

"If that pistol had misfired," says our Sandy Milne, "there might not be such a thing today as The Glenlivet. A thought horrible to contemplate."

What is a single malt Scotch?

A single malt is Scotch the way it was originally: one single whisky, from one single distillery. Not, like most Scotch today, a blend of many whiskies. The Glenlivet single malt Scotch whisky should therefore be compared to a château-bottled wine. Blended Scotch is more like a mixture of wines from different vineyards.

The Glenlivet.
The Father of All Scotch.

The audiophile fraternity zealously guards against technology or ideas that would subvert or degrade its hard-won standards.

Naturally, with such a complex and sophisticated concept as PASC, the first thing most people want to know is if it in any way degrades any parameter of audio quality: Are any artifacts audible? In the initial stages of DCC development, the effect of PASC was clearly audible seven or eight times out of 10. Philips is planning a world launch of DCC recorders and at least 500 titles of prerecorded DCCs in September.

With the latest embodiment of PASC, Philips wanted assurance that this system would not produce detectable audio glitches and that it was sonically transparent. Thus, they enlisted the golden ears of the engineers at Decca Records (conveniently part of Philips' PolyGram group). To me, this made a lot of sense because of Decca's musical and engineering expertise, built up over many years.

In 1976, I was the guest of Decca's great pioneering engineer, the late Arthur Haddy, and engineer Tony Griffiths, now general manager of the Decca Recording Centre in London. At that early date, they demonstrated Decca's proprietary digital recorder to me. From the beginning, they used a sampling rate of 48 kHz (now the professional standard), and the recorder was capable of 18-bit performance (although Decca was using it for 16-bit coding). In 1991, they switched to 18-bit recording and, with the company's extensive recording schedule, now have a large supply of 18-bit masters on hand. I was Decca's guest on several other occasions, most recently in 1986. At that time, I had the pleasure of meeting Jim Lock, the chief recording engineer, and John Dunkerley, the Decca engineer who has made so many memorable recordings.

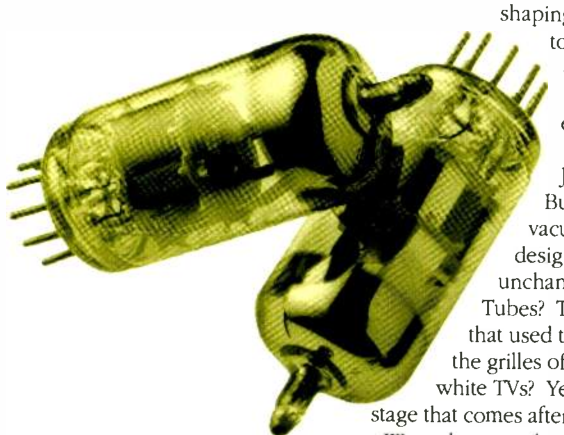
Recently, I had a phone conversation with Dunkerley in which we discussed a series of tests Griffiths had run on a Philips DCC recorder, paying particular attention to any glitches from the PASC system. In Griffiths' test, a Decca 18-bit master tape was output to the DCC recorder, which was set up for 18-bit encode/decode. An A/B switch was used to compare the master with the DCC decoded output to determine if PASC was in any way detectable. The Decca engineers (including Jonathan Stokes, who had worked with earlier PASC units) could not reliably state whether they were listening to the master or to the decoded DCC! As Griffiths said, "We may think we hear something, some of the time, but on over a hundred tests, there was no statistical evidence that anything was audible." Now, Tony Griffiths is a brilliant but basically no-nonsense, conservative engineer. He is so impressed with the results of the DCC tests and performance of PASC that he thinks a DCC recording from a Decca master could be used as the dubbing master for prerecorded DCCs! He says that DCC now has a dynamic range greater than CD's! I asked Dunkerley what he felt about the A/B tests. On that kind of short-term basis, he replied, the results were convincing and impressive, but he said he wanted to hear some DCC recordings in normal, extended listening conditions.

Philips plans to introduce entry-level DCC recorders with 16-bit performance, with Marantz introducing a more upscale 18-bit DCC recorder. Griffiths feels that if a 20-bit D/A chip is made available, Decca could provide 20-bit masters for a complete 20-bit DCC recorder!

So, audio purists, what now? Has the rapid advance of digital technology finally done the unthinkable? Has it made data compression undetectable? Just remember, there is digital data compression for video too—all the HDTV systems under FCC consideration use it—so perhaps it is a technology whose time has come.

CAN TUBES WARM UP CD SOUND?

How a very old technology can make a brand new compact disc player sound extraordinarily good.



Our new SD/A-490t has a clock that "ticks" 33 million times a second, multi-stage noise shaping, pulse width modulators and enough other edge-of-the-art circuitry to finally qualify us for entry into the hallowed Compact Disc Techno-Jargon Hall of Fame.

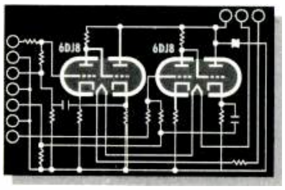
But it also includes two vacuum tubes whose classic design has remained unchanged for over 35 years.

Tubes? Those warm glass things that used to glow cheerily through the grilles of old radios and black & white TVs? Yes. In an important circuit stage that comes after all the digital wizardry.

We and many other critical listeners believe that this anacronistic addition to an already excellent CD player design significantly enhances its sound. Read on and decide for yourself.

THE AMPLIFIER THAT DOESN'T AMPLIFY.

Between a CD player's D/A converter and external outputs is circuitry called a buffer amplifier stage. When you hear the word amplifier, you think of something which makes a signal louder. But that's not a buffer amp's purpose. In fact, contrary to popular lore, a CD player's buffer amplifier doesn't boost the signal strength at all — the final output of a CD player's D/A converter already has sufficient voltage to directly drive a power amplifier!



Instead, the buffer amp is a *unity gain* device which *1) increases output current, and 2) in the process, acts as a sort of electronic shock absorber.

A signal emerging from a CD player's digital-to-analog conversion process has sufficient voltage but insufficient current for proper interaction with a preamplifier or power amp. By acting as a current amplifier, the buffer stage helps lower impedance to a level that's compatible with modern components — about 50 ohms in the case of the SD/A-490t.

At the same time, the buffer stage helps isolate the relatively fragile D/A chip set from the nasty outside world of demanding analog components.

TUBES VERSUS SOLID STATE.

All compact disc players have buffer amplifiers. But more than 98% of them use solid state devices for this stage: either integrated op-amp circuits or discrete transistors.

A handful of hard-to-find, esoteric designs in the $1200 to $2500 range employ one or more tubes instead. As does our readily-available $699 SD/A-490t. For fundamental physical reasons, tubes have different transfer function characteristics than transistors. When used in ultra-expensive, audiophile preamplifiers and power amplifiers, their sound is variously described as "mellower", "warmer", "more open and natural" or simply "less harsh than solid state".

At the heart of these perceived differences are three basic facts:

1. Tubes produce *even*-order distortion (i.e. 2nd, 4th, 6th harmonics, etc.) while transistors create *odd*-order distortion, particularly 3rd harmonics which are less psychoacoustically pleasant.
2. In a buffer stage, a tube acts as a pure Class A device, which is considered the optimal amplifier configuration. Op-amps function as Class A in and Class B out, with potential crossover distortion as voltage swings from positive to negative.
3. Tubes "round off" the waveform when they clip. When over-driven, solid state devices cut off sharply, causing audible distortion.

THE SD/A-490t'S OUTPUT SECTION

Our new CD player uses two 6DJ8 dual triodes (each literally two separate tubes in a single glass envelope) placed between the digital-to-analog converter and a motorized volume control.**

Operated at less than 30% of their maximum capacity, these tubes achieve a highly linear output voltage with very low static and transient distortion while providing very high dynamic headroom.

And because they're "loafing" at 1/3 their rated current capability, the SD/A-490t's tubes are designed to last the life of the CD player without replacement or need for adjustment.

A "LESS IS MORE" DIGITAL APPROACH FOR CLEANER ANALOG SOUND.

It would be pointlesss to have a tube output stage if the digital circuitry which precedes it

The Carver SD/A-490t.
At $699, its suggested retail is $500 less than the nearest competitor with tube output***

wasn't first rate. The SD/A-490t uses Single-Bit D/A circuitry to eliminate a form of exceedingly audible distortion inherent in most current CD player designs, and to provide better signal linearity than ever before.

If you've read current CD player brochures, you've probably stumbled across descriptions of de-glitcher circuits, laser trimming and even 22-bit converters. All these are merely fixes, applied to the same basic kind of D/A converter in an attempt to overcome built-in shortcomings.

In contrast, the SD/A-490t uses a completely new technology which avoids many of the problems that older approaches have struggled to surmount. We'd have to buy a whole section in this magazine to fully explain the differences (if you're interested, call 1-800-443-CAVR for an appropriately long and detailed brochure), but here's a short synopsis.

Traditional converters require 16 separate reference circuits, each of which must be accurate to one part in 65,536 — but, due to the realities of mass production, rarely are. If they're not "dead-on", an unpleasant form of noise called *zero-cross distortion* is produced. Because Carver's Single Bit D/A Converter transforms a 16-bit signal into a 1-bit pulse signal array, the "ladder" of 16 ultra-high-precision reference devices is not required. In effect, the SD/A-490t need only manipulate a stream of varying-width on/off pulses instead of having to accurately create 65,536 different amplitude levels at all times.

Zero-cross distortion is non-existent, and the SD/A-490t's Single Bit converter is able to decode linearity in excess of 115 dB below peak level with exceptionally low noise. You'll particularly notice the difference in the heightened purity and clarity of music during very quiet passages. Every nuance, intonation and harmonic of the original recording is there. Yet "digital" harshness is noticeably absent even before it enters the SD/A-490t's mink-lined tube stage.

AN ARRAY OF FEATURES AS RICH AS ITS SOUND.

We've designed the SD/A-490t to be both useful and easy-to-use. 21-key front panel or remote programming. Fixed and variable output. Programming grid display. Random "shuffle" play. Variable length fade. Automatic song selection to fit any length of tape. Even index programming for classical CD's.

Plus our proprietary Soft EQ circuitry which compensates for variables in spacial (L-R) information and midrange equalization found in many CD's mastered from analog tapes.

BRING YOUR TWO BEST CRITICS TO A CARVER DEALER.

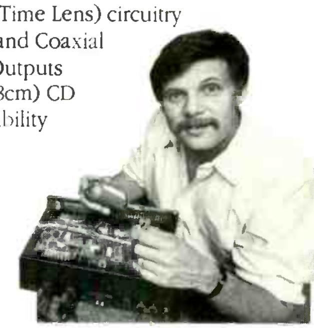
It's tempting to further regale you with how well we think the SD/A-490t's tubes and Single Bit circuitry improve the sound of a compact disc. But your own ears should be the final arbiter of quality.

Thus you are invited to bring a few familiar compact discs down to your local Carver dealer and compare for yourself, hopefully creating your own superlatives in the process.

Suffice it to say that almost all critical listeners not only are able to hear a difference, but prefer the sound of the remarkably affordable SD/A-490t's dual triode transfer function.

THE SD/A-490t

- Dual 6DJ8 Vacuum Tube Output Stage
- Over-sized Disc Stabilizer Transport
- 24-Track Programming with 21-key front panel & remote input
- Music Calendar Display
- Indexing
- Random Play
- Motorized Volume Control
- Time Edit/Fade Taping Feature with user-variable time parameters
- 2 to 10 Second Variable Length Fade
- Exclusive Carver Soft EQ (Digital Time Lens) circuitry
- Optical and Coaxial
- Digital Outputs
- 3-Inch (8cm) CD Compatibility



Bob Carver

CARVER

CARVER CORP., LYNNWOOD, WA, U.S.A.
Call 1-800-443-CAVR for information and dealer listings.

*A device which neither amplifies nor attenuates a signal is said to have unity gain. In other words, what goes in comes out unchanged. Or does it?

**Remote control variable output is a wonderfully convenient feature, but it would be pointless to eliminate solid state circuitry in the buffer amp stage and then use a solid state circuit for the final gain attenuator. So the SD/A-490t changes volume the old fashioned, physical way: a nice, clean carbon potentiometer, in this case, physically rotated by a small motor.

***Source: 1990 Audio Magazine Annual Equipment Directory.

JOHN EARGLE

A MAN OF HONORS

Photograph: David Hamsley

There is no question that the exquisite musical and technical collaboration between Robert Shaw and Telarc Records has, over the last decade and a half, produced such an extraordinary orchestral/choral discography that it is unmatched in the annals of commercial recording. Now, while I realize this may seem a bold statement, it is bolstered by the sheer number and consistency of the recordings and by the high standards that Shaw has always set for himself.

As I write this, Shaw is approaching his 76th birthday, and last December he received a Kennedy Center Honor, which came as a fitting tribute for a lifetime of achievement in a truly estimable career. That career began in the '40s, as Shaw "prepared" choruses for such famed conductors as Arturo Toscanini and Bruno Walter. In 1949, the Robert Shaw Chorale was organized and came to enjoy a reputation as America's premier touring choral ensemble until it was disbanded in 1966. Shaw had worked closely with George Szell in Cleveland for 11 years prior to accepting the post as music director for the Atlanta Symphony Orchestra and Chorus in 1967.

As have all major choral conductors, Shaw has always achieved a sonic texture and style of his own. In texture, he emphasizes blend and cohesion; no voice ever obtrudes. Technical execution is superb, and even in the midst of polyphony the diction is always clear. In style, Shaw approaches all periods idiomatically, but without any radical departure from his own personal basic sense of what a large chorus should be. In an age in which most record companies have espoused early performance practice in baroque works, Shaw's traditional approach may seem anachronistic. Would that more of the early music specialists spent as much time as Shaw on precision and details.

Whatever the period, the Telarc recordings all benefit from Jack Renner's sensible engineering and Robert Woods' expert production. And it is a further credit both to Shaw and Telarc that they have never stinted in their choice of soloists.

The collaboration with Telarc began in 1978 with a recording of the Stravinsky *Firebird* suite (1919), backed up with Borodin's Overture and Polovtsian Dances from *Prince Igor*. The choral portion in the Dances is almost insignificant (and is often omitted), but the *Firebird* became a landmark audiophile LP during the late '70s. Other works that followed included Carl Orff's Carmina Burana, Handel's Messiah, and Robert Russell Bennett's *The Many Moods of Christmas*. By the mid-'80s the release pace at Telarc had quickened, and by the end of 1991 there were 20 CDs in the series. Two additional discs of the Robert Shaw Festival Singers, recorded in France, have been released as well. Many of the Atlanta Symphony Orchestra and Chorus recordings were made possible by a grant from the Fulton County Arts Council, a division of the Fulton County (Georgia) government.

The Atlanta recordings take place in the city's Symphony Hall. Jack Renner describes the stage as quite large, and the orchestra shell sections can be moved to increase the space to the sides, to the back, and overhead. The chorus is placed on risers behind the orchestra. The intent in moving the orchestra shell sections is to provide as much space around the chorus as possible. This minimizes reflections (and cancellations) that might cause

Robert Shaw Discography

In addition to the four discs discussed in the text, Telarc has issued the following CDs with Robert Shaw leading the Atlanta Symphony Orchestra and Chorus:

Stravinsky: *Firebird* Suite; Borodin: Overture and Polovtsian Dances from *Prince Igor* (CD-80039)
Orff: Carmina Burana (CD-80056)
The Many Moods of Christmas, arranged by Robert Russell Bennett (CD-80087)
Brahms: Ein Deutsches Requiem (CD-80092)
Handel: Messiah (CD-80093-2CD)
Berlioz: Requiem; Bioto: Prologue to *Mefistofele*; Verdi: Te Deum (CD-80109-2CD)
Choral Masterpieces (CD-80119)
Mozart: Requiem (CD-80128)
Beethoven: Missa Solemnis; Mozart: Great Mass in C Minor (CD-80150)
Verdi: Requiem and Operatic Choruses (CD-80152-2CD)
Britten: War Requiem (CD-80157-2CD)
Brahms: Alto Rhapsody; Gesang der Parzen; Nänie; Schicksalslied (CD-80176)
Vivaldi: Gloria; Bach: Magnificat (CD-80194)
Schubert: Masses 2 and 6 (CD-80212)
Bach: Mass in B Minor (CD-80233-2CD)
Beethoven: Mass in C; Elegiac Song; "Calm Sea and Prosperous Voyage" (CD-80248)
Verdi: Quattro Pezzi Sacri; Stravinsky: "Symphony of Psalms" (CD-80254)
Mahler: Symphony No. 8 in E Flat, "Symphony of a Thousand" (CD-80267)

The following are with the Robert Shaw Festival Singers:

Rachmaninoff: Vespers (CD-80172)
Poulenc: Mass in G Major; other works (CD-80236)

In this age of early performance practices, Shaw's approach may seem anachronistic, but it is precise and detailed.

coloration and also helps blend the choral sound with that of the orchestra. The chorus is miked separately from the orchestra, as are any soloists.

If necessary, acoustical changes are made in the house. This technique first became apparent to me in the Berlioz Requiem, where the hall seemed to have taken on a significant increase in reverberation time. This was accomplished by laying down sections of plywood over the absorptive seating in the house.

The following are brief comments on a few of my favorite 20th-century works:

Walton: "Belshazzar's Feast" (CD-80181). The problems in performing and recording this 1930s oratorio arise from the sheer difficulty for all forces involved and from the rich orchestration, which includes two brass bands and an expanded percussion section. The only thing missing in this performance is the optional organ part. The declamatory baritone solo part that connects the major sections of the work is superbly sung by William Stone. The engineering is first-rate, with ideal balances throughout and precise stereo imaging. (Of all the "Belshazzar" recordings, it should come as no surprise that the top three were all conducted by choral specialists—Robert Shaw, Roger Wagner, and David Willcocks.)

Fauré and Duruflé: Requiems (CD-80135). I believe this is the only coupling of these kindred works. They are at the "quiet" end of the requiem scale, far removed from the apocalyptic tone of Verdi and Berlioz. Both works make use of organ and limited instrumentation and were primarily written for liturgical use. They are unmistakably French, and both bear the same mystical imprint. Soloists in the Fauré are Judith Blegen and James Morris.

Janáček: Glagolitic Mass (CD-80287). This stark work is a setting of the Old Church Slavonic text to the Mass. It is written in the typical fragmentary and motivistic style of Janáček, in which the text literally shapes the musical line. The soloists are Christine Brewer, Marietta Simpson, Karl Dent, and Roger Roloff.

Hindemith: "When Lilacs Last in the Dooryard Bloom'd" (CD-80132). This haunting work is a secular requiem based on a text by Walt Whitman about the death of Abraham Lincoln. It was commissioned by Robert Shaw in 1946 on the sad occasion of Franklin Delano Roosevelt's death. Obviously, the work has great personal meaning to Shaw, and the recording stands as well as a tribute to its soprano soloist, the late Jan DeGaetani. William Stone is the baritone soloist.

The work goes on. Although Shaw retired from the helm of the Atlanta Symphony after 21 years, he remains Music Director Emeritus and Conductor Laureate and maintains an active recording schedule with Telarc. 🅐

Season tickets for a lifetime.

The season begins tonight. In the comfort of your own home. No parking hassles. No babysitter. No annoyances from the guy in the row behind you.

With the D400 stereo power amplifier coupled to your speakers, your favorite performers will be right there with you, as you've never heard them before. Palpable. Holographic. Immediate. With the most explosive dynamics heard outside of a concert hall.

Simply put, the D400 will transport you. Thanks to the enormous reserves of musical power lurking within the D400's classic, understated exterior. And to sophisticated leading-edge circuitry that focuses and clarifies instrumental timbres as only a great seat or the finest tube amplifier could do before. Without maintenance.

So, why not enjoy the best seats in the house? Your house, every night of the year. Audition the D400 soon at your nearest Audio Research retail specialist.

audio research

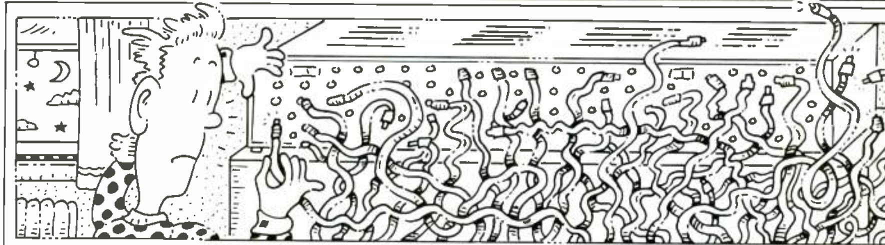
HIGH DEFINITION®

5740 Green Circle Drive / Minnetonka, Minnesota 55343-4424 / Phone: 612-939-0600 FAX: 612-939-0604

Enter No. 4 on Reader Service Card

IVAN BERGER

PLAYING JACKS



Hooking Up for Digital

The first home digital components, CD players, had trios of RCA phono jacks on their back panels—a pair for analog and one for digital, with the latter following the SP-DIF Standard. By the time other digital components, such as outboard D/A converters, signal processors, and DAT recorders came along, fiber-optic digital connections using Toslink connectors were becoming common too. Professional digital equipment usually has AES/EBU connectors. And now some home audio equipment sports "AT&T" fiber-optic connections, which are totally incompatible with the more common Toslink type. (The AT&T system uses light of shorter wavelengths.)

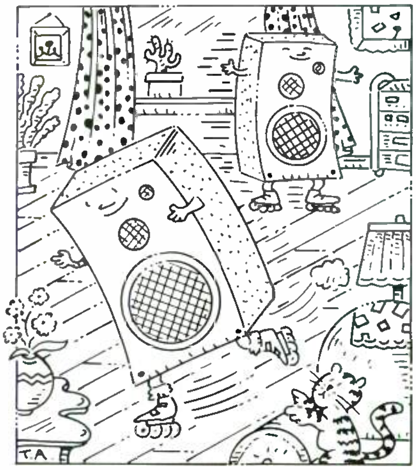
Feeding a CD player into an outboard D/A converter or a DAT recorder is no problem; it's not difficult to find a pair of digital components that have matching hookup facilities. But what of the future, when home systems will be almost entirely digital? A modest control center with one tape loop, five other inputs, and one output for an amp requires eight sets of connectors for every type of signal interface. In a pure analog system, that's 16 jacks, but a purely digital system with all possible current interfaces would require 32 connectors—48, if it's to handle analog as well. Systems with more inputs and video switching (which already requires both S-video and composite jacks) would be even more complex. Should that happen, say goodbye to elegant, slim-line preamps unless they're connected to bulky boxes whose sole job is to hold and switch between the various jacks.

For that reason, Goldmund and Meta Research, both of Switzerland, have called on makers of high-end digital hardware to agree on some single interconnection standard—*any* standard, as long as it's universally agreed upon and meets the performance and quality requirements of high-end manufacturers. This does not mean, however, that it will be identical to whatever standards prevail in lower priced home digital equipment; performance should come first, says Michel Reverchon, president of the two companies.

Illustrations: Teresa Anderko

Easing the "Ummph!"

Many speakers that sound best when placed a few feet from the walls wind up in rooms where such placement blocks the traffic pattern. If the speakers are heavy, moving them back and forth can be awkward to impossible. Casters, such as those found on some of the larger Ohm Walsh speakers, ease the job, but there are those who feel that speakers should be anchored solidly to the floor during listening sessions. I can think of two solutions, one from typing tables and one from an old refrigerator.



The office-furniture solution would be retractable casters in the speaker base, with a pedal to lower the casters into operating position. Lowering the casters requires raising the speaker at least ½ inch, so heavy speakers would require a pedal mechanism with some sort of mechanical advantage, like a car's jack. I've seen refrigerators that solve the problem less expensively, with a base that's reasonably airtight except for a round hole the size of a vacuum-cleaner hose. To move the refrigerator, you plug your vacuum's hose between the cleaner's output and the hole in the base, then glide the fridge away on a cushion of air.

For Your Dining Pleasure

Restaurants are often divided into smoking and nonsmoking sections. In San Francisco, *Audio* contributor Christopher Greenleaf saw a restaurant divided another way: With and without background music.

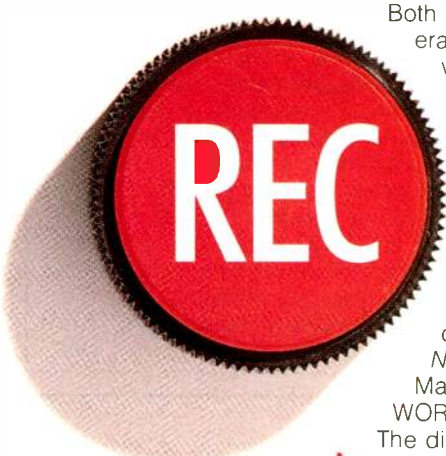
Terminology Trouble

The tie-in with CD that led to the belated rise of the laser videodisc has also led to one widespread example of terminological inexactitude. Until very recently, a "multi-disc" player was, understandably, one which could hold a multitude of discs at once—in other words, a changer. Now the term is being used by virtually every manufacturer of laser videodisc players to signify a player that can hold just one disc at a time, but can handle discs of several sizes and formats. It's probably too late to call such players "multi-format," but it would have saved a bit of confusion.

RECORDABLE CD promises

Michael B. Martin

Since the announcement of the Compact Disc in 1980, it has been reasonable to suppose that a CD system for recording by the consumer is under development and that sooner or later a recorder would appear on the market. However, 11 years have passed without the appearance of a completely satisfactory system. In recent years several technical papers on the subject have been published, news releases about research activity have been issued, and prototype digital audio disc (DAD) recorders have been exhibited at trade shows and reviewed by magazines. At the February 1991 Audio Engineering Society Convention in Paris, DAD recorders for professional applications were exhibited by START Lab/ Sony, Kenwood, and Yamaha from Japan as well as by Thomson and Studer from Europe.



Both erasable magneto-optical and non-erasable write-once (WORM) systems were represented but at prices beyond the normal consumer range. For example, the Studer cost from $10,000 to $11,000, while the Yamaha was about $17,500 for the recorder plus $4,750 for a controller handling up to seven recorders. The Studer and the Yamaha produce nonerasable recordings that are claimed to be fully compatible with CD players. (*Editor's Note:* We published a review of the Marantz CDR-1, a $7,000 professional WORM recorder, in the March 1992 issue. The discs it records cannot be erased but they can be used in regular Compact Disc players.)

All commercially produced Compact Discs and CD players are made to standards defined by Philips and Sony, who hold the master patents. This allows them to control the licensing of other makers of CD-Audio, CD-ROM, CD-I, and CD-V and to control the licensing of makers of recorders and recording discs for all CD applications. The standards are defined in a series of five books supplied to licensees as part of a licensing procedure. Also, the CD standard is defined in the International Electrotechnical Commission (IEC) Standard BNN15-83-095, "Compact Disc Digital Audio System." The Philips/ Sony books are identified by the color of their covers: The Red Book is for CD-Audio, the Yellow Book for CD-ROM, the Green Book for CD-I, Orange Book 1 for CDR-Write/Erase or CD-MO, and Orange Book 2 for CDR-WORM.

A reasonable assumption is that a disc that can be recorded by the user should be capable of meeting the same playback standards as a commercial CD and that any standard CD player should be able to play the disc after it has been recorded. The ideal medium should also be capable of being erased and rerecorded many times. In reality, the development of a medium that meets these criteria has proved to be extraordinarily difficult, and none of the systems which have been demonstrated are capable of creating a recording that can be *erased* and that is *completely compatible* with CD standards.

Most of the major companies which design and manufacture recording hardware, companies which are active in data memory and companies which make recording media for consumers and data processing, have active programs aimed at developing recording media for optical playback. It has been estimated that more than 150 companies in the world are trying, or have tried, to solve the technical problems. Already the gross expenditure has been so great that it is doubtful whether the successful CD recording product will earn as much in its useful life; notwithstanding, success is likely to pay handsomely for the holders of the patent rights to the product technology chosen as the world standard.

CD playback standards do not apply to the use of optical discs in the data processing field other than CD-ROM. However, a high proportion of the scientific work on data processing media is applicable to blank audio discs, and it is probable that any successful consumer product will be a fallout from developments in data processing.

Photographs: David Harnsley

The Compatibility Factor

When embarking on the design and development of an audio recording system for the CD format, the question of compatibility and what this means are the first major issues to be faced. The obvious answer to the question is: To be compatible with CD, a recorded disc must be capable of playback on any standard CD player. In other words, the recorded disc must meet the same physical, optical, and digital encoding standards as a commercially produced CD. A review of the technologies by which an optical playback medium can be recorded shows quickly that the issue of playback compatibility with CDs is not simple. This article will consider compatibility at the following levels:

- Backward compatibility with all existing players and compatibility with all future players;
- Partial backward compatibility with existing players that have certain specific features;
- Forward compatibility with a modified CD playback standard, and
- Forward compatibility with a hybrid playback system.

In order to be fully compatible, a recordable Compact Disc (CDR) must conform to the dimensions given in Table I and Fig. 1, and it must meet the optical requirements given in Table II. After the disc is recorded, its recorded information must have the characteristics given in Table III, and the recorded data must be compatible both with single-beam (push-pull) and with three-beam tracking systems. CD players use the binary musical information on a commercial disc to guide the playback laser head. Because the CD is read from the substrate side, the laser "sees" the data pits in the reflective surface through the substrate as a series of bumps that create a reduction in the reflected light. This reduction is caused by interference between the incident and reflected beams because the depth of the pits is one-quarter of the wavelength of the playback laser beam in polycarbonate. (See Fig. 2.) If the playback laser were to be presented with the "dimples" instead of "pimples" (that is, an information surface deformed in the opposite direction to that of a commercial CD), the half-wavelength interference would still take place and the information would be read correctly. The same situation exists with a three-beam tracking system as with the musical information, so the player would still track pits or bumps correctly; however, a push-pull single-beam tracking system depends on the phase of the tracking signals. As a result of this phase dependency, if

Michael B. Martin is a retired electroacoustics engineer who spent approximately half of his 40-year career designing consumer and professional recorders (analog and digital) and the other half in the field of magnetic recording tape. The last three years of his career were devoted to optical recording.

& problems

Part I

Table I—Physical dimensions of the Compact Disc.

Disc Diameter: 12 cm (4.72 inches).
Disc Thickness: 1.1 to 1.3 mm.
Disc Flatness: ±0.6° (0.5 mm at rim).
Diameter of Center Hole: 14.95 to 15.05 mm.
Recording Diameter: Minimum, 46 mm (1.81 inches); maximum, 117 mm (4.61 inches).
Program Diameter: Minimum, 50 mm (1.97 inches); maximum, 116 mm (4.566 inches).
Diameter of Lead-In Area: 46 to 50 mm.
Diameter of Lead-Out Area: 116 to 117 mm.
Substrate Material: Any transparent material meeting the optical spec.

NOT ONE SYSTEM DEMONSTRATED SO FAR HAS BEEN ABLE TO MAKE RECORDINGS THAT ARE ERASABLE *AND* FULLY COMPATIBLE WITH CD STANDARDS.

Table II—Optical system of the Compact Disc.

Wavelength of Standard Laser: In air, 780 nm (7,800 angstroms); in substrate, 500 nm (5,000 angstroms).
Focal Depth: ±2 μm.
Substrate: Refractive index, 1.55 at 780 nm; birefringence, <100-nm deviation from 500-nm wavelength.
Reflectance of Metal Layer: 70% to 90% at 500 nm.

Table III—Signal format of the Compact Disc.

Number of Channels: At normal speed, two; at twice normal speed, four.
Quantization: 16 bit linear, concurrent on all channels.
Sampling Frequency: 44.1 kHz.
Channel Bit Rate: 4.3218 megabits/S.
Data Bit Rate: 2.0338 megabits/S.
Data-to-Channel Bit Ratio: 8 to 17.
Error-Correction Code: CIRC, with 25% redundancy.
Modulation System: EFM.
Recorded Track: Spiral, inside to outside.
Track Pitch: 1.6 μm.
Rotation at Constant Linear Velocity (Variable rpm): 1.2 to 1.4 m/S.
Minimum Pit Length: At 1.2 m/S, 0.833 μm; at 1.4 m/S, 0.972 μm.
Maximum Pit Length: At 1.2 m/S, 3.05 μm; at 1.4 m/S, 3.56 μm.
Pit Depth: 110 to 130 nm.
Pit Width: Approximately 0.5 μm.

surface deformities were to be seen as pits and not bumps, the playback laser would track on the "land" between the data and miss the recorded information. This could be handled by a new generation of players having single-beam tracking and a switch to invert the "phase" of the tracking servo when playing CDRs—or the problem could be handled by abandoning push-pull tracking systems for CD players. This is an example of partial backwards compatibility.

The CD standard calls for the disc to have a minimum reflectance of 70%. Some of the disc technologies in development will make it difficult to achieve this comparatively high ratio of reflected-to-incident light, although 30% reflectance is readily obtained. Fortunately, the modern laser playback system can be designed to function very reliably with reflectance figures in the 20% to 30% range; this makes a realistic proposition of forward compatibility for CD players designed to accept a lower percentage of reflectance than the present standard of 70%.

Strictly speaking, a CDR that needs a hybrid playback is not a blank CD because the technology used to read the recorded disc is not the familiar optical cancellation system; a separate playback optical system is required. The best-known example of hybrid playback occurs with magneto-optical (MO) discs; a second example is the electron trapping technology (ETT) proposed by Quantex Corp. For any noncompatible blank recording disc system to be fully successful as a commercial product, the majority of the manufacturers of CD players must agree to make players that can accommodate the system, and Philips and Sony must license the use of eight-to-fourteen modulation (EFM) encoding. Without the occurrence of these two things, the DAD system will be in direct competition with DAT and DCC; it will have the advantage of rapid random access but the probable disadvantage of higher cost.

The Importance of Erasure

Several decades of consumer familiarity with magnetic recording have made the ability to erase and record again a near essential for any type of recording medium. Magnetic media can be erased an infinite number of times without loss of medium life and with no reduction in performance when recorded again. Erasure as a property of the magnetic system was not one of the principal reasons for the system's original introduction and widespread use; it was merely a useful attribute that came with the territory. Nevertheless, the freedom to erase and overwrite has been designed into all existing audio, video, and data recording systems. Life without erasing is difficult to contemplate.

The need for simple erasure is a significant problem for researchers in their quest for a medium to be used in a CD recording system. Erasable media are being researched that cover the gamut in terms of cost, new technology, and new materials. The software architecture of most data processing applications requires that at least one million erasures be possible. Fortunately, the needs of a consumer entertainment application are not as severe; the ability to erase a thousand times is usually considered adequate. (In practice it is doubtful whether more than 5% to 10% of cassettes in use today, audio or video, are erased even 100 times.) Although the ability to erase and record again is very important to both the amateur and the professional, nonerasable Write Once, Read Many (WORM) media have been developed, and systems based on them have reached the market.

WORM media present additional challenges to the designers of recorders, particularly if the recorded disc is to be compatible or partially compatible with CD. The CD standard specifies a directory or lead-in at the beginning of a recording, and the first few seconds of all CDs tell the playing equipment the number and duration of all selections on the disc and the total duration of the recording. The directory is recorded in the lead-in area shown in Fig. 1. When a CD is inserted into the player, the directory is read and the information is stored in the player's memory. If the player does not find a directory at the start of a disc, it will not operate. A CD recorder must be able to create a directory if the disc is to be used in a CD player. Similarly, lead-out information is necessary at the end of a disc to tell the player to shut down. A full discussion of all the ramifications associated with nonerasable media is beyond the scope of this article, but a few points should be made:

- Making a copy of a complete CD is relatively simple, because with special playback electronics all directory and index information can be copied from the disc.
- Adding more "tracks" to a partially recorded disc, and updating its directory, is difficult. (Note: It is reported that some makers have solved this problem.)
- When a mistake is made during recording, an expensive blank disc may be wasted.
- Making a test recording probably means that a disc must be committed to the test.

Competing Technologies

The systems to be considered here are based on media which use one of the following technologies: Magneto-optical, phase change, or dye polymer. In addition to significant problems with materials, manufacturing technique, and fragility of the finished product, each of these technologies has a major drawback associated with either CD com-

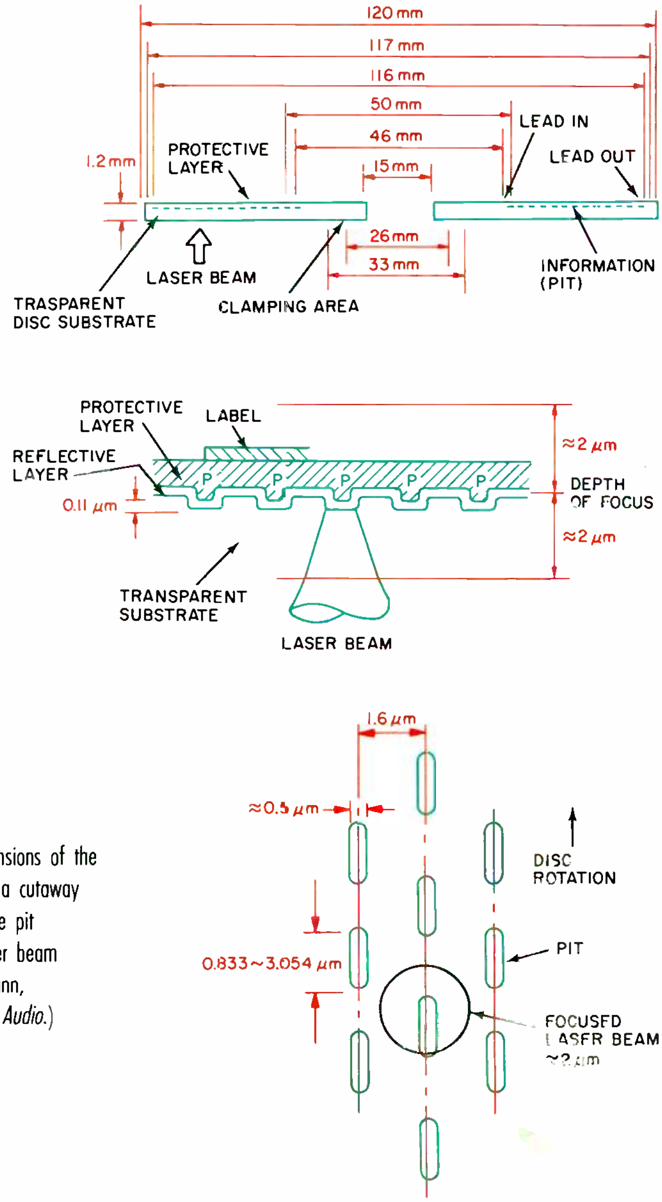


Fig. 1—Basic dimensions of the Compact Disc, with a cutaway drawing showing the pit structure and a laser beam track. (After Pohlmann, *Principles of Digital Audio.*)

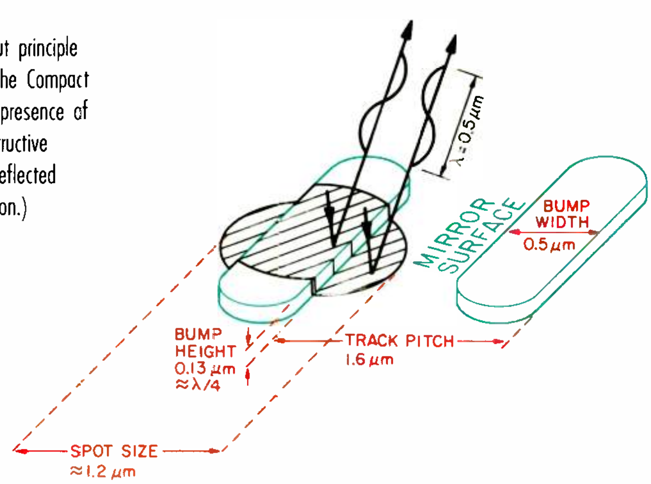


Fig. 2—The readout principle and dimensions of the Compact Disc. Note that the presence of a bump causes destructive interference in the reflected light. (After Watkinson.)

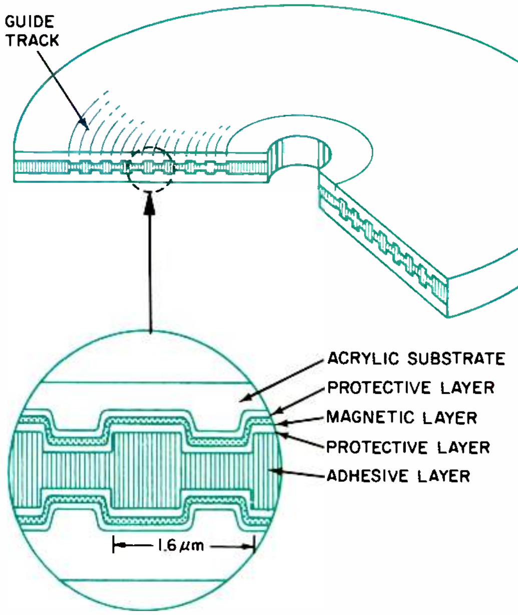


Fig. 3—A cutaway drawing of a magneto-optical disc. (After Pohlmann, *Principles. . .*)

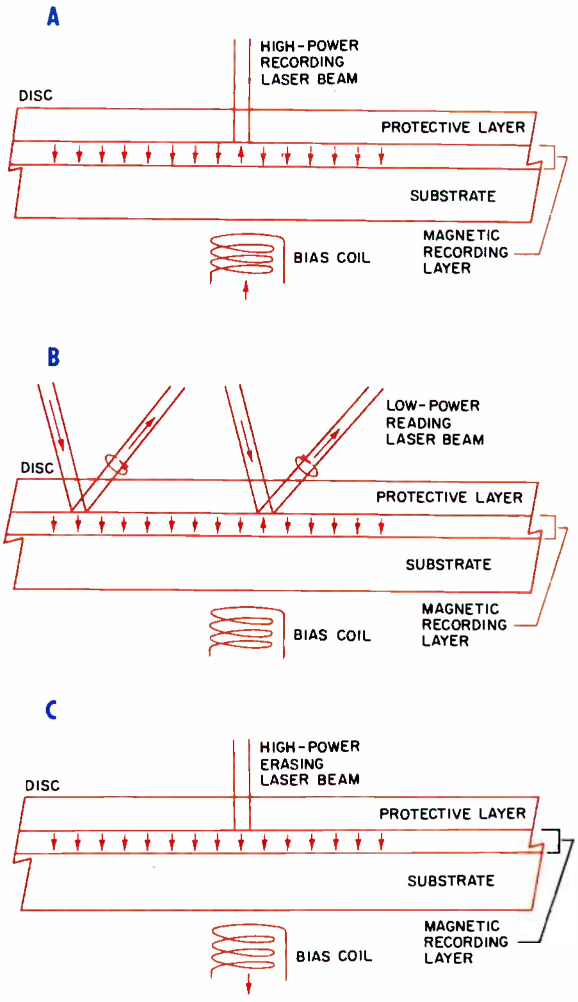


Fig. 4—Magneto-optical recording principles: A laser beam heats the medium while magnetic recording is induced by the bias coil (A); data is read by shining a laser beam on the surface and observing the rotation in the plane of polarization of the reflected light (B), and data is erased by heating the medium and reversing the bias field (C). (After Pohlmann, *Principles. . .*)

patibility, erasure, or both. An MO recording requires a sophisticated playback head that bears little relation to the laser head of a normal CD player. Dye-polymer recordings cannot be erased, are limited in the number of erasures which can be made before the medium fails, or have limited compatibility with the CD standard. Phase-change media need a playback system with a higher sensitivity than standard, and some changes in phase are not reversible and do not permit erasure. I will not be discussing the Quantex electron trapping technology because the medium needs a low-power blue laser for playback. Semiconductor laser diodes that emit a blue beam will not be available for several years, so the system has not been demonstrated.

The magneto-optical approach to the problem of developing a consumer CDR system is the only one known to have the property of infinite erasure and overwrite capability. This makes it very attractive to the data processing community, which is not concerned with CD compatibility. The MO discs are comparatively expensive to make and can be fragile during use and in transit. Figure 3 shows a typical structure of an MO disc. Magneto-optical recording is not optical recording in the strict sense; a more correct description is heat-assisted magnetic recording. Full compatibility with CD is impossible, and the systems that have been announced and demonstrated are only forward compatible in that they use EFM encoding for the audio. The use of EFM permits an MO recording to be played back and decoded by the standard electronics of a CD playback chain. It also brings MO under the umbrella of the Philips/Sony patents.

Magneto-optical recording depends on a phenomenon known as the Curie effect. A thermomagnetic property of all magnetic materials is that when they are heated above a certain temperature, they become nonmagnetic; this temperature is the Curie point of the particular material. If a material at a temperature above its Curie point is cooled in the presence of a magnetic field, it becomes magnetized to saturation in the same direction as the applied field and remains magnetized until it is reheated in a neutral magnetic field or is exposed to an erasing field of sufficient strength.

An MO disc is coated with a thin layer of material that has a comparatively low Curie point. Compounds of rare earths, such as terbium and gadolinium alloyed with iron and bismuth, have been used and can be very expensive. To make a recording, the disc is rotated in a constant magnetic field that is perpendicular to the disc surface. (See Fig. 4A.) The field will not be strong enough to magnetize the coating unless the surface temperature is raised above the Curie point.

The beam of a laser diode is focused to the smallest possible spot at the active layer of the disc, and the heat generated by the energy concentrated in the light spot raises the temperature of the magnetic material above the Curie point. As the disc rotates and the laser is turned off, the hot spot cools (passing the Curie point), and the magnetic layer is magnetized locally throughout its depth. Thus, by modulating the laser, a perpendicularly polarized magnetic recording is created. When a single magneto-optic layer is used in conjunction with a modulated laser, the recording of new information must be preceded by a separate erase step. (See Fig. 4C.) Normally this will require a delay of one revolution of the disc, during which erasure is achieved by unidirectional magnetization of a track before rerecording. One method of overcoming this disadvantage is the use of complex magnetic layers. A proposed method of achieving overwriting (one-step rerecording) is to use a field-controlling magnetic layer as the bottom coating on the disc and depositing the magneto-optic memory layer on top of it. A second method, used in the Thomson recorder, modulates the magnetic field with the signal and heats the MO layer with a laser of constant intensity for both recording and erasure, thus making an overwriting action possible.

Diffraction within a light beam puts a lower limit on the diameter of the spot to which the beam can be focused. Because diffraction is a function of the wavelength of light, short-wavelength laser beams can be focused to smaller spots than can long-wavelength laser beams. However, the size of a diffraction-limited spot achievable with practical laser diodes results in magnetization of a much smaller area than is possible with any conventional magnetic head. As a result, MO discs are capable of data densities several orders of magnitude greater than those realized with either longitudinal or vertical magnetic systems. Typical laser diodes used for recording emit in the near infrared and have wavelengths of 780 to 840 nanometers (nm). Visible-red diodes with a wavelength of about 640 nm will be used in the near future. They will permit a smaller spot than do the near-IR diodes, which will make it possible to record higher data densities. Red laser diodes are available now, but as yet the beam quality of production diodes is not good enough for precision recording; precision diodes are in the laboratories of several semiconductor makers.

Playback of an MO disc makes use of a phenomenon known as the polar Kerr effect, which is a rotation of the plane of polarization of light due to a magnetic field. The direction of rotation of the plane depends on the direction of the magnetization of the layer. To read an MO disc recorded with digital information, a polarized laser beam is focused onto the information track, and the angle between the polarization plane of the reflected beam and the polarization plane of the incident beam is detected. As the incident beam passes each magnetic reversal, the polarization plane of the reflected beam will flip from one side of the plane of polarization of the impinging beam to the other. Detection of this angular shift makes it possible to read the recorded information. The power of the laser used for reading the information is low and does not heat the recorded layer, which ensures that the playback operation has no influence on the recorded information. Because the magnitude of the Kerr rotation is minuscule (usually less than 0.5°), a sophisticated optical playback head is necessary to achieve a satisfactory signal-to-noise ratio.

Another difficulty is that compounds magnetically suited to MO applications tend to corrode very rapidly in air. To protect the active layer from corrosion, either a disc is coated with an impervious layer or an hermetically sealed cavity construction is used. Either method of protection may result in a disc thicker than the maximum of 1.3 mm in the CD specification, though this may be unimportant with a forward-compatible system. A pinhole can easily be made in a thin protective layer, thus making a point where corrosion can start. The cavity in a sandwich disc may be mechanically susceptible to a reduction in external air pressure, so shipping magneto-optical discs via airfreight might be a problem if the airplane hold is not adequately pressurized.

In Part II of this article, I will discuss two other competing technologies (phase change and dye polymer), the interrelationship of CDR hardware and software, and recorder tracking.

Bibliography

For further information, the following books are recommended. They were of great assistance to me in the preparation of this article and are very valuable for the extensive reference bibliographies given in each.—*M.B.M.*

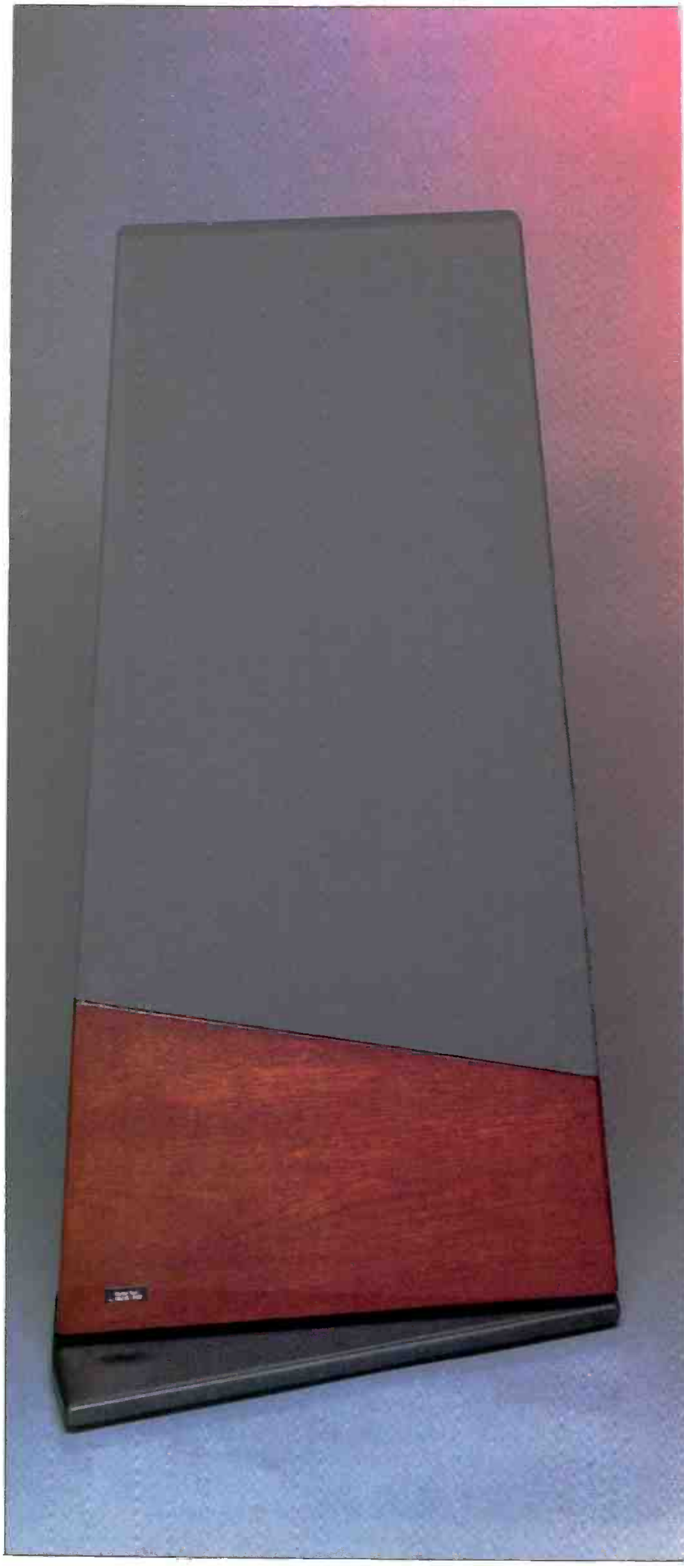
1. Pohlmann, Ken C., *Principles of Digital Audio, Second Edition*, Howard W. Sams & Co. (Indianapolis, Ind., 1989).
2. Pohlmann, Ken C., *The Compact Disc: A Handbook of Theory and Use*, A-R Editions (Madison, Wisc., 1989).
3. Watkinson, John, *The Art of Digital Audio*, Focal Press (London, England and Boston, Mass., 1988).
4. Mee, C. Denis and Eric D. Daniel, editors, *Magnetic Recording, Volume III: Video, Audio, and Instrumentation Recording*, Chapter 6, "Magneto optical Recording" by Dan S. Bloomberg and G. A. Neville Connell, McGraw-Hill (New York, N.Y., 1987).

IN THEIR QUEST FOR A MEDIUM TO BE USED IN CD RECORDING SYSTEMS, RESEARCHERS HAVE FOUND SIMPLE ERASURE TO BE QUITE A SIGNIFICANT CHALLENGE.

A NEW TYPE

A SPHERE

MORAY CAMPBELL AND SCOTT ROBINSON



The word "loudspeaker" means very different things to different people. To some, it connotes a small box that can be neatly placed on a shelf or side table. To others, the image is of a towering panel. A hi-fi buff with more esoteric tastes might picture an obtusely chiselled shape that more nearly resembles a sculptured work of art.

Each of these mental images is accurate. Loudspeaker designers have used all of these approaches in making systems that change the signal voltages coming from the amplifier into sound waves that the ear can hear. When all is said and done, however, there are very few basic ways for a speaker system to operate—so when someone does come up with a new way to make a speaker work, it usually captures a good deal of general interest. Museatex Audio believes its Melior loudspeaker has indeed added some new wrinkles to design.

Despite the wide range of styles and methodologies in speaker design, there is still one mechanical principle common to almost all: The use of a simple piston motion by a rigid diaphragm to create air motion. Generally, speaker designers regard any deviation of the diaphragm from pistonic motion as distortion. Yet the Melior Point Source speakers deliberately avoid making the diaphragm behave as a simple piston.

While a piston is indeed an effective method of producing the sound pressure levels in the air that our ears require to perceive sound, it is also a mechanism that presents several fundamental physical limitations in the construction of a full-range speaker. If the diaphragm of a regular dynamic (cone-type) driver is to move as a piston, accurately following the motion of the voice-coil, it must be rigid, lightweight, and nonresonant. In order for this speaker to reproduce lower frequencies, the diaphragm must also be appropriately large. The problem is that there is always a trade-off between the size of a speaker's diaphragm and its weight or rigidity. A diaphragm large enough to reproduce lower frequencies and rigid enough to have low distortion will weigh too much to efficiently reproduce higher frequencies. On the other hand, a diaphragm that is rigid and light enough to operate efficiently at the faster speeds needed to reproduce higher frequencies will not be large enough to reproduce bass. Consequently, full-range dynamic loudspeaker systems must use separate drivers for different frequency

OF SPEAKER

OF SOUND

Moray Campbell is the design engineer who led the team that developed the Melior Point Source speaker for Museatex. Scott Robinson is a Canadian freelance writer and associated with Museatex.

ranges. This, in turn, requires a crossover network to distribute the workload among the drivers.

Several planar loudspeakers—some electrostatic, some magnetic—have been able to achieve an effective compromise between size and weight. These speakers are driven by forces that act evenly over the entire surface of their diaphragms, so rigidity is not much of a factor. This enables them to be large and lightweight enough to accurately reproduce the full frequency range without having to resort to separate drivers, although several of these speakers still make use of crossovers before their transformer stages. The problem with most planar speakers is that, above a certain frequency, the radiated energy begins to concentrate into an increasingly narrow angle directly in front of the speaker. This produces the effect known as treble beaming, where frequencies whose wavelength is shorter than the width of the diaphragm have very narrow dispersion. Such a beaming of certain frequencies requires listeners to sit in a specific "sweet spot" for best sound.

The theoretically ideal speaker has been discussed by designers for decades, and almost always the answer is a pulsating sphere. If a true pulsating sphere were built, it would behave as if the sound came from a tiny point source located at the center of the sphere. There would be perfect omnidirectional dispersion at all frequencies without any sort of beaming. Early attempts at building such a speaker have included designs using quarter spheres and cylinders.

The problem with a spherical speaker is that its curved diaphragm must pulsate by expanding and contracting over the entire surface. Such technology does not exist at present, with the exception of some gas plasma tweeters. Attempts at curved diaphragms have shown that it is difficult to construct a diaphragm that is sufficiently rigid to maintain a curved shape while remaining elastic enough to allow the surface to pulsate evenly. This is why existing curved designs have been forced to "borrow" from the elastic material at the edges of the diaphragm in order to allow the more rigid material at the center to pulsate. This can result in the edges of the diaphragm moving out of phase with the center at some frequencies.

Our design team thought that it might be possible to reproduce the hemispherical wavefront of a pulsating sphere from a flat diaphragm. Clearly, a simple piston action could not do this. The key was to imagine what a hemispherical wavefront would do if it passed through a thin, acoustically transparent diaphragm. As the curved wavefront expanded away from its point source toward the diaphragm (Fig. 1A), it would first contact the diaphragm at its center (Fig. 1B). The wavefront would pass through the diaphragm into the air on the other side, while the initial displacement of the diaphragm would expand across its surface to its edges (Fig. 1C), much as ripples on the surface of water.

Following this imaginary example, we designed a speaker that, instead of acting like a piston, operates by driving only a point at the center of a Mylar diaphragm which is fixed at the edges. The rest of the diaphragm is not directly driven, but follows naturally from the motion of the driven central section to create the desired ripple effect. (Compare this system, illustrated in Fig. 2, with the imaginary example shown in Fig. 1.)

Because of the natural time delay involved in the spread of energy across the diaphragm from the center, the sound pressure wavefront travelling through the air away from the speaker gets a head start at the center of the diaphragm and lags at the edges. This accumulated delay in the transmission of the wavefront across the diaphragm acts to curve the wavefront's edge as it moves into the air, providing a close approximation of the ideal spherically spreading wavefront at all frequencies. Of course, the dipolar nature of our flat diaphragm is able to produce only half of this spherical wavefront in constant phase. So our design complements the forward-moving hemispherical wavefront with a similar wavefront in reverse phase that travels away from the back of the speaker. This is very similar to the effect produced by the Quad ESL-63. While the Quad uses inductor delay lines for frequency shaping and time delays, the Museatex Point Source speaker produces the same effect by purely mechanical means, without delay lines, crossovers, frequency shaping, or other electronic processing.

Although the Melior diaphragm is made large enough to reproduce bass (much as the diaphragm of a conventional planar loudspeaker), it behaves as if it were the ideal small pulsating sphere. Our measurements show almost constant directivity over a 60° arc at all frequencies from 45 Hz to 8 kHz. (See the polar responses in Fig. 3.) Above and below these limits, the speaker's coverage begins to narrow. Thus, with careful design to keep the mass of the moving element low enough for high-frequency reproduction, a full-range speaker without treble beaming is possible.

To obtain a linear response over the audible frequency range (Fig. 4), it is necessary not only to keep the mass of the moving system as low as possible but also to keep coil inductance to a minimum in order to yield a relatively flat impedance characteristic. This results in a flat power response and, because there are no other components in the speaker circuit, a very easy amplifier load. Fortunately, a low-inductance coil is consistent with the requirement for low mass. We use a coil with an out-of-gap inductance of less than 0.1 mH and only 60 turns of copper-clad aluminum wire. The speaker's impedance curve (Fig. 5) therefore resembles a very gentle, classic single-coil plot, reaching a minimum of about 4.5 ohms in the midband and rising smoothly to less than 6 ohms at 20 kHz. The bass resonance is extremely well damped, with a rise to only 7.5 ohms.

The low-inductance format, together with the use of a Kapton former and the copper-clad aluminum wire, yields a total mass of 1.5 grams for the coil and the former. The complete motor assembly—including dust cap, tinsel connecting leads, and all adhesives—weighs only 2.2 grams. Our sensitivity rating is 85 dB at 1 meter with 2.83 V rms applied. Very little additional diaphragm or air mass is coupled to the motor, particularly at critical higher frequencies, as the travelling-wave operation of the speaker allows the centrally located motor to work independently of the outlying portions of the diaphragm.

The coil relies on the diaphragm itself for positioning relative to the magnet gap. No spider is used in the design, because spiders were found to contribute significant coloration to the sound. To prevent coil rubbing, we developed a "fluid bearing" within the magnet gap using a ferromagnetic fluid, and we believe this to be a unique

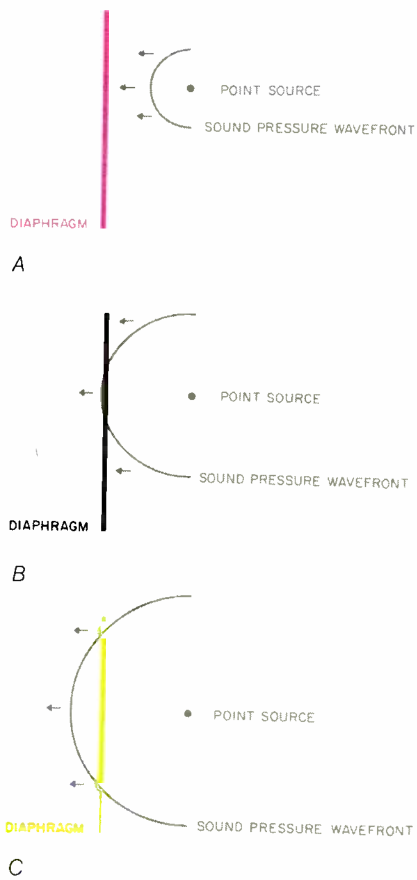


Fig. 1—Passage of a theoretical point source wavefront through a diaphragm. As the expanding wave nears the diaphragm (A), it first contacts the diaphragm's center (B), then passes through. During this passage, the displacement of the diaphragm expands in a ring around the initial contact point (C).

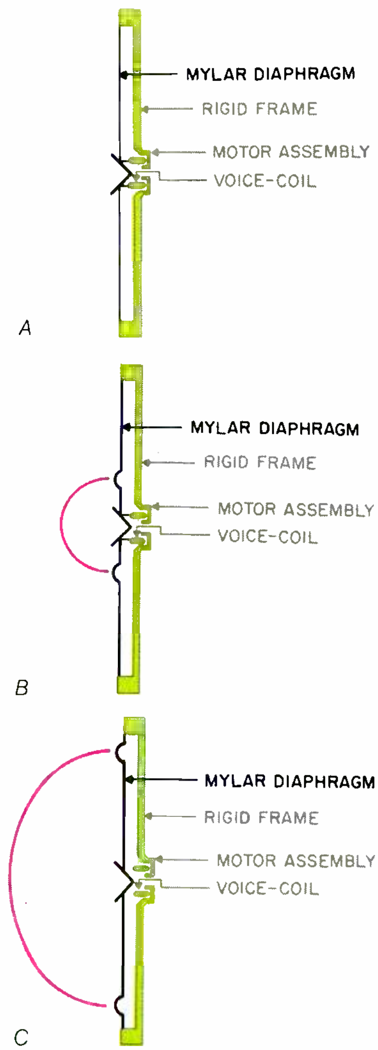


Fig. 2—Action of the Melior speaker. Diaphragm displacements caused by the voice-coil (A) spread in a ring as the resulting wavefront expands (B and C) Note similarity to Fig. 1.

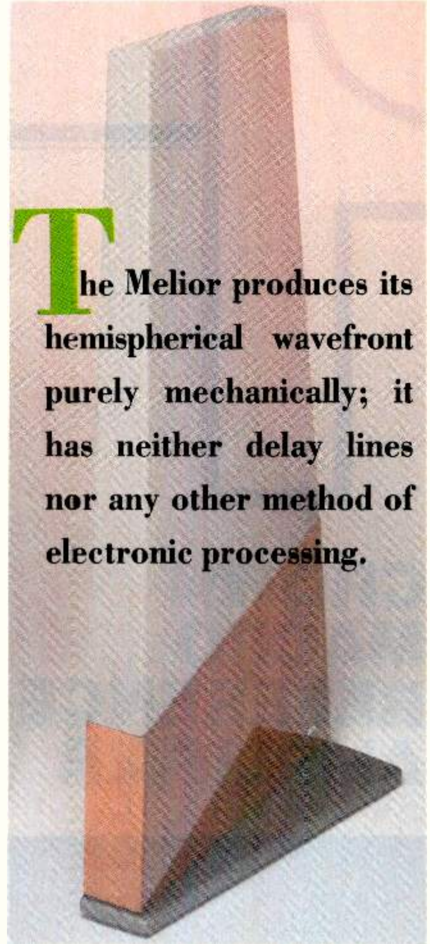
application in a bass driver. The ferromagnetic fluid also serves to increase the thermal capacity of the coil. Further thermal-protection measures include the use of a relatively long magnet gap, copper pole-piece sheaths, and damping rings. These items not only function as flux-damping mechanisms but also ensure that under heavy mid-band drive, when current is high but excursion relatively low, the entire coil has effective heat dissipation.

The damping rings and copper sheaths serve the traditional roles of reducing in-gap inductance and controlling high-frequency roll-off. They also reduce bass intermodulation caused by changes to inductance with position in the gap. Both of these techniques are well known in speaker design but are often not used because of their additional expense. Multi-way systems can use separate drivers to get around these problems, but we had no such choice and found these solutions proved to be effective.

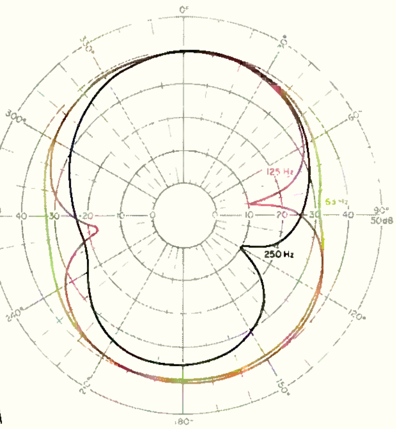
Since the diaphragm must be held under tension, the system resembles a drum, and it will generate tympanic resonant modes at certain frequencies if some form of damping is not applied. We experimented with several different approaches to damping as well as with methods of attenuating or spreading the frequencies at which resonance occurs. Ultimately, we decided against adding stiffeners or mass and against treating the diaphragm with any of the commercially available damping formulations. Instead, a damping system that makes use of resistive air loading was adopted.

The damping system operates in a similar way to that of a conventional box enclosure, providing an air load to the diaphragm that controls the Q of the tympanic modes. However, our system of resistive damping is positioned very close to the diaphragm, employing a nonwoven polyester fabric that is firmly supported by a plastic gridwork behind the diaphragm. (There is no damping layer in front of the diaphragm.) Despite its relatively complex construction, the damping layer still allows sound to pass, preserving the speaker's dipolar, double-hemisphere radiation. The system allows us to easily vary the degree of damping across the diaphragm in order to combat specific modes, making it possible to optimally tune the speaker for maximum bass extension while minimizing resonances. (This tuning process began with the basic idea that more damping would be required near the edges of the diaphragm, which are not directly driven.) Further experimentation resulted in critically damped diaphragms for several different-size speakers.

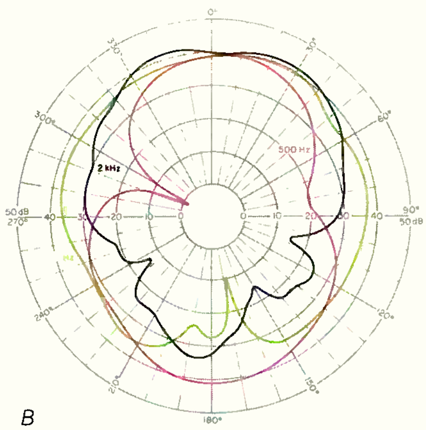
In addition to applying the principle to full-size, floor-standing speakers, our Melior One and Two, we have also used it in our in-wall and satellite models. Naturally, we will seek other applications.



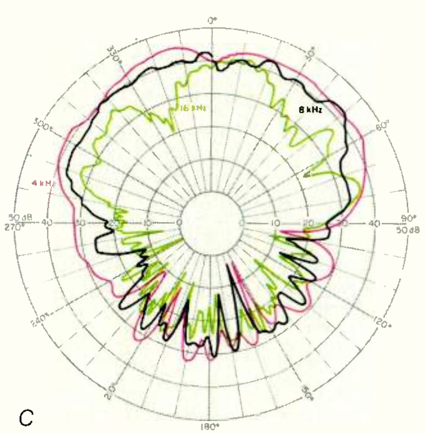
The Melior produces its hemispherical wavefront purely mechanically; it has neither delay lines nor any other method of electronic processing.



A



B



C

Fig. 3—The Melior speaker's polar response at low frequencies (A), middle frequencies (B), and high frequencies (C).

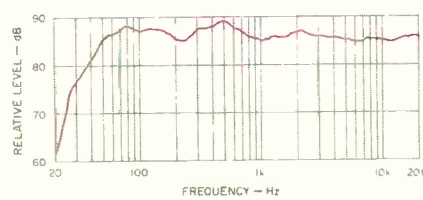


Fig. 4—Melior speaker's averaged in-room frequency response at 1 meter with 2.83-V input signal.

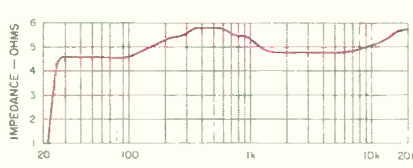


Fig. 5—Impedance vs. frequency.

CROWN MACRO REFERENCE AMPLIFIER

Manufacturer's Specifications

Power Output at 0.02% THD, Both Channels Driven: 760 watts/channel into 8 ohms, 1,160 watts/channel into 4 ohms, or 1,500 watts/channel into 2 ohms.

Power Bandwidth: 10 Hz to 25 kHz, +0, −1 dB; 4 Hz to 30 kHz, +0, −3 dB.

Frequency Response: 20 Hz to 20 kHz, ±0.1 dB, at 1 watt; overall bandwidth, 3 Hz to 100 kHz, ±1.5 dB.

S/N: 120 dB, A-weighted, below rated output, at 26-dB gain.

IM Distortion: 0.005% from 760 watts through 76 watts, increasing to 0.025% maximum at 0.076 watt, measured at 26-dB gain.

Damping Factor: From 10 to 200 Hz, greater than 20,000; at 1 kHz, 1,800.

Input Sensitivity: Selectable; 26-dB voltage gain or 0.775 V for full rated output.

Nominal Input Impedance: Balanced, 10 kilohms; unbalanced, 5 kilohms.

Power Requirements: 120 V, ±10%, 60 Hz; 70 watts or less at idle; 26 amps maximum for full rated 8-ohm output at 1 kHz.

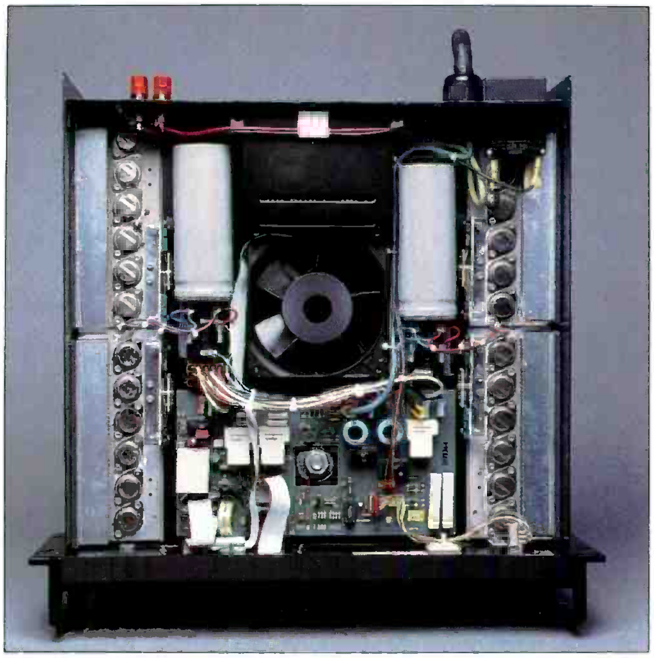
Dimensions: 19 in. W × 7 in. H × 18¾ in. D (48.3 cm × 17.8 cm × 47.6 cm); requires 16-in. (40.6-cm) depth behind mounting surface and projects 2¾ in. (7 cm) in front of surface.

Weight: 56½ lbs. (25.6 kg); center of gravity approximately 6 inches behind front mounting surface.

Price: Studio version, $3,500; Esoteric version, $3,995 (see text).

Company Address: 1718 West Mishawaka Rd., Elkhart, Ind. 46517.

For literature, circle No. 90



The Macro Reference is a relatively new amplifier from Crown International. Like a number of their other power amps, it is rated at an astonishingly high power output for its size—in this case, 760 watts per channel into 8-ohm loads! A close look reveals a number of very interesting features of this design. And, according to the very complete and informative owner's manual, "Great care has been taken with the routing of each wire, the layout of each circuit board, and the selection of each component. As a result, its sonic integrity is without peer."

The manual also talks about the amplifier's large dynamic range, 120 dB between its high power and low noise floor. Crown also talks about another very practical, real-world matter—dynamic stability, or the lack of spurious oscillations at very high frequencies. The manufacturer points out that quite a few solid-state amplifiers oscillate on parts of the audio signal cycle with some particular loads, and this can cause subtle intermodulation effects. The careful layout in this design is intended to prevent such mischief. A very high damping factor of 20,000 is specified and is said to result in killer bass. Also of note is the use of a tape-wound, low-noise toroidal power transformer with extremely high power density. This must be so if Crown can get this kind of power output from a nonswitching amplifier that weighs only 56½ pounds. Of course, the relatively light but quite thermally efficient heat-sinks help here.

An interesting feature is the Input-Output Comparator (IOC) distortion indicator. This circuit continuously compares the input to the output, and a front-panel indicator flashes if these signals differ by more than 0.05%. The Output Device Emulator Protection (ODEP) circuit is surely one of the most intelligent and comprehensive in the industry.

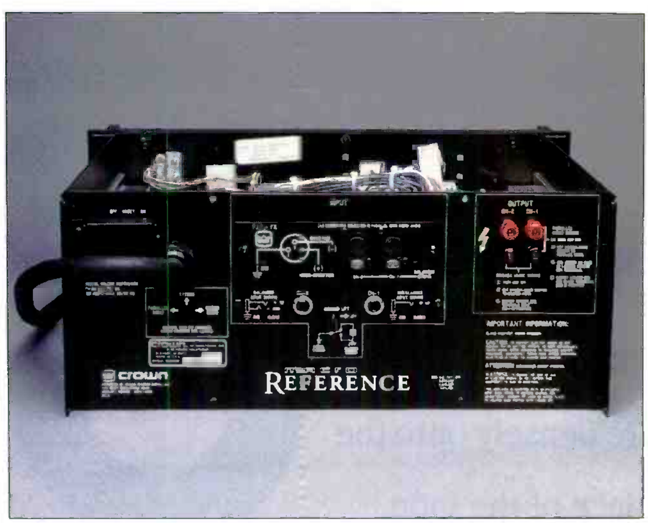
Another useful feature is the provision for installing Programmable Input Processor (P.I.P.) modules. The module normally supplied has no active or special circuitry but adds XLR balanced inputs to the built-in quarter-inch phone jacks, which can be used for balanced or unbalanced input. Crown offers a number of interesting optional P.I.P. modules, including low-level crossover filters, input isolation transformers, precision attenuators, input limiters, and specialized types for sound reinforcement work.

The styling of this amplifier is rather unique—somehow, it reminds me of a combination of a guitar amp and an old jukebox, but overall, I think it is attractive. On the front surface we find two large air inlet ducts with cleanable filters that take up most of the lower panel area. Along the top of the panel are the back-lit Macro Reference logo, two rotary gain controls with detents, a power switch, and multiple-LED displays for "Dynamic Range," "Signal Present," "IOC," and "ODEP." The five LEDs per channel can be switched to indicate the dynamic range in the program (computed as the ratio of peak to average power) or the output level in decibels relative to full output.

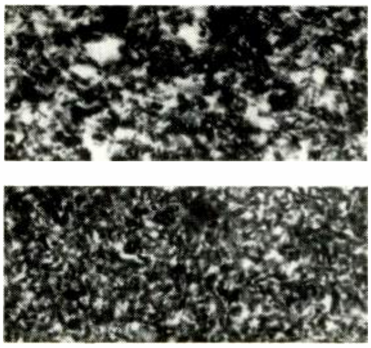
On the rear panel are the signal input and output connections. Signal input connection can be either with XLR or quarter-inch phone plugs, balanced or unbalanced. Output connectors are five-way binding posts; each channel's pair is spaced ¾ inch away from the other's, so a dual banana plug could be connected between both channels' hot terminals in the bridged mono mode. By the time this review appears, the amp will be fitted with two sets of output binding posts. It will also be available in an Esoteric version, using Cardas output posts and adding RCA phono inputs (switchable between floating balanced or unbalanced operation) on the same module as the XLR jack, plus switches to turn off the display and the front-panel illumination.

Also on the rear panel are a captive power cord, a circuit-breaker "Reset" switch, a "Parallel Mono/Stereo/Bridged Mono" slide switch for operating mode, and a "Ground Lift" slide switch to disconnect signal ground from the a.c. third-wire and chassis grounds. I must give special mention to the power cord, which is wonderfully flexible considering its large diameter and wire gauge.

The internal layout is well thought out and executed. On the underside of a horizontal partition plate, about halfway



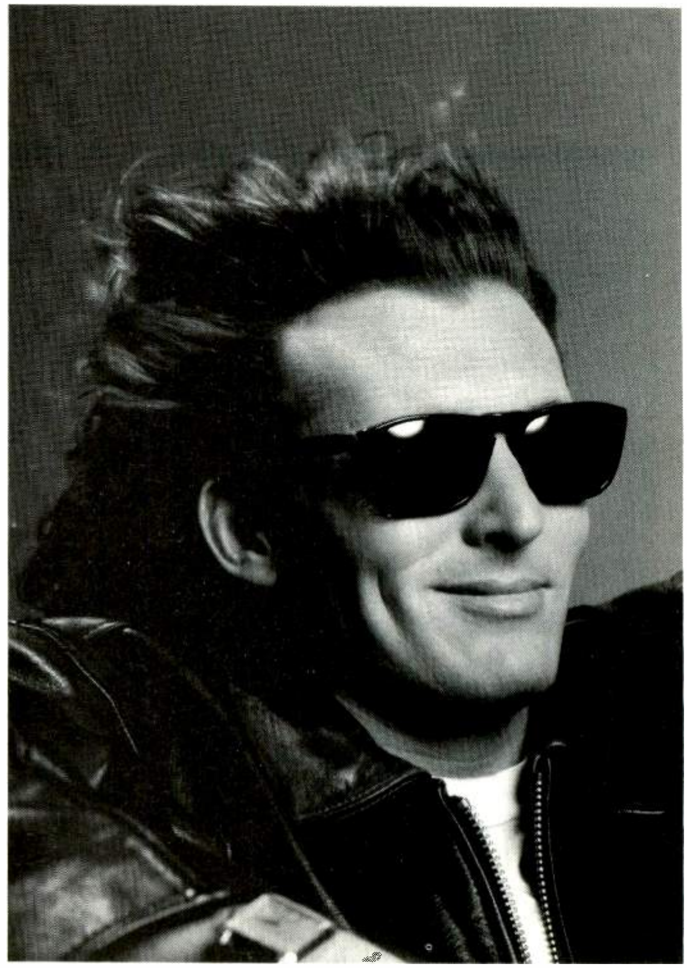
A warning to those with toupees, small vulnerable house pets, and a fear of flying: Maxell has taken high bias tapes to an even higher level of performance.


Compared to other tapes, XLII-S has a higher density of magnetic particles.

The tape is XLII-S. The power behind it is Black Magnetite—a unique magnetic material recently harnessed by Maxell engineers.

With 13% greater power than the magnetic coating on all other high bias tapes, Black Magnetite helps XLII-S deliver higher maximum output levels and wider dynamic range.

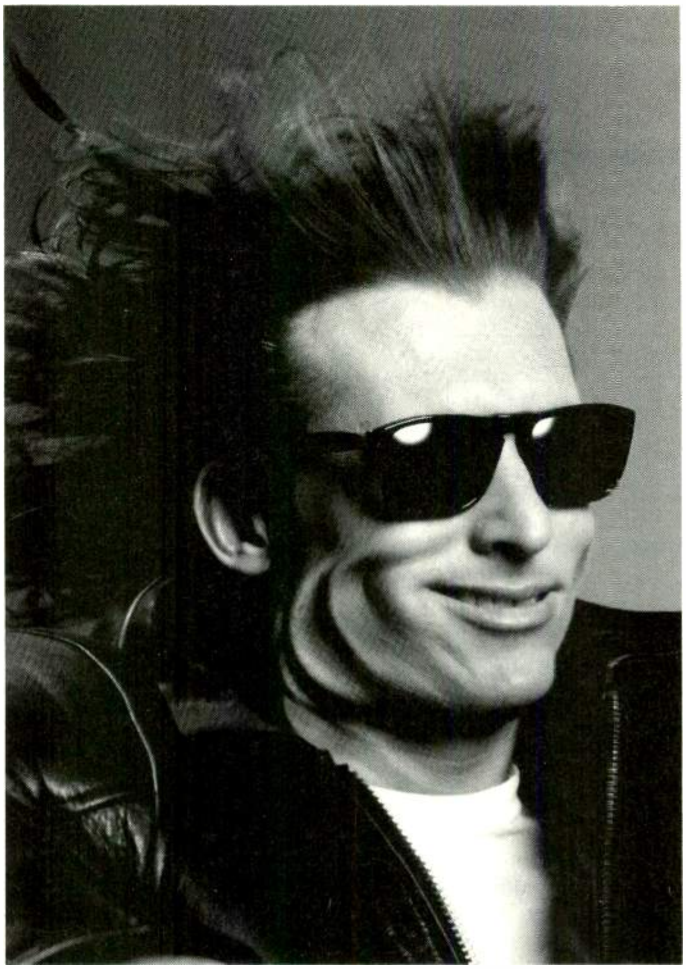
Black Magnetite's tiny magnetic particles are not only more powerful than conventional gamma ferric oxide particles, they're smaller and more uniform in shape. This enables us to pack more particles more densely onto the surface of the tape.



HIGH BIAS

During manufacture, conventional tapes run through a magnetic field where many of the magnetic particles adhere any-old-which-way. Like flies on flypaper.

But at Maxell, we employ a complex process called *"multi-orientation"* to set the particles straight. The result is a



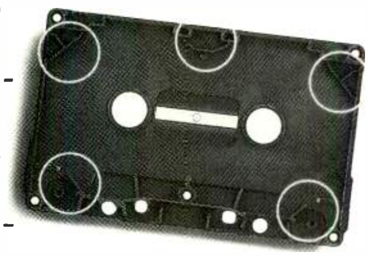
BLACK MAGNETITE

smoother magnetic coating, which produces less AC bias noise.

Unwanted noise is further reduced by our patented *dual-surface base film*. One side of the film is super-smooth for closer tape-to-head contact. The other is rough, deliberately so, for a stable ride through your transport mechanism with the least possible friction and tape jitter.

These innovations, however, are no more remarkable than the cassette shell that houses them.

More rigid and weightier than standard cassettes, the XLII-S *high resonance-damping cassette* has been precision engineered to reduce modulation noise. By making the window smaller, for instance, we were able to build in more anti-resonant material and five support points instead of three.



XLII-S vibration-damping cassette shell has five support points for increased rigidity and durability.

All of which helps XLII-S maintain phase accuracy as well as an extremely low noise threshold.

You can feel a difference in XLII-S just by picking up the cassette. Of course, it's nothing compared to what you'll feel the moment you press 'play'.

TAKE YOUR MUSIC TO THE MAX.

Bridge-balanced design is what allows the Crown's channels to be bridged together safely.

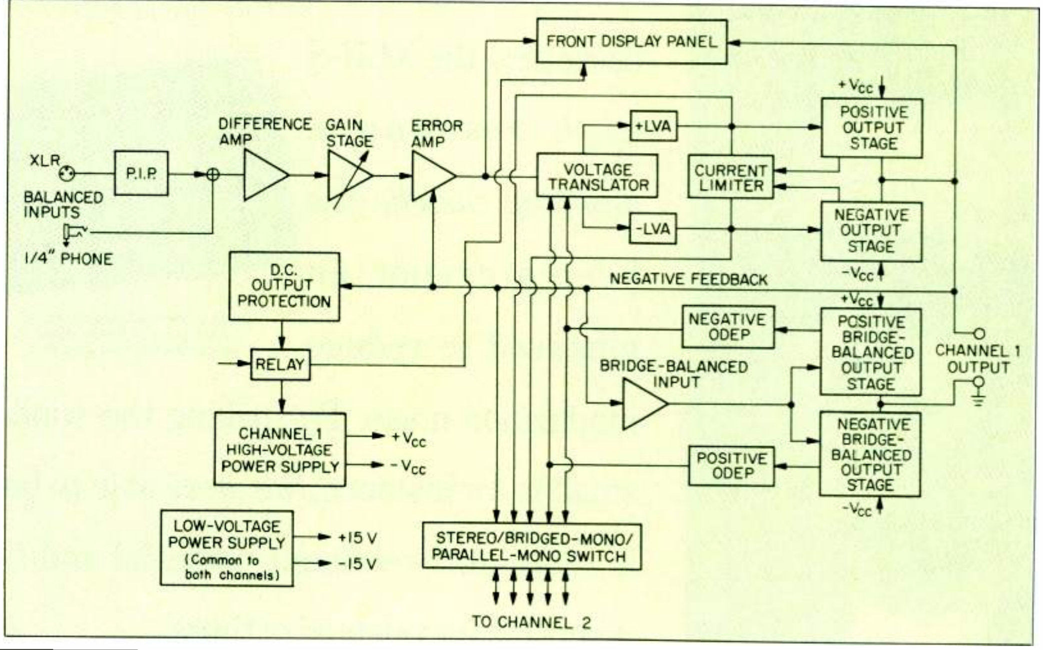


Fig. 1—Block diagram; one channel shown.

up the interior, are the toroidal power transformer, main circuit board, and output-stage interconnect boards. The transformer is at center right behind the front panel, the main circuit board is at the rear, and the output stage boards run fore and aft along each side. In the center of the plate is the grille for the variable-speed cooling fan. This fan only operates when the ODEP computer determines (by simulating the operating conditions of the output devices and comparing them to the devices' safe operating areas) that the output transistors need cooling. There are also temperature sensors on the heat-sink but just for backup. Air drawn through the front-panel filter openings enters the lower section of the unit and passes through the fan into the upper section. Mounted on top of the dividing partition are the four output-stage mounting plates with integral dissipating fins, the cooling fan, filter capacitors, bridge rectifiers, a control p.c. board, and the housing and connector for the P.I.P. input module. The level-control potentiometers and the display circuitry are mounted behind the front panel.

The rest of the chassis construction is rather straightforward and consists of separate rear, side, and front panels screwed together. Top and bottom plates are attached by screws through the side and rear panels to bent lips on the top and bottom plates. The unit is neatly wired and has high-quality parts. Construction technique is good but not stellar, using machine screws into tapped holes rather than into pressed-in Pemm nuts. The transferrable full warranty is unusually long, six years, and includes round-trip shipping.

Circuit Description

The Macro Reference is a relatively complicated piece of gear; a block diagram is shown in Fig. 1. One of the most unusual things is the "grounded bridge" arrangement. Generally, in full-bridge or stereo amplifiers used in bridge mode, the output is taken between the hot terminals of two half-bridge output circuits—either the two stereo output channels or the equivalent two half bridges that make up the usual full-bridge output stage. Two of the problems in the usual bridge arrangement are not being able to use certain servo woofer systems that have velocity bridge-feedback sensing schemes and the general fear of accidentally grounding one side of the output in demonstration switchers or sound systems. Crown introduced this unique topology a number of years ago (I believe in the Model M600). It permitted one output of the bridge to be grounded, thus rendering it possible to bridge these two channels—or "bridge the bridges"—for a really impressive output in excess of 1 kW. This newer Macro Reference amplifier can produce about *3 kW* of steady-state power into a single 4- or 1-ohm load!

Signal input from the phone jacks or output of whatever P.I.P. module present is fed into an op-amp circuit configured to convert from a unity-gain differential input to a single-ended output. Input and feedback resistors are 5 kilohms, thus setting the unbalanced input impedance to a low (for normal audio use) 5 kilohms and the balanced input impedance to 10 kilohms. This feeds another op-amp circuit set up as a variable-gain, inverting feedback circuit, with a front-panel control varying the gain. A slide switch in the P.I.P. module sets input sensitivity for full output power with front-panel gain controls at 0.775 or 3.9 V rms maximum; the latter corresponds to a voltage gain of 26 dB. I would call this circuitry "front-end signal conditioning."

From here, the signal is capacitor-coupled to the amp's first stage, shown in Fig. 1 as the "error amp." This IC op-amp is set up in an overall inverting mode but is noninverting as a local circuit and has its own negative feedback loop. Overall low-frequency feedback runs from the output of the following bridge phase, before the output buffering network, back to the error amp's noninverting input; it works

Perhaps the most Important feature of all in Compact Disc Players.

In a category where manufacturers try to convince you of their superiority with digital theory and laboratory specifications, Denon adds an all-important new criterion: *Overall Consumer Satisfaction.*

In the most exhaustive research ever conducted, Verity Research, the nation's leading independent Consumer Electronics research firm, ranked Denon CD Players Number 1 in Overall Consumer Satisfaction.

This honor, determined by interviewing hundreds of thousands of people across America, takes into account the many factors that make someone fully satisfied with their purchase.

Denon is especially proud to win in this category, because CD Players, more than any other component, challenge a company's abilities in the electro-mechanical, analog *and* digital domains.

Denon is even prouder, because the ultimate judge in this unprecedented competition was not a reviewer or a magazine editor, but someone just like you.

DENON

The first name in digital audio.

Denon America, Inc., 222 New Road, Parsippany, New Jersey 07054 (201) 575-7810

Enter No. 11 on Reader Service Card

Bridged together, the amp's channels can deliver about *3 kilowatts* of power into a 4- or 1-ohm load!

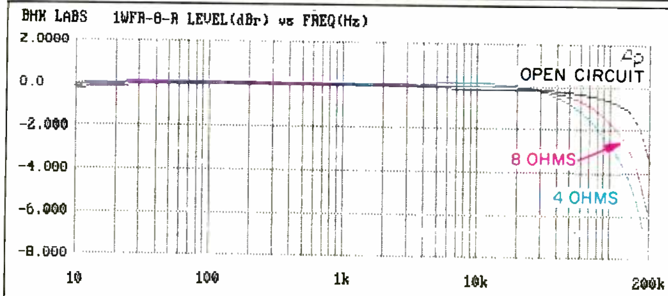


Fig. 2—Frequency response at 1 watt output.

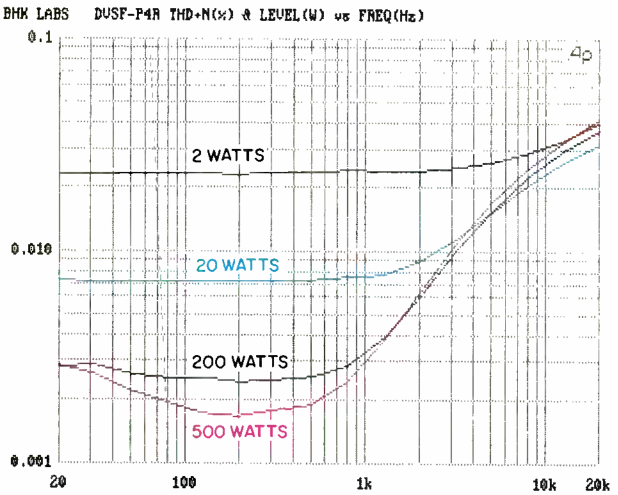


Fig. 3—THD + N vs. frequency, as a function of power into 8-ohm load. The vertical offshoot of the 500-watt curve is due to action of the amp's protective circuit; see text.

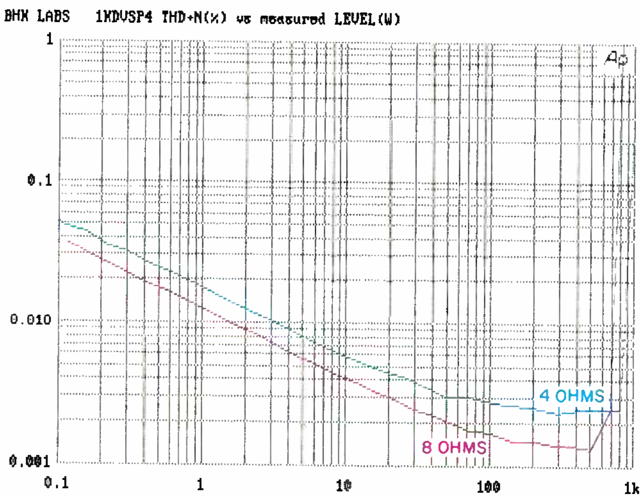


Fig. 4—THD + N vs. power at 1 kHz.

against a series resistor fed from the gain-setting stage, which precedes the error amp.

The output of this first stage is fed into a voltage-translation circuit, at last composed of discrete transistors, that couples the op-amp's limited voltage-swing capability to the last voltage amplifier stage (+LVA and −LVA in Fig. 1).

A high-frequency feedback loop from the output side of the RL output buffering network is capacitor-coupled back into the voltage-translation stage to provide high-frequency feedback that excludes the preceding op-amp stage. This nested feedback-loop structure is quite sophisticated.

The last voltage amplifier stage is a complementary common-emitter circuit with emitter feedback that swings the full output voltage of the amplifier. Following is a triple Darlington-connected, complementary emitter-follower output stage using three pairs of output transistors. This constitutes the main half of the overall bridge output stage.

The other, "bridge-balanced," half consists of a similar output stage with the same number of output transistor pairs, but its function and mode of operation are different. First of all, its output stage emitters are grounded; thus, the output is taken from the collectors, which are, lo and behold, the power-supply lines for both halves of the bridge! Feedback, taken from each supply rail and from the output of the main amplifier output stages, controls this half of the circuit so that it precisely modulates the supply rails by exactly half of the amplitude of the main amplifier's output voltage. (This is accomplished by another IC op-amp that feeds the input to this triple Darlington "slave" half of the overall grounded-bridge output stage.) Instead of the usual bridge circuit, where power-supply rail voltages are fixed and the voltages of both output terminals swing equally in opposite directions, the Crown circuit swings the supply rails, and one output terminal is grounded. This grounding lets you bridge channels together—normally, you can't bridge a bridge. I have always admired this grounded-bridge circuit for its outrageously original and clever concept. Kudos to Gerald Stanley of Crown, who, I believe, invented it.

In the main power supply for the output stage, one unusual feature stands out, the use of one main filter capacitor rather than the usual two. In a grounded-bridge circuit, the high-current secondary winding does not need to be center-tapped; thus, only one filter capacitor is needed between positive and negative outputs of the full-wave rectifier bridge. The capacitor value is modest by ultimate amplifier standards, only 6,300 µF, but has a 135-V rating. I still can't figure out how they get so much power out of this relatively small power supply!

Measurements

Frequency response with open-circuit, 8-ohm, and 4-ohm loads is shown in Fig. 2. Response is shown for the left channel, which was down slightly more than the right. If you compare these curves with those for other amplifiers I have reviewed, it will be clear that the Crown's voltage regulation in the audio range portends a very low output impedance because the curves appear as one over most of the audio range. Some out-of-band differences do show up, due to the output buffering RL network used in this and most other solid-state amplifiers.

A S C E N D I N G
Model 9
Mono
Power
Amplifier
JEFF ROWLAND
DESIGN GROUP
Post Office Box 7231 Colorado Springs, CO 80933 USA Phone: 719-473-1181 Fax: 719-633-4 58
Enter No. 20 on Reader Service Card

In the listening tests, my first impression was: Wow! This is the best Crown amp I've ever heard!

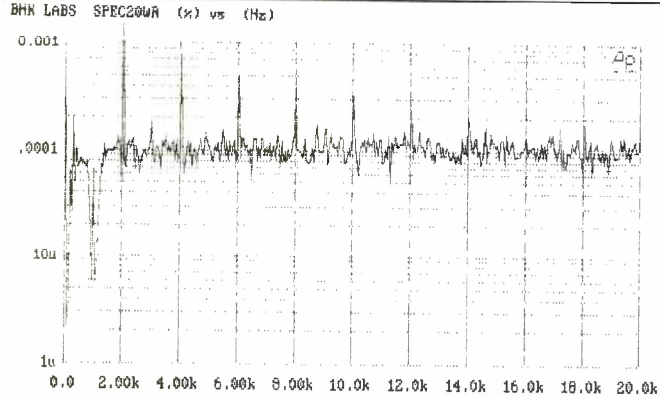


Fig. 5—Distortion spectrum of right channel for 1-kHz signal at 20 watts into 4-ohm load.

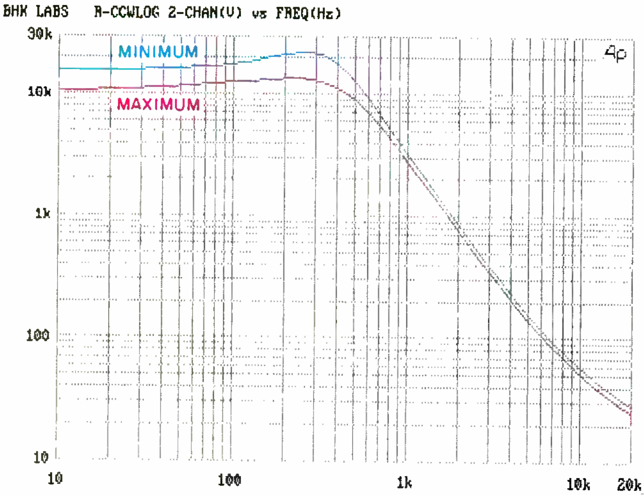


Fig. 6—Damping factor vs. frequency for minimum and maximum settings of level control.

Gain and sensitivity were measured with the front-panel gain controls set fully clockwise and with the controls set 14 clicks down from clockwise, about half rotation. Results with controls at maximum were a very high gain of 40 dB for each channel, yielding a sensitivity of 28 mV to produce 1 watt into 8 ohms. With the controls at about half rotation, gain was down to 23.5 and 23.3 dB for the left and right channels, respectively, corresponding to a sensitivity of 189 and 193 mV. With controls set fully counterclockwise, gain was down to about −56 dB. These tests were done with the sensitivity switch set for maximum gain. When it is set to the other position, voltage gain is 26 dB (not measured) with level controls set to maximum.

Distortion in this amplifier is so low that it was hard to measure, as it is down in the noise over much of the power and frequency ranges. Figure 3 shows THD + N as a function of frequency and power level, for the right channel with a 4-ohm load. The figure mostly shows noise at lower power levels, although at high frequencies we can see the distortion rising out of the noise, even at the low level of 2 watts. Notice that one curve shows an abrupt distortion rise below 100 Hz. This occurred on my second 500-watt power sweep, when the protection circuit came in and caused current limiting on the signal peaks. The cooling fan came on with an impressive roar, but what was even more impressive was how fast it slowed down when the input signal was removed.

Shown in Fig. 4 is 1-kHz THD + N as a function of output power for 8- and 4-ohm loads. (The curves are displaced by a factor of 1.414, because S/N ratios with 4-ohm loading are automatically 3 dB lower.) Only when the downward slopes of the curves begin to change, and eventually turn upward, is real measured distortion seen. A plot of SMPTE-IM distortion (not shown) was similar.

The power levels reached in Fig. 4 are lower than what the Crown can achieve when connected to a true low-impedance a.c. line, which I don't really have in my lab. In the case of the Macro Reference, I had my 25-ampere Variac cranked wide open when the power was approaching maximum and the measured line voltage at the end of a 4-ohm power sweep had sagged to about 110 or 112 V. A spectral plot of the right channel's harmonic distortion residue at 20 watts output into a 4-ohm load (Fig. 5) shows that the distortion is dominantly even-order. Dominant even-order distortion frequently is relatively constant with increasing power output. This proved to be true over a wide power and frequency range.

Interchannel tracking of the gain control was found to be within 1.2 dB down to −50 dB and within 4 dB at an attenuation of 70 dB. This is quite good over a large range of 50 dB.

Interchannel crosstalk versus frequency, with the front-panel level controls at maximum, was found to be down about 100 dB to about 200 Hz; it then rose at 6 dB per octave to a level of about −62 dB at 20 kHz. With the controls set to about half rotation, crosstalk was again about 100 dB down, this time staying there to about 1 kHz before rising with frequency. At 20 kHz, crosstalk was about −75 dB. The results were very similar for left-to-right and right-to-left measurements.

Damping factor as a function of frequency, with the level control at its minimum and maximum, is shown in Fig. 6 for the right channel, which had the higher damping factor. I have never encountered such a low output impedance in an amplifier before! When I injected a constant current of 1 ampere into the channel being measured, the voltage across the undriven channel was less than 1 mV from 10 to 500 Hz! Damping factor decreased above about 500 Hz

In 1986, Yamaha developed what many industry experts consider the most significant audio advancement since stereo. We're referring to Digital Soundfield Processing.

Digital sampling of actual soundstages to recreate the same acoustic environments you once had to go out to enjoy.

Now this remarkable technology is available in an audio/video receiver. The one you see before you. Yamaha's new RX-V1050.

The RX-V1050 has four DSP settings, in fact. Concert Video, Mono Movie, Rock Concert and Concert Hall.

But what may ultimately be more exciting is something no other receiver can offer. Dolby* Pro Logic Enhanced. A technical feat which combines DSP and Digital Dolby Pro Logic.

An incredible enhancement which allows you to enjoy all the sonic information embedded in the movie soundtrack, as well as the acoustics of the theatre, all without leaving the house.

Under the hood, the RX-V1050 sports five power amplifiers—110-watt amplifiers for the left, right and center front channels, and 30-watt amplifiers for each of the rear effects channels.

A high-powered center channel combined with Yamaha's DSP and Digital Dolby Pro Logic enables Yamaha's RX-V1050 receiver to recreate the experience other receivers have promised, but have never quite delivered.

Stop by your nearest Yamaha dealer and hear the new RX-V1050 receiver. The best argument for staying home anyone's ever come up with.

YAMAHA®

The only receiver that can make your home theatre sound as good as the original.

Space and resolution were extremely good, bass was *beautifully* defined and tight, and dynamics were effortless overall.

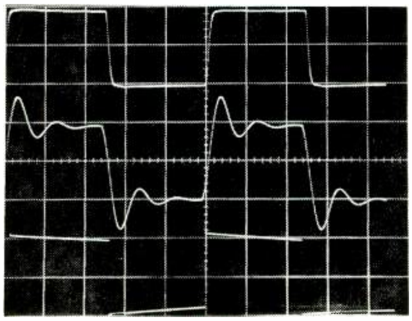


Fig. 7—Square-wave response for 10 kHz into 8 ohms (top), 10 kHz into 8 ohms paralleled by 2 μF (middle), and 40 Hz into 8 ohms (bottom). Scales: Vertical, 5 V/div.; horizontal, 20 μS/div. for 10 kHz, 5 mS/div. for 40 Hz.

due to the impedance of the output RL buffering network (and probably a decreasing amount of feedback for increasing frequencies, borne out by the rise in THD), but note that the damping factor is greater than 20 at 20 kHz.

Rise- and fall-times for 8-ohm loads at an output level of ±5 V were about 2.4 μS, both at full level and with level controls at half rotation. For 4-ohm loads, rise- and fall-times lengthened to about 3.2 μS. Figure 7 shows the amp's square-wave response. The top trace is at 10 kHz with 8-ohm loading. With a 2-μF capacitor in parallel with the 8-ohm load (middle), we see ringing caused by the output buffering RL network. The 40-Hz wave in the bottom trace displays satisfactorily low tilt.

Noise levels (Table I) are impressively low, and no a.c. line harmonics were visible in the noise residuals on my 'scope. Note the similarity between the readings for bandwidths of 22 Hz to 22 kHz and 400 Hz to 22 kHz.

In the test of IHF dynamic headroom, I got a prodigious ±120 V, peak, into 8-ohm loads, for an equivalent rms power level of 900 watts and dynamic headroom of 0.7 dB. With 4-ohm loads, I got equivalent figures of 1,500 watts and 1.1 dB. These values are undoubtedly low, due to my a.c. power line's impedance, but are nonetheless most impressive! Power-line considerations prevented measurement of clipping headroom and any attempt to measure maximum attainable current into a 1-ohm load. As a final measurement note, the amplifier's a.c. line draw at idle was about 700 mA.

Use and Listening Tests

Equipment used to evaluate the Macro Reference included as signal sources an Oracle turntable fitted with a Well Tempered Arm and Spectral Audio MCR-1 Select cartridge, a Krell MD-1 CD transport feeding a VTL Straight Line D/A converter, a Nakamichi 250 cassette deck and ST-7 tuner, and a Technics 1500 open-reel recorder. Preamplification for records was supplied by my reference tube phono preamp. Additional preamps used were a First Sound Reference II, an Acurus L10, and a Quicksilver Audio. Other power amplifiers on hand during the review period were a pair of Carver Silver Sevens, Quicksilver Audio M135 prototypes, a prototype digital switching amplifier, and a McIntosh MC2600. Loudspeakers used were Win Research SM-10 monitors and Spica Angelus systems.

My first listening impressions of the Crown amplifier were: Wow! This is the best Crown amplifier that I have ever heard! Overall frequency balance seemed just a little thin in the lower midrange, but I had grown accustomed to the tube amplifiers I use, which tend to be stronger in this region. The Crown's space and resolution were extremely good. Bass was indeed *beautifully* tight and defined. Overall dynamics were just as effortless as you'd expect from such large power reserves. When I used the Acurus line-level preamp, the sound got a bit congested and irritating when it got loud.

Overall, best sound was obtained using the First Sound passive preamp with its level controls set to about half rotation and the level controls on the Macro Reference controlling overall volume. I sure did get the feeling of more accuracy than usual in a lot of my listening with the Macro Reference, although I didn't always completely like the results with certain software that also tends to be irritating through other component combinations. I have heard that other reviewers have been comparing the Macro Reference to some of the big names in solid-state amplification and that the Crown has been judged to be superior in a number of instances. When considering its price, which is really very reasonable for the performance obtained, I give this amp a most enthusiastic thumbs up! I may just buy this honey.

Bascom H. King

Table I—Output noise, with volume control fully clockwise and at approximate halfway point (14 detents down). The A-weighted S/N ratio was 96 dB for either channel.

	Output Noise	
	Volume Control Clockwise	
Bandwidth	LEFT	RIGHT
Wideband	1.1 mV	1.26 mV
22 Hz to 22 kHz	364 μV	357 μV
400 Hz to 22 kHz	360 μV	355 μV
A-Weighted	275 μV	275 μV

	Output Noise	
	Volume Control Down	
Bandwidth	LEFT	RIGHT
Wideband	283 μV	258 μV
22 Hz to 22 kHz	72 μV	71 μV
400 Hz to 22 kHz	71 μV	69 μV
A-Weighted	55 μV	59 μV

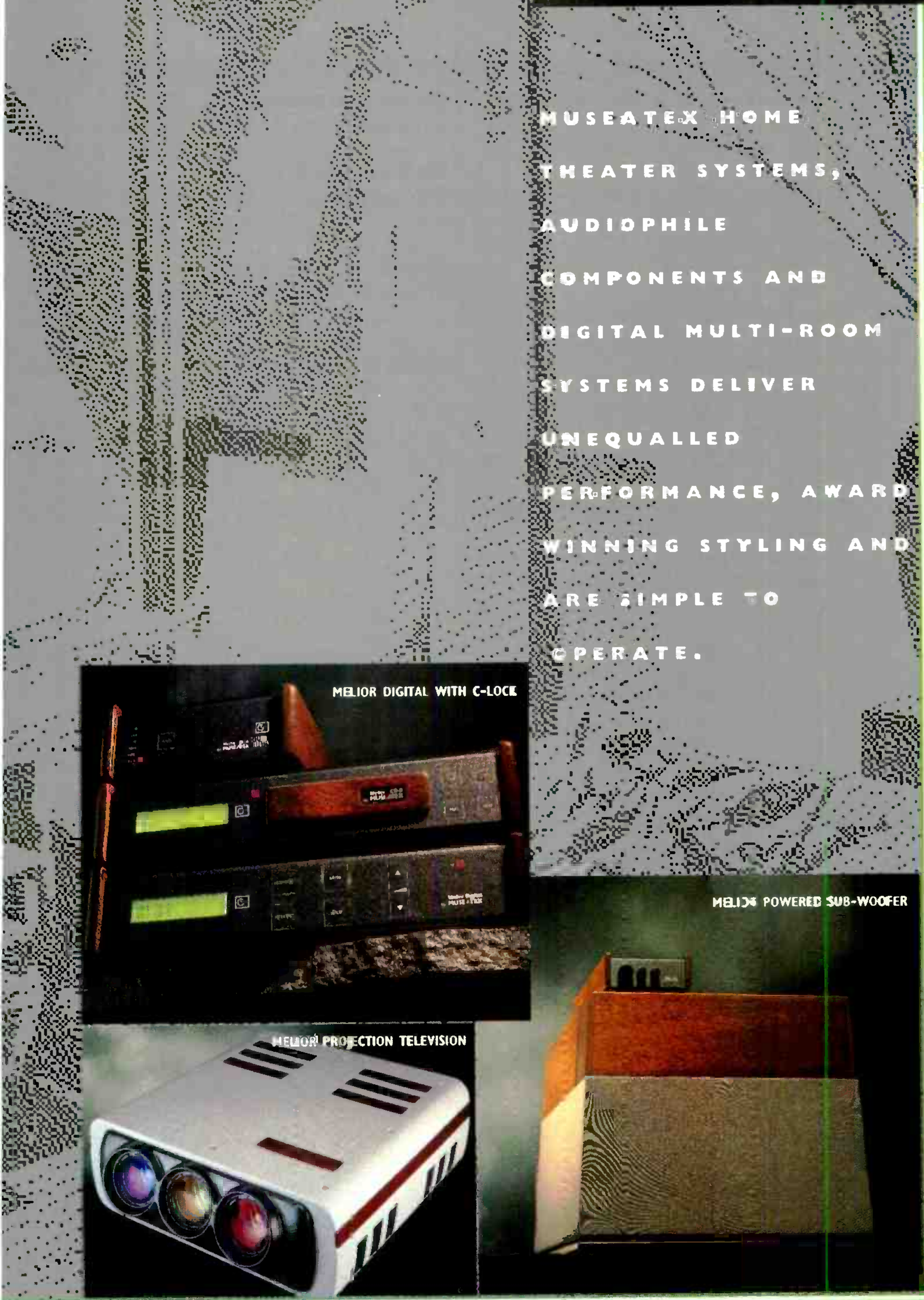
INTRODUCING SPEAKERS THE EXPERTS SAID WOULDN'T WORK.

When Museatex engineers started working on a speaker using a single pulsating sphere to reproduce perfectly time aligned sound, the experts agreed that this was theoretically an ideal solution, but impractical to implement. Now, after five years of research, Museatex engineers have perfected the most revolutionary speaker to be introduced in over three decades — **Real-Time Ripple-Effect (RTRE) speakers.** The Melior RTRE speaker uses a single point source to drive a flat diaphragm to propagate sound with naturally perfect time-aligned signals. In addition to near perfect reproduction, this speaker has several other unique advantages. It is less than 3" deep and can be integrated into any decor. It operates as a pulsating sphere with di-polar characteristics and is less critical to room placement than any other high quality speaker. The speaker has no cross-overs or transformers and presents a uniform load to amplifiers. Virtually any amplifier can drive these speakers although they reveal the fine nuances of the best in electronics. As the speaker is naturally flat, it can be designed as an in-wall speaker without sacrificing performance. The RTRE speakers by Museatex are available in a variety of finishes, including lacquered mahogany and piano black.

THE EXPERTS ARE NOW SINGING A DIFFERENT TUNE ABOUT THE REVOLUTIONARY 'REAL-TIME RIPPLE-EFFECT' SPEAKER BY MUSEATEX. "...FOR THE FIRST TIME IN HI-FI HISTORY, A FULL RANGE SPEAKER WITHOUT CROSSOVERS AND ELECTRONIC GADGETS HAS BEEN ABLE TO DEMONSTRATE NEAR PERFECT REPRODUCTION..." HANS JÜRG, SOUND, SWITZERLAND.

REAL-TIME RIPPLE-EFFECT LOUDSPEAKER
RTRE
MUSEATEX

WE KEEP PROMISES OTHERS MAKE ... AND MORE



Home Theater. Museatex HES (incorporating the highly rated Shure HTS 5300 surround sound processor) is designed to provide theater-like realism for video in home environments and audiophile music reproduction. Other home theater systems, like THX, demand exact and often impractical room specifications and require "box" speakers which offer little aesthetic flexibility for decorators. Furthermore, such home theater systems cannot also be used as an audiophile stereo system for music. △ **Audiophile Components.** Meitner and Melior products by Museatex have consistently been among the highest rated audio products since the early eighties. Our digital and analog products are universally compatible and will augment any system. △ **Speakers.** Real-Time Ripple-Effect speakers by Museatex are the most accurate transducers presently available. △ **Digital Multi-Room System.** Museatex has just introduced the Muselink Digital Distribution system, which is capable of multi-zone, multi-source distribution using standard telephone wire. Multi-room systems offered by others are analog switching systems or digital systems that do not address our performance criteria. △ **Museatex Technology.** Museatex delivers a higher level of performance than others by using innovative and patented technology: C-Lock™ for eliminating digital jitter, Floating Charge Power Supply to reduce power line pollution, VCA to eliminate mechanical switches and pots, Static Fan Heat Sink for heat dissipation in amplifiers, etc.

PARTS AND LABOUR 5 YEAR GUARANTEE PARTS AND LABOUR
MUSEATEX AUDIO INC.

ANTI-OBSOLESCENCE 5 YEAR GUARANTEE DIGITAL EQUIPMENT
MUSEATEX AUDIO INC.

MUSEATEX

THE FUTURE OF ENTERTAINMENT

(403) 273-2552 Facsimile: (403) 272-3860 Toll free: 1-800-463-3447

Enter No. 29 on Reader Service Card

2

ARCAM DELTA 110 DIGITAL PREAMP

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz, +0.1, −0.5 dB, via line or digital inputs.

Sensitivity: MM phono, 2 mV; MC phono, 100 µV; line level, 200 mV.

Input Impedance: MM phono, 47 kilohms; MC phono, 220 ohms; line level, 45 kilohms.

Noise (CCIR): MM phono, −64 dB; MC phono, −50 dB; line level, −89 dB; digital, −96 dB.

Nominal Output Level: Line, 2 V; tape, 0.3 V; headphone, 4 V.

Output Impedance: Line, 25 ohms; tape, 70 ohms; headphone, 200 ohms.

Minimum Recommended Output Load: 5 kilohms.

Recommended Headphone Load: 32 ohms to 2 kilohms.

Maximum Output Level: More than 8 V.

Channel Balance: ±1 dB.

Crosstalk at 1 kHz: Line, below −70 dB; tape, below −65 dB.

Muting: 40 dB.

Dimensions: 17 in. W × 2½ in. H × 10½ in. D (43.2 cm × 6.4 cm × 26.7 cm).

Weight: 8.2 lbs. (3.7 kg).

Price: $1,500, including remote; phono input-loading modules (see text), $35.

Company Address: c/o Audio Influx, P.O. Box 381, Highland Lakes, N.J. 07422.

For literature, circle No. 91

It's one of those apparent quirks of fate that both the Cambridge in Cambridgeshire and its namesake in Massachusetts have been nuclei not only of learning but of technical development and design elegance. One of several audio manufacturers that might be cited as examples from the Old Country is Arcam, the brand name of A&R Cambridge. (The initials stand for amplification and recording, incidentally, not artists and repertoire.) While the companies that made the American city an audio mecca were generally founded by people associated with the first wave (post-

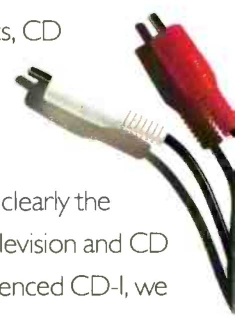
Philips Presents CD-Interactive

The Hardware

When the engineers from Philips invented CD audio, they knew they were at the forefront of a remarkable new technology. Naturally, they continued to evolve their idea. The result of their effort is the latest Philips innovation: CD-Interactive.

The Philips CD-Interactive player connects quickly and easily to both your television and stereo system. By simply inserting a CD-I title into the player, you can then use the special "thumbstick" remote to chart your own course along the CD-I disc, controlling everything you see and hear.

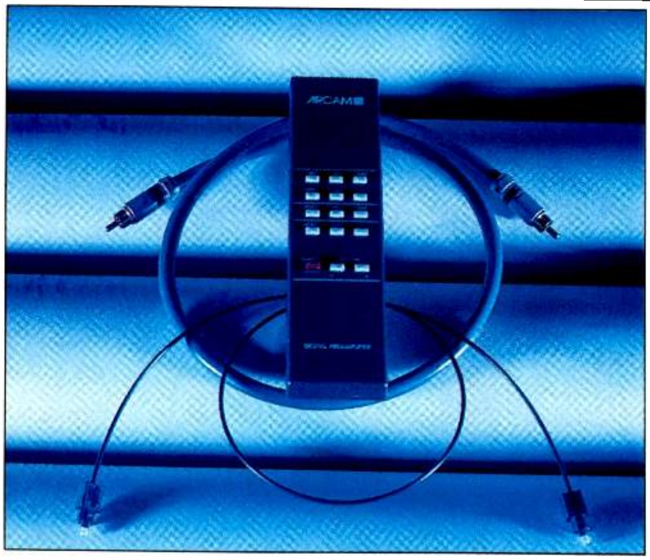
And because CD-I is a global standard, the Philips CD-Interactive player will be compatible with all forthcoming CD-I titles. It is also backwards compatible with 3" and 5" audio CDs, CD Graphics, CD ROM-XA "bridge" discs, and forward compatible with the new Photo CDs.



Philips CD-Interactive is clearly the next generation of both television and CD audio. Once you've experienced CD-I, we think you'll find it impossible to get it out of your system.

PHILIPS

The Delta 110 removes the potential for disastrous feedback, as its control logic doesn't allow you to monitor the source deck.



World War II) of high fidelity, the British crowd tends to be both younger and more firmly rooted in the later solid-state and digital technologies.

In particular, Arcam and its brethren have been on the cutting edge in designing D/A converters, offering both built-ins and free-standing units that can be used with any CD player or digital recorder having a digital output. The Delta 110 preamp continues this tradition by including a D/A converter in an otherwise analog design. It also offers electronic switching, including provision for two tape decks or other outboards, controlled by a logic system that is as finely polished as it is unobtrusive.

If you admire the Delta 110's finesse but don't think you need the D/A converter (or don't *yet* need it), Arcam offers the Delta 110S for $400 less. The 110S dispenses with the converter and uses its coaxial input and output jacks as analog inputs for a CD player (selected at the front panel's "Digital" button). You can retrofit the D/A converter to the 110S if you later want to upgrade, but at present prices that route would cost you $100 more than going directly to the model reviewed here.

Control Layout

The front-panel selectors are all rectangular buttons with bicolor LED pilots just above them. In general, a green pilot indicates that the button has been selected, while a red one indicates a special function or its use in taping. The selectors themselves are at the left end of the panel and are marked for "Disc" (phono), "AV" (implying video use but actually functioning as an AUX input), "Tuner," "Tape 1," and "Tape 2." There is no input labelled "CD," since it is assumed you will use the D/A converter for that purpose.

The next group of buttons to the right selects the D/A converter's "Digital" and "Optical" inputs and "Phase." This last inverts the polarity of the converter's output so that, if you can tell the difference and have a preference, you can correct for presumably phase-inverted CDs. (There is no switch for phase-inverted LPs.) What looks like a round muting button to the right is actually the sensor for the supplied remote control, with the muting LED above it. The muting can only be triggered from the remote.

The "Record" button flashes its LED when you press it; during the 5 S or so that it remains flashing, you can choose any input as the recording source. Once you've chosen the source, the "Record" LED goes off. If the source you've selected is not the one you're listening to, its LED will glow red, while the LED for the source you're monitoring will glow green. If the same source is chosen for both listening and recording, its LED glows green. If you then monitor the deck to check the recording, the LED for the selected deck ("Tape 1" or "Tape 2") turns green and the source's LED turns red.

During dubbing, which can be in either direction between the two sets of tape connections, the preamp's control logic prevents you from monitoring the source deck—and will, in fact, interrupt the dub if you try to do so. This is a byproduct of the logic circuitry's prohibition against choosing the same deck as recorder and source, to prevent feedback. Inability to monitor the source directly could prove somewhat onerous in some dubbing setups, but the feedback that could be the alternative could prove disastrous—to the recording, if not to amps or loudspeakers.

Next to "Record" is a toggle button for selecting mono or stereo. Moving farther to the right, we find a small rotary "Balance" control (with no detents), the "Volume" knob, the headphone jack, and finally the "Power" switch. The volume control is motor-driven by the remote but clutched so that aggressive manipulation won't burn out the motor windings via back EMF. The headphone jack is wired to disconnect the main outputs when a headphone plug is inserted.

The remote (made for Arcam in Germany, incidentally, though the preamp itself is made in the U.K.) includes all the front-panel control functions except "Balance" and "Record." The latter's absence is deliberate, to prevent accidental interruptions once recording has begun. Volume is remotely adjusted with "+" and "−" buttons, and there is a button for muting and a red one marked "Standby." The latter turns off the preamp's main outputs (but does not defeat the tape feed, if any is selected) and leaves the

Philips CD-Interactive

The Software

Every CD-Interactive title is a uniquely crafted key, designed to unlock the potential of your television.

As the leading developer of CD-I titles, Philips is working closely with the world's most renowned publishing and entertainment companies.

Time Life, The Smithsonian Institution, Children's Television Workshop, ABC Sports Presents, and Mercury Records are just a few of the groups already involved in the production of CD-I titles.

The current CD-I catalog covers a wide spectrum of interactive games, how-to's, children's programs, museum tours, musical jukeboxes and historical journeys.

Scores of new CD-I's will be released in the coming year. And with the introduction of Photo CD processing, you will be able to create your own CD-I family albums.

The doors CD-Interactive can open are endless. And the entertainment and educational opportunities it brings into your home will revolutionize your entire concept of what television has to offer.

PHILIPS

PHILIPS

Most phono sections today roll off the bass to handle warp, but few are as flat above the bass as Arcam's.

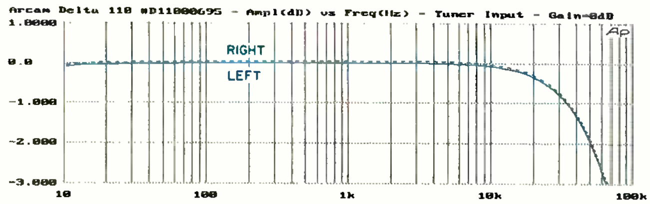


Fig. 1—Frequency response through the "Tuner" input at an output level of 500 mV.

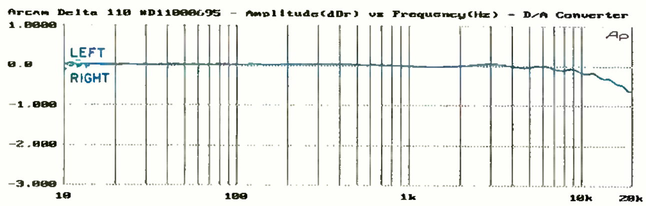


Fig. 2—Frequency response through the D/A converter, with gain set for 2 V out from 0-dB signals.

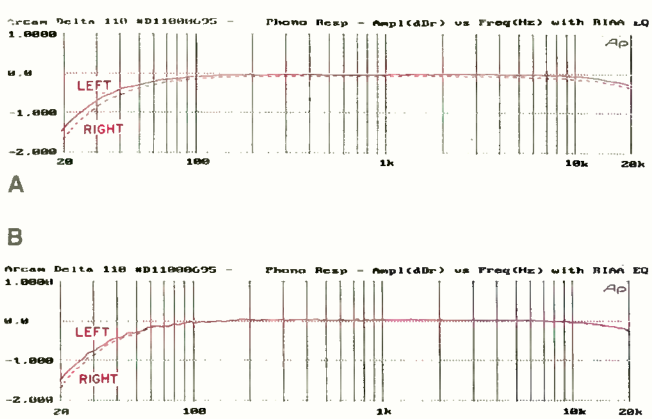


Fig. 3—Phono frequency response (RIAA accuracy) through MM input with gain set to 40 dB at 1 kHz (A) and through MC input with gain set to 60 dB at 1 kHz (B).

power supplies on so that the Delta 110 will be fully warmed up whenever you turn it on.

Arcam evidently finds a sonic advantage in this, though none was confirmed in testing. In "Standby" mode, only the power LED glows on the front panel. Previous settings are restored when you press "Standby" once again. Should you misplace the remote, normal operation can be restored by turning the preamp off, and then on, with its power switch.

Most of what you'll find on the back panel is implicit in the foregoing. In addition to optical and coaxial digital inputs, there's a digital output to pass on the incoming digital bitstream, unaltered, to other equipment. The various analog input and output jacks—including two sets for the main output—are all gold-plated. Next to the pair of phono inputs (and a binding-post ground) is a phono mode switch to choose between MM operation (for moving-magnet or high-output moving-coil pickups) and MC operation (for traditional, low-output moving-coil models).

One further adjustment is not visible from the outside. If your phono pickup would be better served by an input impedance other than the fixed values provided in the Delta 110, you can buy a separate MM or MC loading module. The module plugs into a connector beneath the preamp's top plate and incorporates a switch array to select other impedance values. Unless you have an oddball cartridge, there's no reason to suppose that adding a module would effect an improvement; the tested unit did not have one.

Measurements

Diversified Science Laboratories' measurements generally confirmed—within reasonable tolerance, once differences in test method are accounted for—Arcam's claims for the Delta 110. Two quibbles are raised by the data in Table I. The main output impedance measures twice as high as the manufacturer's specification, though not high enough to be of concern. And the muting is even greater than the claim of 40 dB. This too is of little real importance; however, if you're used to the almost universal 20 dB of attenuation, the near inaudibility of the muted output at moderate volume settings may make you forget to turn the muting back off.

One other point may be of concern if you plan to use the Delta 110 with components that deliver exceptionally high signal levels. The input overload points are not particularly generous, though they should be more than acceptable with normal equipment. With any preamp, it is always best to adjust any output level controls on your source components for parity with the levels delivered by your other sources; the Delta 110's design simply makes this consideration slightly more urgent than usual.

The balance control's lack of a detent leaves its centering slightly equivocal, but the unusually gentle action of the Delta 110 in this regard—its maximum attenuation at either extreme is only about 10 dB—means that small rotations make only tiny sonic differences. The 0.3 dB of measured channel imbalance is well within the spec and certainly of no great concern. Anyway, channel balance is best adjusted by ear for the acoustic properties of the listening room, whatever the measurement may say.

Figure 1 shows overall analog frequency response. Again, it is well within the spec and is, in fact, flat within a

All in all I am confident that CD-I will play a dramatic role in the future...I give CD-I a thumbs up!

Harry Somerfield
San Francisco Chronicle

The Reviews

Okay. So we've told you that the Philips CD-Interactive is the next generation of both television and audio.

And we've gone on and on about our amazing selection of CD-I titles.

But because our opinion is, admittedly, more than a little biased, we wouldn't dream of asking you to settle for our word on it.

We would, however, like you to consider the opinions of electronics writers from coast to coast who've had the chance to see the Philips CD-Interactive system in action.

Review after review heralds CD-I as the future of home entertainment and a format that's here to stay.

Popular Science even went so far as to call it one of 1991's 100 greatest achievements in science and technology.

Of course, the opinion that matters most is, ultimately, yours. So we'd like to encourage you to take your own CD-I test drive. For the name of the Philips dealer nearest you, call **1-800-223-7772**.

This technology may well signal the start of a new era of interactive entertainment and education.

Brent Butterworth
Kenneth Korman
Video

Philips CD-I system is one of the year's 100 greatest achievements in science and technology.

"Best Of What's New"
Popular Science

Children can reap the benefits of CD-I too. Titles based on Sesame Street characters and Mother Goose rhymes, along with interactive coloring books and other educational games, stress the value of CD-I as a learning tool.

Frank Vizard
Rolling Stone

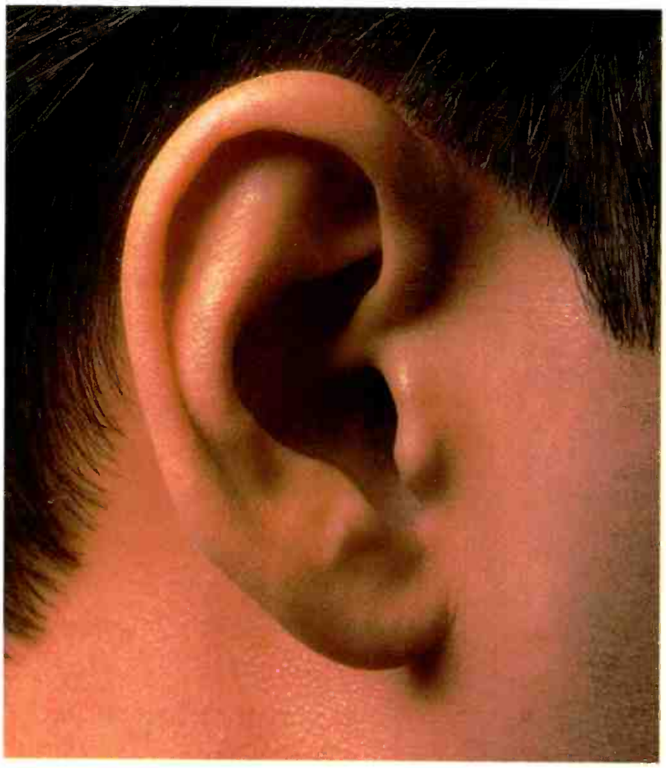
YES, IT SINGS! IT DANCES! IT TELLS YOU STORIES AND TAKES YOU PLACES YOU'VE NEVER BEEN BEFORE!

Johnathon Takiff
Daily News

CD-I also includes a photo CD standard which was jointly developed by Philips and Kodak for storing photos on CD. The image quality is as good or better than anything you'll see on cable TV.

Tom Malcom
Info Magazine

PHILIPS



Beauty is in the e

Serious music appreciation involves more than just your sense of hearing.

It involves your individual sense of taste.

Which is why we created a revolutionary new

DSP car audio unit. One that, when added onto your current system, lets you fine-tune your sound with a level of accuracy never before possible.

So that now you can hear music in a completely new way. The way *you* like it.

Introducing the Premier™ DEQ-7500 Digital Signal Processor from Pioneer.®

While most DSP units just let you choose different sound field options, the DEQ-7500 does something radically different. It actually corrects the deficiencies in your sound, caused by an imperfect car interior environment (everything from poor speaker placement to plush seats, which absorb sound waves). The result: our new DEQ-7500 gives you the premium sound performance your car's interior has been depriving you of.

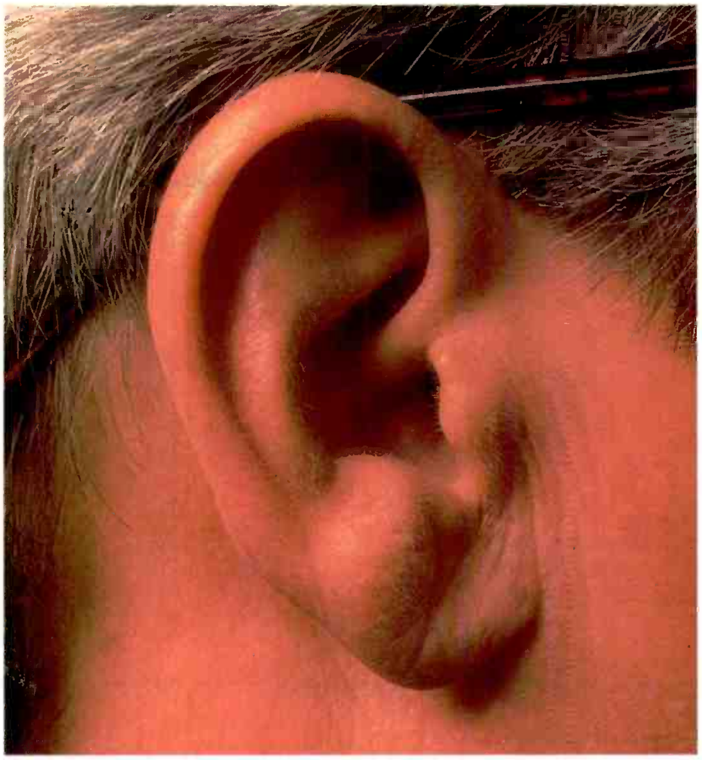
This is all made possible thanks to Pioneer's dual-chip Digital Signal Processor—high-powered integrated circuitry that carries out thousands of complex functions, all in a unique three-step process.

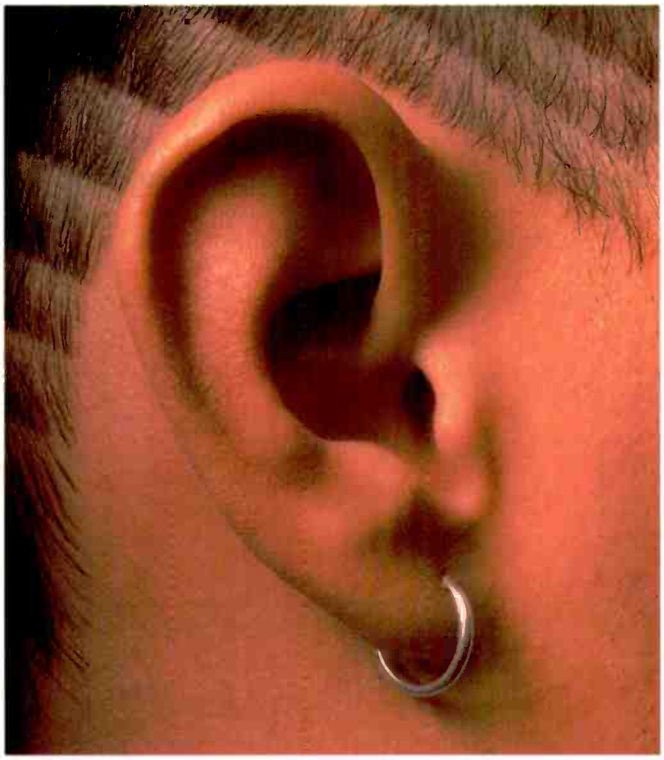
Step one: Correcting your existing sound.

The DEQ-7500 lets you choose between four-band, 1/3 octave parametric EQ or seven-band graphic EQ, to dial in the best overall sound characteristics for your particular car environment.

You can then add parametric bass and treble for even further refinement. And when you're all finished, save these critical adjustments with six user presets.

Step two: Having corrected your sound, you





ar of the beholder.

can then use the Listening Position Selector to move the center stage image around your car. So that no matter where you're sitting, it'll always sound like the best seat in the house. Once you've chosen the position you want, you can use the Image Focus Control for ultraprecise imaging and staging, particularly in vocals.

Step three: At last, you can start enhancing your sound. Choose from any of five listening environments: Studio, Jazz Club, Concert Hall, Cathedral and Stadium.

You can then further fine-tune your sound field, by adjusting the delay time and intensity within each of these particular venue modes.

Of course, while it's nice to sit here and read about the DEQ-7500, it's even better to sit behind the wheel and experience it for yourself. Which reminds us of one final step: visiting your nearest Premier dealer. He's part of a network of expert craftsmen who install and design sound systems with PREMIER the utmost care and attention to detail.

If you'd like more information regarding the DEQ-7500, as well as the name and address of the Premier dealer located closest to you, simply give us a call at 1-800-421-1601, extension 901.

And discover how nice it is to have an audio unit that adapts to your ears. Instead of the other way around.

PIONEER
The Art of Entertainment

In use, the Delta 110 proved an unalloyed joy—logical, handsome, and sonically pure.

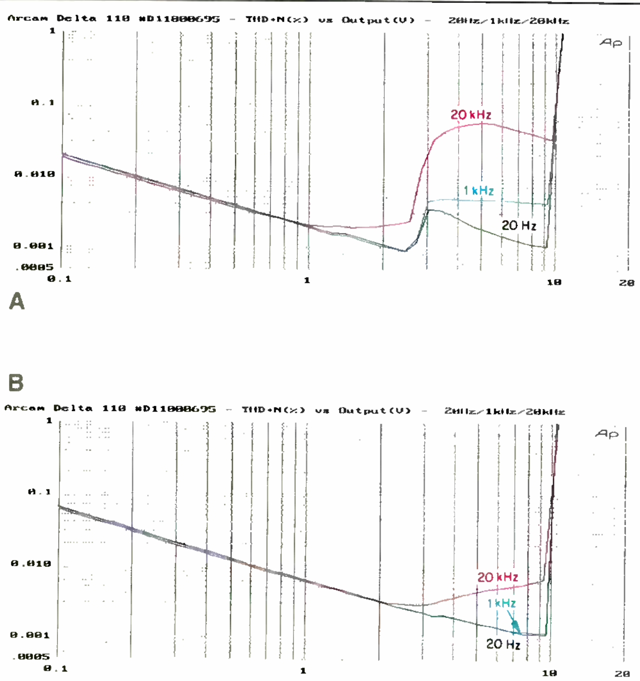


Fig. 4—THD + N vs. output voltage through the "Tuner" input, with gain set to 12 dB (A) and to maximum (B); see text.

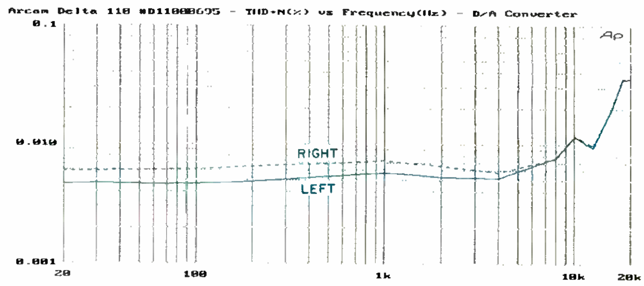


Fig. 5—THD + N vs. frequency through D/A converter, with output level set to 2 V.

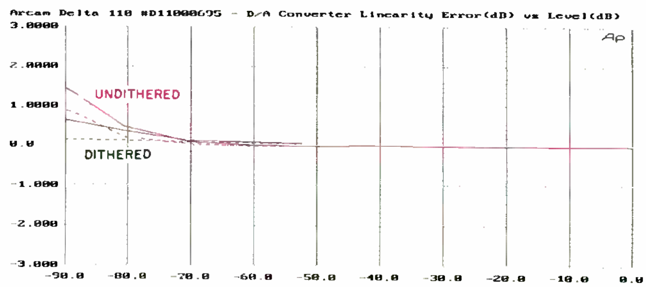


Fig. 6—Linearity error vs. level at 997 Hz, for dithered and undithered signals. Left channel shown by solid curve, right channel by dashed curve.

tiny fraction of 1 dB from 10 Hz to 10 kHz. The ultrasonic roll-off only makes very small demands (less than the specified 0.5 dB) within the audio range. The frequency response through the D/A converter (Fig. 2—which, unlike Fig. 1, is limited to the audio band) is very similar, with only minor ripples at the highest frequencies.

Figure 3 shows phono frequency response. The curves for MC cartridges (Fig. 3B) are, if anything, even marginally flatter than those for MM cartridges (Fig. 3A). The bass roll-off to attenuate spurious warp "information" in the near-infrasonic range is virtually universal these days; the extreme flatness elsewhere in these curves is harder to find in competing products.

Figure 4A, showing THD + N at three frequencies, gave us pause when we first saw it. Wherever possible (and appropriate), Diversified Science Labs follows the EIA/IHF measurement standard, which demands that testing conditions be as near to those in the real world as possible. For most measurements, the stipulations result in a volume setting that delivers a 0-dB gain (out of a possible 20.1 dB)—and, not incidentally, puts the volume control near the 9-o'clock position, which was used for most of the listening tests. For distortion measurements, however, volume is raised to yield a 12-dB gain. At this setting, the THD + N curves are all well within spec. Moreover, they demonstrate that distortion should be in the range from 0.001% to 0.003% for all typical peak signal levels—in other words, of no consequence whatever. But why do the curves start to take off near 2.5 V and "think better of it" above 3 V before finally hitting their limit above 9 V?

In looking at the actual distortion products involved, we could see that, at low levels, distortion is predominantly second harmonic. The increase in distortion just below 3 V was occasioned by a rise in the proportion of third harmonic, until it dominated the harmonic content. Clipping only begins above 9 V, as you would expect. It soon became apparent, however, that the amplitude of this increase in the third harmonic was dependent on the gain setting.

Figure 4B shows results for THD + N with the volume control wide open, for the full 20.1-dB gain. The noise level is higher (the downward sloping curves) because of the higher setting, but the anomaly above 2.5 V has entirely disappeared! The gradual rise in the 20-kHz curve at higher levels is attributable to slew-rate limiting but is of no conse-

Arcam's D/A converter is among the best I've heard, making harsh CDs behave and revealing new felicities in good discs.

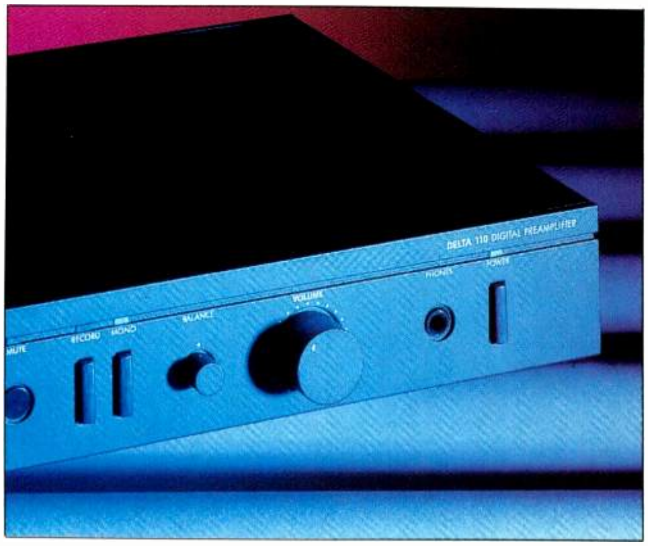


Table I—Miscellaneous test data.

Parameter	Tuner Input	Phono Input MM	Phono Input MC
Input Clipping Level	3.15 V	66 mV	4.4 mV
Input Impedance	45 kilohms	47 kilohms + 120 pF	270 ohms
Voltage Gain	20.1 dB	53.5 dB	77.1 dB
Sensitivity (re: 500 mV)	49.3 mV	1.06 mV	71 μV
A-Wtd. Noise from 22 Hz to 22 kHz (re: 500 mV Out)	−101.1 dB	−77.3 dB	−75.8 dB
Unwtd. Noise from 22 Hz to 22 kHz (re: 500 mV Out)	−98.5 dB	−71.5 dB	−70.0 dB
Channel Separation			
At 100 Hz	103.2 dB	77.1 dB	58.0 dB
At 1 kHz	83.7 dB	74.4 dB	67.8 dB
At 10 kHz	63.8 dB	58.8 dB	60.7 dB
Tape Record Output Voltage	730 mV	340 mV	570 mV

Maximum Output Level: Main, 10.4 V; headphone, open circuit, 9.3 V; headphone, into 50 ohms (27.8 mW), 1.18 V.

Output Impedance: Main, 50 ohms; tape, 75 ohms; headphone, 185 ohms.

Muting: 48.3 dB.

Notes

1. Measurements made on one channel were made on the left channel.
2. With the exception of gain and sensitivity (which were measured with maximum gain and no load on the preamp), volume was set in accordance with the IHF/EIA Standard and outputs were terminated in 10 kilohms plus 1,000 pF.
3. From the "Tuner" input, with balance centered and volume set per IHF/EIA Standards, the right channel's output was 0.3 dB greater than the left channel's.

quence; any signal that delivers 20 kHz at this level must be considered abuse—of your tweeters, if nothing else.

So we know that the phenomenon is one that would not show up at all in full-gain testing (which is not uncommon), and presumably it is caused by distortion in the input stage. No rational use of the preamp would call for leaving the volume control at maximum, and the anomaly should not be audible even at normal volume settings. It is merely a testing curiosity.

The THD + N curves in Fig. 5 were made through the D/A converter with output set to 2 V. There is some distortion increase in the ultra-highs, as you might expect from Fig. 4, but again it is too low to be of consequence. The linearity curves of Fig. 6, with the curves for dithered signals superimposed on those for undithered signals, are excellent. As signal level drops, distortion becomes an increasingly greater percentage of the decreasing signal, producing the characteristic increase in nonlinearity as the signal level approaches the limit of the 16-bit medium's resolving power. This increase, however, is ameliorated by the use of dithering. Absolute values of the distortion products actually are highest at maximum signal levels but remain about 84 dB (worst case) below a 0-dB signal at 1 kHz (actually, 997 Hz) in the measurements.

Use and Listening Tests

Using the Delta 110 was an unalloyed joy. Its design is handsome, logical, and sonically pure. Beyond that, there really is little that need be said.

Naturally, the focus of the listening was on the D/A converter, as the most unusual element in the preamp. The CDs that I always test with, because they can sound a mite harsh or strident on some players, were as well behaved here as I've ever heard them. Those with more ingratiating sonics stood to profit less, but they frequently revealed small felicities that had not been apparent before. Simply put, this D/A converter is among the best I've heard.

With my equipment, signals passing through the converter sounded, subjectively, somewhat lower than those from the tuner or tape deck. However, only a minor level adjustment, if any, was required to rectify this. And, of course, the remote makes the adjustment easier with the Delta 110 than it is with most audiophile-class preamps.

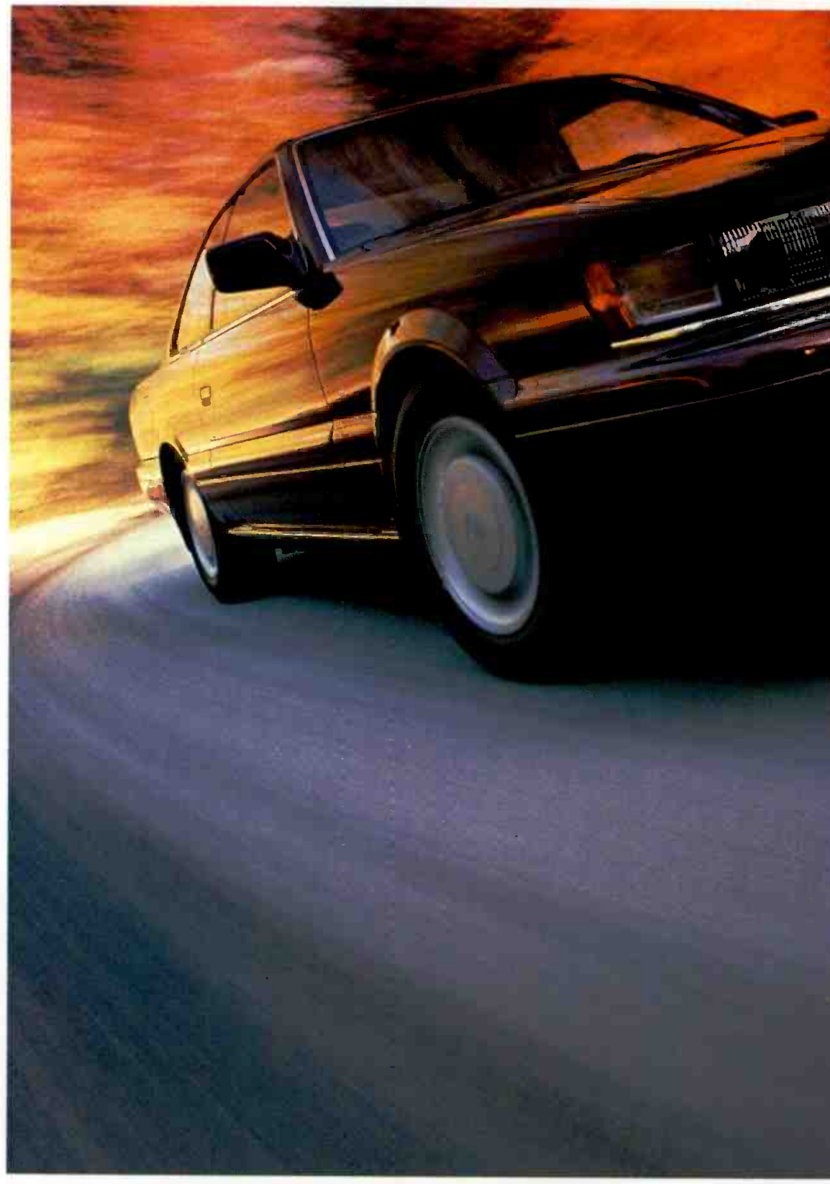
Incidentally, the tape outputs on the reviewed sample remained live even in "Standby" mode, despite the contrary implication of the manual, so you can record from a timer (assuming your deck can handle it) without turning on the preamp. From the measurement of tape output impedance, it's evident that the outputs are buffered, which prevents ancillary equipment from loading down the listening path. Therefore, more than just the power supplies appear to remain active in "Standby."

Available information about the internal workings of the Delta 110 was rather sparse. For testing purposes, this is possibly a good thing; fiery descriptions of arcane circuitry can prove to be more of a smoke screen than a source of illumination. And in the end, it is the results that matter, not the means by which they are achieved. The results in this case are extremely gratifying.

Robert Long with Edward J. Foster

Compact Disc: On a Roll.

CD Takes a Road Trip.



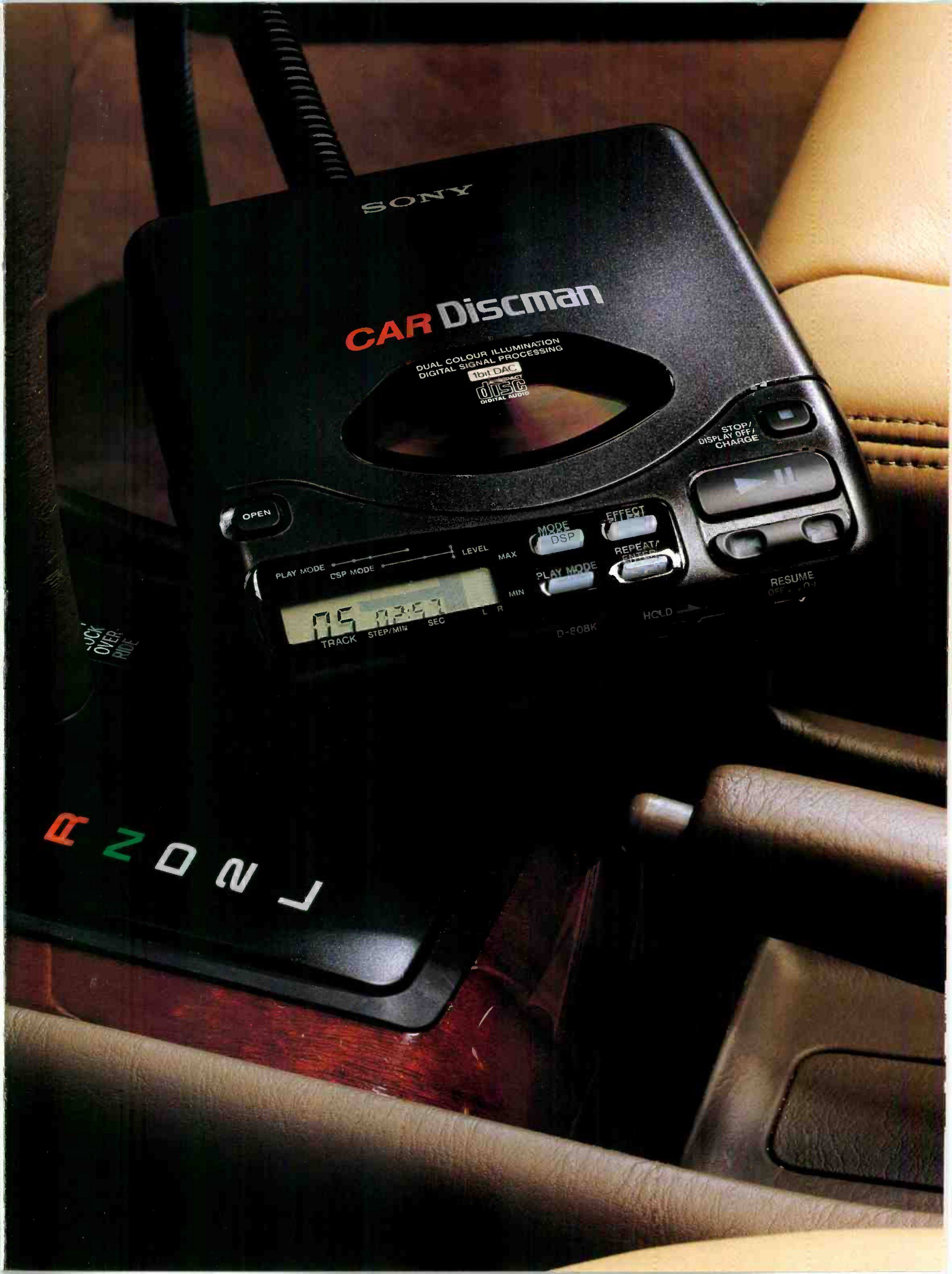
Grab your driving gloves, your darkest shades and a few of your favorite CD's. Come with us as Sony celebrates the 10th Anniversary of the Compact Disc the best way we know how. By taking to the streets. Because your car is the ultimate place to enjoy the ultimate sound. In fact, we had your car in mind when we first introduced the Compact Disc 10 years ago.

You see, when Sony invented the Compact Disc, we knew the brilliance of digital audio would make any car stereo system sound its best. The CD's resistance to dust, dirt, fingerprints and scratches was ideal for the less-than-clinically clean car environment. Even the CD itself—at 4¾ inches in diameter—was just the right size for car CD players.

Americans have already bought over 40 million CD players and 1 billion CD's. So we know that many of you have CD's at home. But if you're not enjoying CD in the car, you're missing half the fun. Why miss out? Putting CD in your car is easier than ever. It's also far less expensive, thanks to a new generation of Sony car CD players and our Car Discman® models. These versatile performers go anywhere: home, outdoors or into your car. On the road, a Discman player can be powered from your cigarette lighter and delivers music to your car stereo system by way of an ingenious cassette adaptor.

Of course, Sony Discman players were the worlds' first CD portables. So it's no surprise that today's Discman designs enjoy all the best: the sonic quality of 1-bit pulse converters, the sonic tailoring of Digital Signal Processing (DSP) and the convenience of 22-track programming. Even the buttons are carefully considered: they're back-lit for easy use at night. Just another way car Discman players make the song of the open road infinitely more alluring.

DIGITAL SIGNAL PROCESSING (DSP) LETS YOU ADJUST THE SOUND WITH THE DIGITAL PRECISION.



SONY
CAR Discman
DUAL COLOUR ILLUMINATION
DIGITAL SIGNAL PROCESSING
1bit DAC
DIGITAL AUDIO
OPEN
STOP/
DISPLAY OFF/
CHARGE
PLAY MODE
DSP MODE
LEVEL
MAX
MIN
MODE
DSP
EFFECT
REPEAT/
PLAY MODE
RESUME
HOLD
TRACK
STEP/MIN
SEC
L R

For Higher Performance, Add a Dash of CD.

You say your old car stereo just doesn't make it anymore? You say you long for the clarity and convenience of Compact Discs? But you're not sure how to make the change? Well Sony, the company that introduced the world's first car CD player, has news for you. Moving up to Compact Disc is easy. Just replace your old car radio with a new Sony in-dash CD player.

It's a simple swap, because Sony included everything you need. There's FM. AM. CD. Even amplifiers to drive your speakers. And in-dash CD has never been more affordable.

Even Sony's lowest-price in-dash CD player offers sound and convenience far beyond the dreams of ordinary car stereo. Going up from there, it just keeps getting better. Sophisticated 1-bit pulse converters give your music new realism and resolution. Sony's anti-theft detachable faceplates, like the one pictured here from our CDX-U8000, fit in your pocket. They leave behind an inconspicuous and inoperable black box. With selected models, our optional wireless remote controls add a touch of fun—making mobile entertainment more entertaining.

And you can always add amplifiers, equalizers, crossovers and speakers, to build an autosound system of sonic brilliance and gut-wrenching power. After all, with the best sound source on wheels, you just naturally want to take full advantage.

WHEN YOU POCKET YOUR CD PLAYER'S FACEPLATE, IT'S FAR LESS LIKELY THAT SOMEBODY ELSE WILL POCKET YOUR PLAYER.


SONY
OFF
HIGH QUALITY MOBILE SOUND SYSTEM
WALKMAN
CDX-4040
LOUD
SENS
A.MEM/M.SCAN
MAX POWER 20W+20W
MUTE
SELECT
INTRO
REPEAT
SHUF
FM
AM
MANU
SEEK
AMS
CD

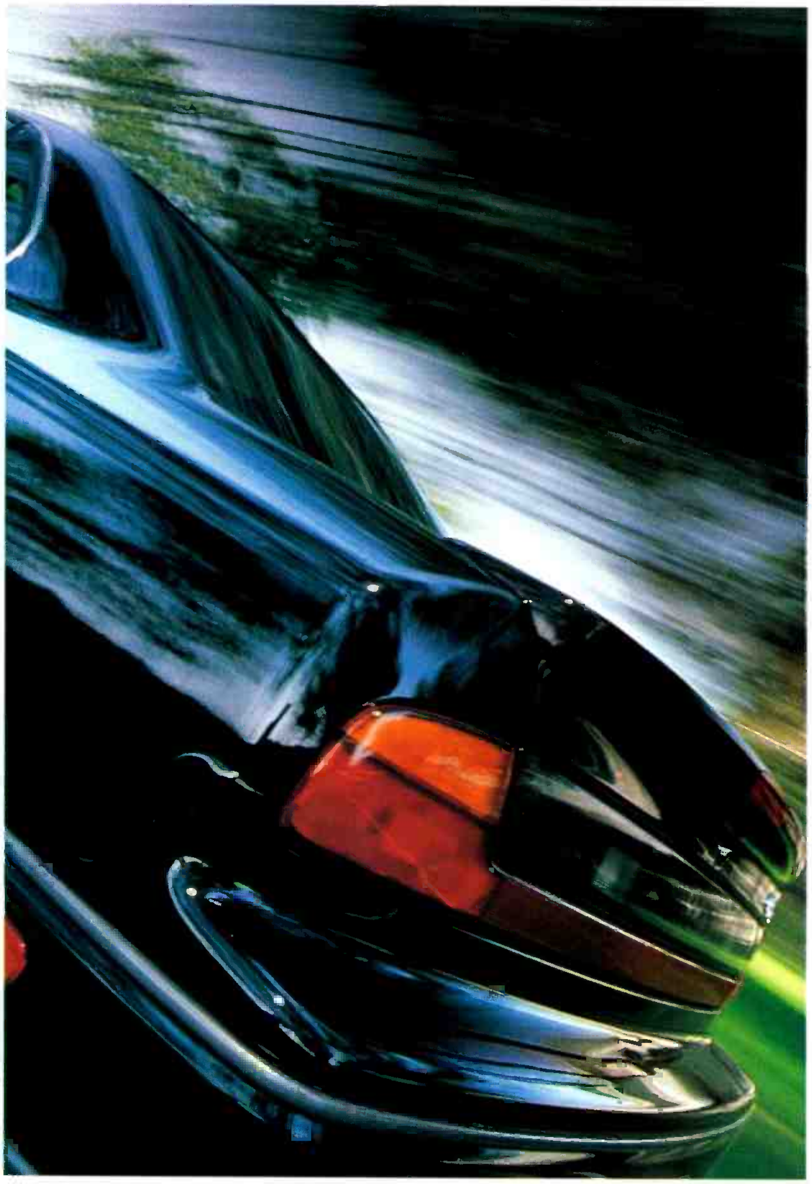
DiscJockey® CD Changers: Music for the Long Run.

If you like the idea of playing one CD, imagine playing ten. Suddenly, you've got more tunes, more options, more genres of music and more ways to have fun. A Sony DiscJockey® ten-disc changer lets you jump from disc to disc, without opening and closing jewel boxes. You can mount a ten-disc changer safely out of sight. And you can run the whole show from an inconspicuous remote control.

With Sony, you can have it all quite easily. You see, we invented car CD changers. And that explains why Sony has so many different ways to enjoy them.

Want to add a CD changer to your existing car stereo? No problem. We have many models that will connect with ease. Want to build a new system around your CD changer? You can do that, too. Want to have it all: AM, FM, cassettes and CD? We have a choice of cassette/receivers with CD changer control.

What's more, our Custom File™ system even tells you which disc is playing. Instead of a simple readout of "Disc 2" or "Disc 9," an 8-character display lets you assign each of your discs titles like "BEETH-9 or "BLUES." Making this one feature you'll appreciate miles down the road.



A SONY CASSETTE/RECEIVER WITH CD CHANGER CONTROL. NOTE THE DISCS IN YOUR CHANGER DON'T JUST HAVE NUMBERS. THEY HAVE NAMES.

DISCJOCKEY 10-DISC MAGAZINES AREN'T JUST FOR THE CAR. THEY'RE EQUALLY AT HOME IN SONY HOME 10-DISC CHANGERS.

10 DISC MAGAZINE
BSL MOTOR/UNILINK SYSTEM COMPACT DISC CHANGER
COMPACT disc DIGITAL AUDIO
10 COMPACT DISC MAGAZINE
DISC AUTOMATIC CHANGER
SONY

MOBILE ES: Where Car Stereo Is.

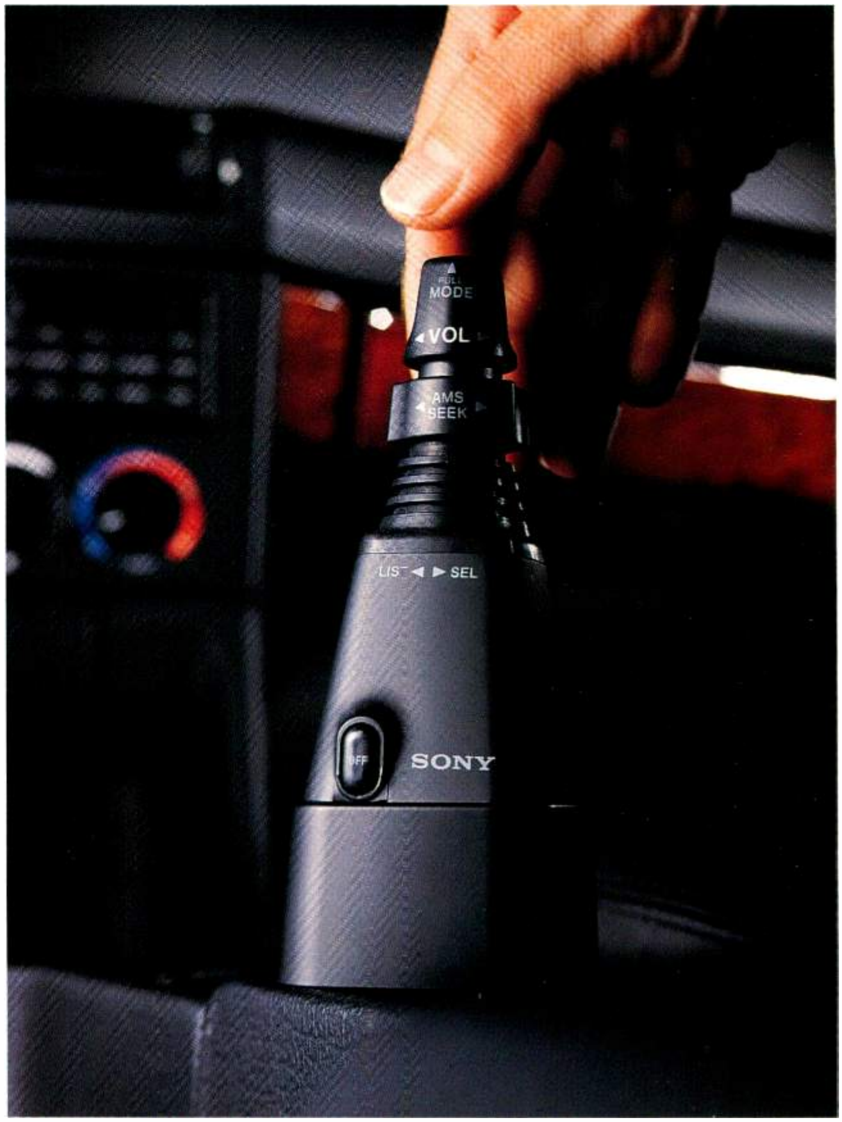
Mobile ES: Where Car Stereo Is Heading.

Many consider CD the last word in car stereo. But at Sony, it's just the beginning. Our Mobile ES extends CD's digital technology throughout the entire car stereo system—a breakthrough of profound proportions. In fact, high fidelity critic Len Feldman proclaimed that Mobile ES, "may well be the most revolutionary concept to hit car audio in decades."[1]

Mobile ES starts with Sony's finest DiscJockey CD changer, and continues with Digital Signal Processing (DSP) preamplifier, digital crossover and frequency-optimized amplifiers. Taking it all in, *Car Stereo Review* exclaimed, "Add Mobile ES to topnotch speakers and you finally may have a system that won't need upgrading in your lifetime."[2]

All of which strongly suggests that Company Disc is not simply the car stereo format for today. It's also the format of the future.

THE MOST ADVANCED SYSTEM IN AUTOSOUND DESERVES THE MOST ADVANCED DISPLAY: THE 15,000-PIXEL MOBILE ES SYSTEM DISPLAY.



RELAX AND KEEP YOUR EYES ON THE ROAD. THE MOBILE ES JOYSTICK LETS YOU OPERATE THE SYSTEM ENTIRELY BY FEEL.

1Len Feldman quote from the April/May 1991 issue of *Jazziz*. Reprinted with permission.

2*Car Stereo Review* quote by Bill Wolfe, appearing in the September/October 1991 issue. Reprinted with permission.

SONY

Sony Corporation of America
National Operations Headquarters
Sony Drive, Park Ridge, New Jersey 07656

3

VANDERSTEEN 2Ci SPEAKER

Manufacturer's Specifications

Drivers: 10- and 8-in. cone woofers, 4½-in. cone midrange, and ¾-in. metal-dome tweeter.

Frequency Response: On axis, 28 Hz to 29 kHz, ±3 dB, or 32 Hz to 21 kHz, ±1.5 dB; 90° off axis, 29 Hz to 16 kHz, ±3 dB.

Sensitivity: 88 dB SPL at 1 meter with 1 watt of pink noise applied.

Crossover Frequencies and Filter Characteristics: 600 Hz (6 dB/octave, Butterworth) and 5 kHz (6 dB/octave, Linkwitz-Riley).

Impedance: 7 ohms, ±3 ohms, from 100 Hz to 20 kHz; 4 ohms minimum.

Recommended Amplifier Power: 40 to 160 watts per channel.

Dimensions: 16 in. W × 36½ in. H × 10¼ in. D (40.6 cm × 92.7 cm × 26 cm); optional base, 16¼ in. W × 6¼ in. H × 13¾ in. D (41.3 cm × 15.9 cm × 34.9 cm); Model 2Ce (see text), 16 in. W × 39¾ in. H × 10¼ in. D (40.6 cm × 101 cm × 26 cm).

Weight: 63 lbs. (28.6 kg) each; Model 2Ce, 60 lbs. (27.2 kg) each.

Price: $1,295 per pair; optional bases for Model 2Ci, $125 per pair.

Finish: Oiled walnut or oiled oak; oak with black semi-gloss lacquer, $50 extra.

Grille: Black, brown, or taupe fabric.

Company Address: 116 West Fourth St., Hanford, Cal. 93230.

For literature, circle No. 92

Vandersteen Audio's Model 2 series has been in continuous production, with updates, since 1977. As this review goes to press, the 2Ci version that I tested is being superseded by the 2Ce, in a taller and narrower cabinet designed to improve the system's appearance. The new cabinet should extend low-frequency performance slightly, but other aspects of performance should remain the same.

Vandersteen has always had a good reputation for producing relatively inexpensive systems with high-end aspirations. The company pioneered the use of so-called baffleless driver mountings—a misnomer, actually, as the drivers are mounted in small, individual enclosures with minimum frontal area, stacked one on top of the other. Richard Vandersteen points out that a speaker can be considered as

Careful alignment of the system's drivers, plus good crossover design, pay off in a phase curve that stays within a ±45° envelope.

baffleless—that is, omnidirectional—at any frequency whose wavelength is more than four times the enclosure's largest horizontal dimension. This design, along with smoothly contoured front baffle surfaces, is said to "virtually eliminate the negative effects of diffraction and refraction." Other systems using this technique are the KEF 107 (*Audio*, Feb. 1988) and the B & W 801 Matrix Series 2 (Nov. 1990).

To maintain proper time and phase response, the individual sub-enclosures of all Vandersteen full-range systems are staggered backward, and pure first-order crossovers are used. The direct sound from this type of design is minimum-phase (having no phase anomalies not directly related to frequency response) and thus preserves time waveshapes if the response is sufficiently flat.

The construction of the 2Ci is quite unusual: What appears to be a conventional, rectangular enclosure on the outside is actually a grille cloth wrapped around a frame

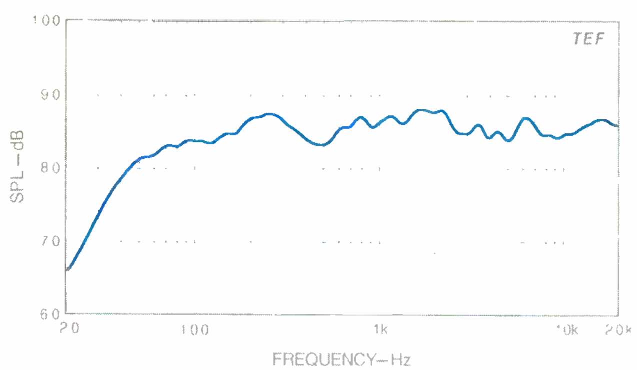


Fig. 1—One-meter, on-axis, anechoic frequency response, for an input of 2.83 V rms, equivalent to 1 watt into 8 ohms.

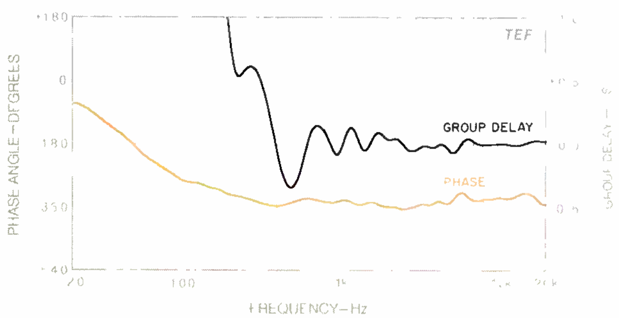


Fig. 2—On-axis phase response and group delay, corrected for tweeter and midrange arrival time.

that supports the assembly of three enclosures housing the system's drivers and crossover. This construction technique is economical, because only the top and bottom plates of the cabinet have furniture finishes. Some sound also escapes through the top panel, via a 5 × 12-inch grille.

The top and bottom panels are separated by four wood dowels, 1¼ inches in diameter, that form the outside of the frame. The inside enclosure assembly is mounted to the lower panel and rigidly attached to the dowels with a bracing panel that runs around the top of the woofer enclosure. The low-frequency system incorporates two woofers, an 8-inch unit mounted on the top front of the woofer enclosure and a 10-inch "acoustic coupler" mounted on the bottom rear of the same enclosure. Both drivers are mounted in a sealed, common air chamber.

Both woofers have die-cast baskets. They use multi-layer voice-coils, 1½ inches in diameter, on ventilated aluminum-coil formers. The front woofer has a curvilinear cone made from a plastic material Vandersteen calls "polycone." The rear woofer, which covers the range from 28 to 35 Hz, has a damped long-fiber paper cone with an added 5¼-inch-diameter wooden disc covering its center to increase the mass and stiffness of the driver.

On the top of the woofer enclosure is a smaller enclosure, set back somewhat and slanted upward, housing the 4½-inch midrange. This speaker also has a curvilinear plastic cone but with an unusual flat surround rather than the typical half-roll surround; this is said to minimize surround reflections. The tweeter, which has a damped metal dome, ¾ inch in diameter, is in its own enclosure, atop the midrange enclosure. The front is covered by a felt shroud that drops down to the top front of the midrange enclosure. This shroud serves to minimize reflections from the face of the tweeter enclosure and from the top of the midrange box, which is exposed because of the tweeter enclosure's offset to the rear.

Vandersteen highly recommends using the 2Ci on its optional metal base, which can be filled with sand to add weight and damping. The base also elevates the system to the proper height for the ears of a seated listener.

Wire-wound level controls for the midrange and tweeter are on the rear of the speaker. Connection to the system is through two pairs of banana jacks (not the usual five-way binding posts) on the rear, providing separate access to the mid/high- and low-frequency sections of the system. This facilitates bi-wiring. As the jacks cannot accept wire or spade lugs, Vandersteen supplies two double-banana plugs for the user to wire up.

Measurements

Figure 1 shows the anechoic on-axis frequency response of the Vandersteen 2Ci. Measurements were taken at 2 meters, 36 inches from the bottom of the system's optional base, with 2.83 V rms applied, and then referenced to 1 meter. The response below 300 Hz was derived from ground-plane measurements taken at several points around the system. The rear-mounted bass radiator mandated these multiple measurements, all of which were taken with the midrange and tweeter controls set to the "0 dB" mid position.

State-of-the-art jewels from AudioQuest.

AudioQuest® cables and plugs are distinguished by intelligent designs, the finest metals and superior insulation. Emerald™ uses 99.99997% pure copper, Lapis™ and Diamond™ use pure solid silver. All three are resistance welded to direct-gold plated FPC copper plugs (RCA or XLR). From Turquoise™ through Diamond, AudioQuest makes seven jewels you will appreciate and enjoy everyday — not just on special occasions.

audioquest®

P.O. Box 3060, San Clemente, CA 92674 USA Tel: 714/498-2770 Fax: 714/498-5112

The low-frequency design works very well, its solid enclosure revealing no major cabinet resonances or air leaks.

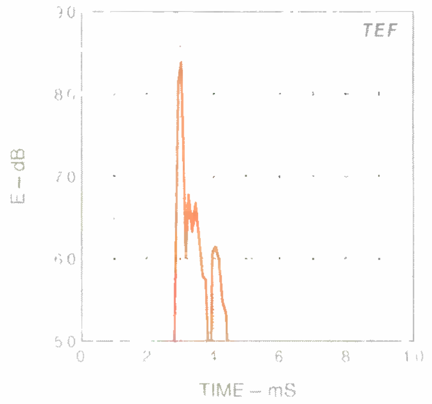


Fig. 3—One-meter, on-axis energy/time curve.

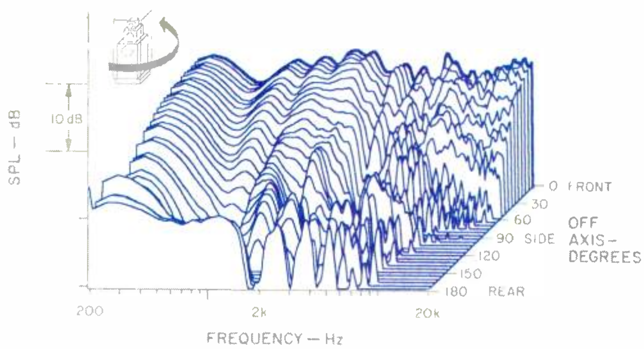


Fig. 4—Horizontal off-axis frequency responses, taken from the front, around the side, and to the rear of the speaker.

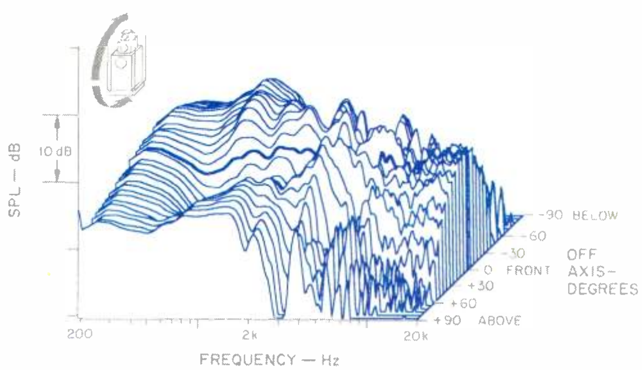


Fig. 5—Vertical off-axis frequency responses, taken from below, up the front, and to the top of the speaker.

Salient points of the on-axis curve include a somewhat rough overall response, a gentle peak-dip combination at 250 and 500 Hz, and a sensitivity of 86 dB (averaged over the four-octave range from 250 Hz to 4 kHz), moderately lower than rated. The curve fits within a fairly tight, ±2.5 dB window from 70 Hz to 20 kHz and is 10 dB down at 35 Hz. Below 40 Hz, the response rolls off at about 18 dB/octave. A right/left comparison (not shown) revealed a close, ±0.5 dB match except for a narrow band between 3 and 4 kHz, where the levels differed by ±1 dB. Note that all measurements were taken with the grille on, as it is not designed to be removed.

The phase and group-delay responses of the 2Ci, referenced to the midrange and tweeter arrival time, are shown in Fig. 2. The phase curve stays within an admirably tight envelope of about ±45° all the way from 180 Hz to 20 kHz. The careful alignment of the system's drivers, coupled with the design of the crossover, pays off here. The group delay is also commendably flat over the range from 600 Hz to 20 kHz, a further indication of how well the system is aligned. The undulations between 400 Hz and 2 kHz, and the rise below 400 Hz, correspond not to driver misalignment but to minimum-phase aberrations caused by the non-flatness of the frequency response (including the system's bass roll-off). If the system were equalized flat with a minimum-phase equalizer, the phase and group-delay responses would also be corrected.

The system's energy/time response is shown in Fig. 3. The aligned nature of the 2Ci contributes to a very tight main arrival at 3 mS. The decay is marred only by some later arrivals, 17 and 22 dB down from the main peak. The space-frame construction may be responsible for some of these later arrivals.

Figure 4 displays the horizontal off-axis responses of the 2Ci; the on-axis curve is shown in bold at the rear of the graph. The horizontal coverage is quite good, as the on-axis curve's shape is carried over quite uniformly off axis. Even out to ±45°, high-frequency coverage to 15 kHz or higher remains quite similar to the output on axis.

The vertical off-axis curves are shown in Fig. 5. In the center of the graph (front to rear), the on-axis curve is shown in bold, with the above-axis responses in the front of the display. The mostly flat on-axis response is partially obscured by off-axis aberrations.

Up/down asymmetries are clearly shown in the off-axis responses in the vicinity of the lower crossover, between 400 and 800 Hz, where the response above axis is depressed and the response below axis is actually several dB higher than the on-axis response. This asymmetry is the main indication of strong lobing, which denotes that the acoustic phase difference between the woofer and midrange (or midrange and tweeter) approaches 90°. This asymmetrical behavior is a direct result of the first-order, 6-dB/octave crossovers used in the 2Ci. Other systems that utilize this type of crossover also exhibit very nonuniform, vertical off-axis behavior.

Figures 6 and 7, respectively, show the NRC-style mean horizontal and vertical on- and-off axis responses. The upper part of Fig. 6 also shows the individual on-axis curves that were averaged to yield the ±15° on-axis curve, which is

The driven rear woofer makes the bass system act like a passive-radiator system 80% larger than its actual size.

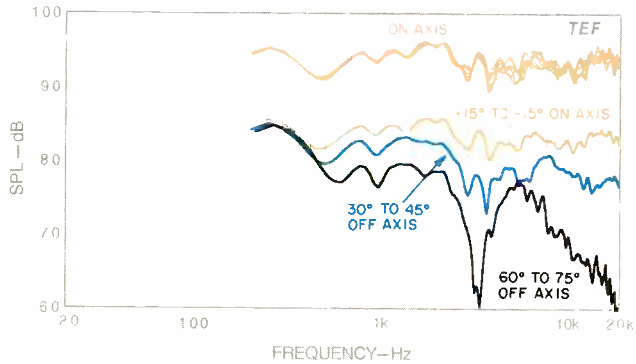


Fig. 6—Mean horizontal responses derived from data of Fig. 4 (lower set of curves) and composite of horizontal responses from +15° to −15°, taken every 5° (upper set of curves). The upper set, which has been shifted up 10 dB for clarity, was averaged to yield the +15° to −15° on-axis mean curve.

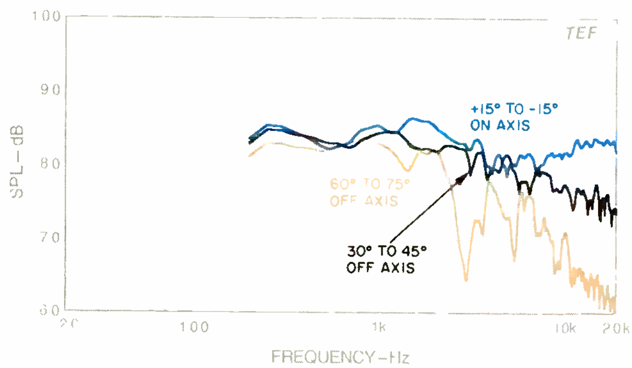


Fig. 7—Mean vertical responses derived from data of Fig. 5.

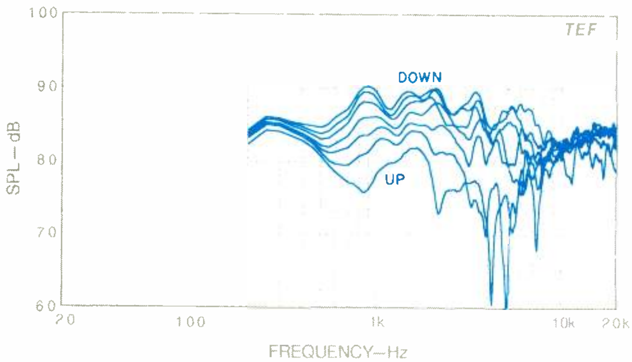


Fig. 8—Composite of vertical responses from +15° to −15°, taken every 5°. These responses were averaged to yield the vertical +15° to −15° on-axis mean curve shown in Fig. 7.

fairly smooth and quite similar to the on-axis response of Fig. 1. The composite on-axis responses group very close together (well within ±1 dB over the whole range), which indicates excellent horizontal off-axis coverage in the primary angular listening range. The 30° to 45° mean response is similar to the on-axis curve but with reduced level from 2.5 to 7 kHz, the upper crossover range. Minimal roll-off above 10 kHz is noted. The 60° to 75° off-axis response, however, exhibits a deep hole at 3.5 kHz, with heavy roll-off above 8 kHz. The physical offset of the drivers, inherent in a staggered aligned-in-time system design, contributes to poorer horizontal off-axis response.

Figure 7 shows the mean vertical responses of the 2Ci. The vertical on-axis curve is very similar to the corresponding horizontal curve but has a slight depression between 3.5 and 8.5 kHz, near the upper crossover region. The apparent smoothness and extension of the mean vertical response is deceptive; as seen in Fig. 8, the individual curves that were averaged to yield the on-axis curve of Fig. 7 actually show extreme variations. The variation of these curves—about 10 dB between 700 Hz and 8 kHz and nearly 25 dB in some ranges—is quite evident when compared to the very tight horizontal composite in the top of Fig. 6. This response is in the upward direction and experienced clearly by standing listeners.

Overall, the 30° to 45° mean response in Fig. 7 is surprisingly uniform but exhibits some roughness and a general decrease in level as frequency increases. The 60° to 75° mean vertical response is quite rough and rolls off strongly above 7 kHz, however. As before, the individual curves that make up both these mean curves are very irregular.

As I was not familiar with the 2Ci's low-frequency system design, I was interested in finding out how well it worked. My investigation showed that it works very well indeed. A high-level, low-frequency sine-wave sweep revealed a very solid enclosure with no significant cabinet resonances or air leaks. The whole assembly is quite inert! The system's woofers did not exhibit any dynamic offset effects, a good and uncommon trait.

Separate near-field measurements of the front and rear woofers revealed that the 2Ci behaves very much like a vented-box (bass-reflex) system, with the rear woofer acting as the port. In this situation, however, the rear woofer performs the function of a passive radiator but is actively driven. I performed a second set of near-field measurements with the rear woofer disconnected, thus converting the system into a true passive radiator. (This test was not quite accurate, because the network driving the rear woofer was still connected internally to the rest of the system.) The rear woofer's bandpass response shape and location were essentially unchanged by this operation, but when reconnected, its output level was raised by about 5 dB. This corresponds to the performance of a pure passive-radiator system with an enclosure 80% larger, a nice trick! Doubling the box volume in a vented-box (or passive-radiator) system will theoretically increase the vent's output by 6 dB, assuming that the system's tuning frequency is held constant by adjusting the vent.

A vector sum of the near-field responses of the front and rear woofers indicated that the 3 dB-down point of the

So Who Are We To Argue? Introducing The NEW Hafler Trans•*nova*

There is something "very right" about tube sound. Audiophiles know it, musicians know it, so who are we to argue? We don't. Jim Strickland, Hafler's chief engineer, has created "tubey" sounding solid state circuitry for Hafler's new Models 9300 and 9500 power amplifiers. A unique drive stage allows the lateral MOSFET output devices to be connected just like tubes! In fact, this new **trans•*nova*** circuitry is so unique, it's patented.

As with the rest of the new Series 9000 line, the **trans•*nova*** amplifiers share the same elegant sonic quality, simplicity in design, modesty in price, reliability, and an unprecedented 7-year warranty!* We know you'll hear the distinction immediately. *Audition the new Models 9300 and 9500* **trans•*nova*** *amplifiers at your local Hafler dealer and hear incredible tube sound... **without the tubes.***

Model 9500

Hafler®

"THE AFFORDABLE HIGH END"

Hafler, A Division Of Rockford Corporation
Tempe, Arizona 85281 U.S.A. 1-800-366-1619
In USA, Fax (602) 894-1528
In Canada, Call Korbon Trading (416) 567-1920
In Europe, Fax (49) 421-487-877
In Pacific Asia, Fax (65) 339-0363

*7-Year warranty valid only in the USA

Enter No. 15 on Reader Service Card

The 3-meter room response is well behaved and fits within a relatively compact, ±3.4 dB window from about 100 Hz to 20 kHz.

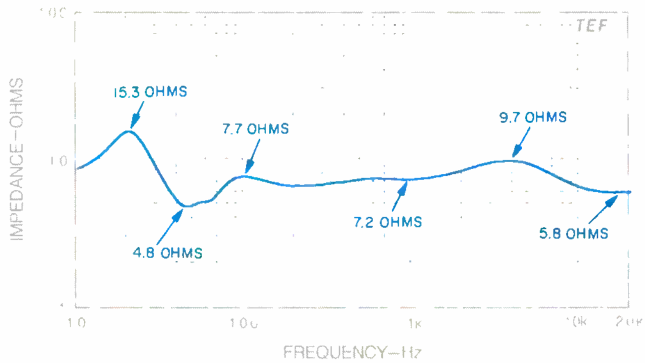


Fig. 9—Impedance.

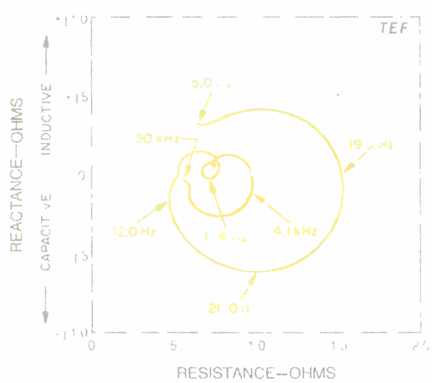


Fig. 10—Complex impedance, showing reactance and resistance vs. frequency.

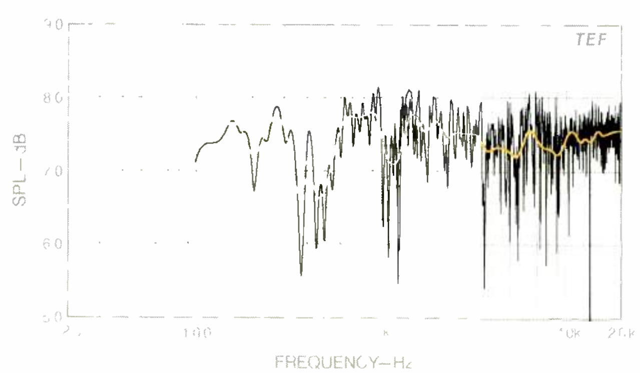


Fig. 11—Three-meter room response, showing both raw and smoothed data.

overall response is extended downward from 51 Hz to 43 Hz when the rear woofer is connected! You don't get something for nothing, however; the extra expense of the functional rear woofer must be considered, along with the decreased low-frequency impedance of the system and its consequently greater power draw.

At high levels, with the rear woofer connected, the front woofer's excursion exhibited a sharp reduction in displacement at the 2Ci's 38-Hz vented-box resonance frequency, a characteristic of properly functioning vented-box systems. At and near this frequency, most of the sound energy is radiated from the rear woofer. The system exhibited minimal extraneous noises at high input levels throughout the low-frequency range. Both woofers overloaded gracefully.

The Vandersteen could handle signal levels in excess of 10 V rms (14.3 watts into 7 ohms) at infrasonic frequencies without generating any unacceptable noises. The 8-inch front woofer's linear excursion capability was a healthy 0.5 inch, peak to peak, while the 10-inch rear woofer could displace an even higher 0.6 inch, peak to peak, before sounding stressed.

The woofer-protection circuitry was triggered above about 18 V rms (46.3 watts into 7 ohms) at 38 Hz. From a cold start, at this frequency and level, it took about 20 S to engage. The woofers' level was then smoothly and quickly decreased to low levels, while the LEDs on the front panel illuminated. After a pause of 10 to 20 S with no power applied, the woofers were reconnected.

The low-frequency enclosure is filled with a white batting-like material. The complete enclosure is substantial—at least ¾ inch thick and made from a material Vandersteen calls "multi-fiber," which appeared to be similar to high-grade, medium-density fiberboard. The whole assembly is very amply braced, and the driver enclosure's side walls are mostly nonparallel.

The crossover of the 2Ci includes a substantial 29 parts: Four inductors, 13 capacitors (effectively eight, due to paralleled elements), and 12 resistors including the two controls, plus some miscellaneous parts in the protection circuitry. Parts quality was high, and heavy-gauge wire was used to connect the drivers. All connections were soldered. The crossover is wired on a p.c. board attached to the inside of the rear panel, behind the front woofer. The crossover consists entirely of first-order filters, with heavy use of impedance-correcting networks across each driver. Separate near-field measurements revealed that the upper crossover is at about 3 kHz.

The front woofer is high-passed at about 40 Hz with a 500-μF capacitor, while the rear woofer is low-passed at about 65 Hz with a large, iron-core, 20-mH inductor. The high and low portions of the crossover are connected to the rear panel separately to facilitate bi-wiring.

At very low frequencies (below 10 Hz, including d.c.), the front and rear woofers are 180° out of phase. When I applied a positive battery wire to the positive terminal of the system, to check the displacement and polarity of the woofers, I was surprised that the front woofer moved a fixed amount out of the box, while the rear driver moved a fixed amount into the box. This implied to me that not only were the woofers 180° out of phase, but the capacitor (which cannot pass d.c.) in

The only reason not to buy an Onkyo Pro Logic Receiver is if you're into antiques.

The World's First Full Digital Dolby Pro Logic Receiver

Onkyo's new Integra TX-SV909PRO offers home theater performance so advanced, other receivers are destined for some unhappy endings.

The TX-SV909PRO is the world's first receiver to feature a full digital Dolby Pro Logic surround decoder. The technical benefits are significant: improved signal-to noise ratio, lower distortion and greater separation. To your ear this means Dolby surround sound that is identical to a first class theater, with pinpoint imaging of all dialog, music and sound effects.

The TX-SV909PRO is also the world's first receiver to incorporate the acclaimed Ambisonic Surround Sound System, which is to music what Dolby Pro Logic is to movies. The Ambisonic process recreates a 360° soundstage, with a seamless, natural transition from the front to rear speakers. Ambisonic recordings (such as those on the Nimbus label) played back through the decoder on the TX-SV909PRO deliver a sense of musical time and space that is more lifelike than anything you've ever heard.

The high technology found in the TX-SV909PRO can only be achieved by Onkyo's dedication to uncompromised engineering. That's why the TX-SV909PRO features 7 Discrete Power Amplifier Sections and 3 Independent Heavy-Duty Power Transformers. True Multiple Room/Multiple Source capability is assured via this 7 channel design as well - you can have full 5 channel Pro Logic in your home theater/media room while someone in the bedroom listens to a CD in stereo.

In addition to the TX-SV909PRO, Onkyo offers an entire family of advanced Pro Logic Receivers. Which means if you're looking for unequalled home theater performance, Onkyo is really the only choice you have.

Unless you're into antiques.

ONKYO®

200 Williams Drive, Ramsey, NJ 07446 201-825-7950

My listening revealed a smooth, faithful sound, with ample bass that lent a solid foundation to organ music and double bass.

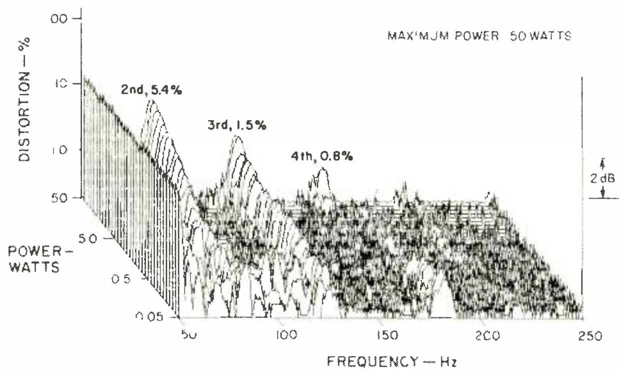


Fig. 12—Harmonic distortion products for the musical tone E_1 (41.2 Hz).

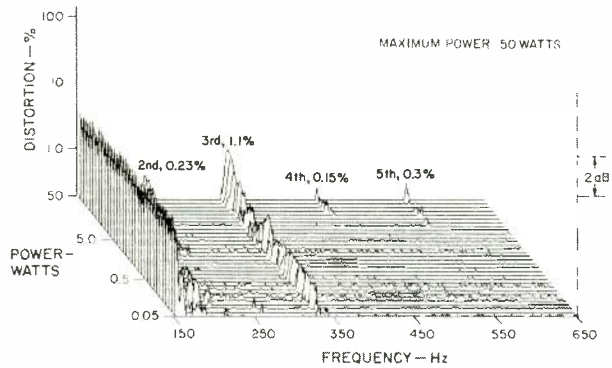


Fig. 13—Harmonic distortion products for the musical tone A_2 (110 Hz).

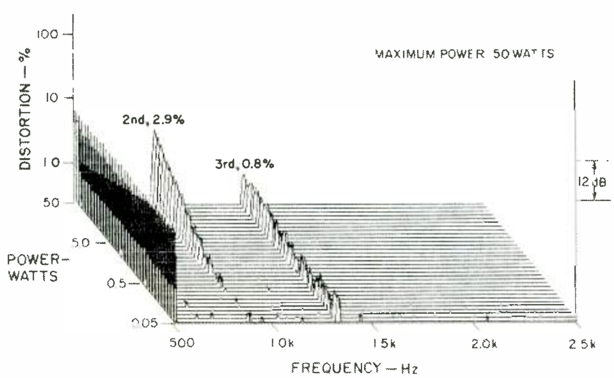


Fig. 14—Harmonic distortion products for the musical tone A_4 (440 Hz).

series with the front driver was not working properly. (I expected an initial displacement of the front woofer, with a quick return to zero.) A call to Richard Vandersteen cleared up the apparent problem, when he emphasized that both woofers are in a tightly sealed cavity, thus coupling the two drivers closely together. The d.c. was directly displacing the rear driver inward while forcing the front driver out of the box because of the increase of pressure inside. (Dumb me!) The woofer enclosure is very well sealed, so well, in fact, that a manual push of one of the woofers causes a corresponding movement of the other woofer. This reaction continues for as long as the original woofer is displaced (or at least for several tens of seconds!).

The 2Ci's impedance from 10 Hz to 20 kHz is shown in Fig. 9. Three impedance minimums are evident, with the lowest a relatively high 4.8 ohms at 43 Hz. Above 30 Hz, in the system's passband, the impedance is very well behaved, with a max/min variation of only 2 to 1 (from 9.7 down to 4.8 ohms). Because its impedance has a relatively high minimum and little max/min variation, the 2Ci is not very sensitive to cable series resistance. Cable resistance should be limited to a reasonably high maximum of about 0.11 ohm to keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. Thus, for a standard run of about 3 meters (10 feet), 16-gauge (or larger) wire is required.

The complex impedance from 5 Hz to 30 kHz is plotted in Fig. 10; it is well behaved. The phase angle of the impedance reached a maximum of only +25° (inductive) at the subsonic frequency of 10 Hz and a minimum angle of −38° (capacitive) at the bass frequency of 30 Hz. The system will be an easy load for any amplifier.

Even though Vandersteen rates the 2Ci as having a nonstandard 7-ohm impedance, I assumed an 8-ohm impedance for calculating input power in the following measurements, except where stated otherwise.

The 3-meter room curve, with both raw and sixth-octave smoothed responses, is illustrated in Fig. 11. The 2Ci was in the right-hand stereo position, aimed at the listening location, and the test microphone was placed at ear height (36 inches) at the listener's position on the sofa. The system was driven with a swept sine-wave signal of 2.83 V rms (corresponding to 1 watt into a standard 8-ohm load). The sweep includes the direct sound plus 13 mS of the room's reverberation. Above 2 kHz, the smoothed curve is well behaved and fits an envelope of ±2.3 dB. Excluding the room dips at 380 and 490 Hz, the complete curve fits within a relatively compact, ±3.4 dB, window from 100 Hz to 20 kHz.

Figures 12 to 14 show harmonic distortion versus power for the musical notes of E_1 (41.2 Hz), A_2 (110 Hz), and A_4 (440 Hz). The power levels were computed using the standard system impedance of 8 ohms (20 V rms equals 50 watts, etc.). Power levels were limited to 50 watts due to the 2Ci's built-in protection circuitry.

Figure 12 shows the E_1 (41.2-Hz) harmonic distortion data at power levels ranging from 0.05 to 50 watts. At full power, the second and third harmonics reach distortion levels of only 5.4% and 1.5%, low values for a system of this size. Tone E_1 coincides approximately with the system's vented-box resonance frequency, thus minimizing the distortion.

HCA-2200

Designed by John Curl

"Krell... Threshold... Madrigal... Rowland Research... Coda... Parasound. What !!!

Parasound?

How does Parasound manage a mention with the above said heavy hitters of the transistor amplifier world? Easy. The new 2200 power amplifier from Parasound has the type of power and performance that would be expected from the big guys, were they to build an amplifier at the two grand mark. The fact that the 2200 only costs $1,585 certainly sweetens the deal, making it a ridiculously great bargain.

But why Parasound?

Actually, this is the amplifier that I had been expecting to see from PS Audio, Superphon or Aragon; a real high calibre audio product that reeks of power, engineering savvy, and bang for the buck. Instead, **a small firm from northern California had the sense to recruit one of the best minds in the business — John Curl — to design for them a product capable of superior performance without a typically prohibitive price tag** to go along with it. John brought with him a full suitcase of engineering and design experience that few others in the industry could match or even dream of. Remember the "JC" designation on some of the Mark Levinson designs of the 1970's — that's John Curl. More recently, John has enjoyed great critical success with his Vendetta phono section electronics, it being declared "State of the Art" by several of the glossy mags. Then, add to the formula the Parasound company, whose reputation has been built on the value-oriented sector of the market. Parasound has put together a method of product development and marketing which emphasizes in-house design and overseas construction. Years of close work with their Taiwan manufacturing facility has resulted in a relationship where both parties know what the other needs in order to produce **a finely crafted product; a product that's basically untouchable by the competition.**

THE AMP. The 2200 weighs in at 58 lbs., that's 8 lbs. more than the Krell KST-100 ($2,700), and only 2 lbs. less than the Madrigal No. 29 ($2,800). It's 19" wide, 8" tall and 19" deep if you include the fore and aft handles. It has balanced and single ended inputs (XLR & RCA), with a switch to convert to mono operation. The rear of the amp also has two sets of speaker terminals for those who desire to bi-wire or just want to hook up more than one pair of loudspeakers. Unlike Parasound designs of the past, the 2200 lacks the two attenuator pots on the front panel and the speaker terminals are honest-to-goodness 5-way binding posts. Both sides of the amp are flanked by an impressive array of "Rowland-like" heatsinks that run quite hot in order to dissipate the considerable heat generated by the 12 high-bias (over 6 wpc in pure class A) bi-polar output devices per channel. Considering that nearly all listening is done at one or two watts per channel, **the 2200 delivers a lot of class A-biased power.** Inside you'll find two 1.2 kva toroidal transformers (one per channel) and 100,000 mfd of filtered power storage. A nice touch is the way all large capacitors are bypassed by smaller film caps for improved performance. This is the first amplifier I have seen in a long time that goes so far as to even bypass the larger filter caps in the power supply (A favored trick by many modifiers). Parts quality throughout is good, but I foresee some industrious owners substituting higher grade and quality parts for those used (high-end neurosis). The basic ingredients are all very sound though, as the **transformers, filtering caps, chassis, output devices and resistors are just about as good as you can get.**

OPERATION. Right up front you should know that I don't care for the 2200 and the Krell KSL preamp as a combination; while both work fine on their own, they didn't work well together, in spite of there being no obvious impedance mismatch between the two devices. Preamps that worked great with the amp included the Cary SLP-70, the Muse Model One and the Counterpoint Solid 8. Speaker cables used were of course dependent on the loudspeaker being listened to. However, the 2200 was quite capable of driving, with ease, any speaker tied to its outputs. As I have found out, this amp shuts down its outputs upon the showing of DC, a handy feature when using some preamps, especially those of the tubular persuasion. I have **operated this amplifier under grueling and strenuous conditions for almost three months without so much as a hint of trouble or breakdown.** As said previously, this amp does tend to heat up a room if given the opportunity, running at about the same temperature at idle as it does wide open — a sign of proper high-bias or class A operation and certainly nothing to worry about. Rich Rodgers at Parasound advises me that the 2200 is designed for continuous operation with the normal exceptions of turning it off during storms or when away from the home for more than a day or two.

THE SOUND. It sounds balanced. No aspect of its operation unduly draws attention to itself. The highs aren't grainy or smeared; the bass isn't bloated; the midrange isn't recessed, or forward for that matter; the stage isn't cramped; and, dynamics aren't compressed. What we have here is an amplifier that flat out refuses to do much wrong, while doing almost everything right. Is it a wonderful amplifier in the manner of the Allegro Cantata? You bet it is, but for different reasons (if this amp were not a wonderful product this review would have been written two months from now, or whenever I got to it).

Comparing the 2200 to the Cantata (reviewed last month) brings to mind the great number of sonic similarities. Both amps are extremely neutral in terms of tone, having a spectral balance that resists characterization as light or dark, warm or cold... Quality of the frequency extremes is very close as both amps have that bipolar signature spoken of last month, i.e., highs are good to very good and the bass is phenomenal. The difference here is in terms of finesse vs. power. **The 2200 is one of the most powerful amplifiers you will ever come across, controlling loudspeakers with such aplomb so as to seem effortless. Transients with the 2200 can be awesome** and are certainly on par with the mono Cantatas or anything else making 200 or more wpc. A mistake will take out woofers with a lethal ease, take my word for it. Without seeming forward (remember the balance referred to), the 2200 extends into the bass region with incredible authority. Combining this amp with the Chapman T-7 loudspeaker, I was able to shake loose the neighbors fillings and send the dog running for cover under one of the kids beds... but the bass wasn't there unless it was supposed to be. That's important, because too much bass or a false emphasis in the bass region will result in fatigue after the initial rush of excitement wears off.

Clarity and the sense of space on a three dimensional stage were very good. Without effort I could pick out the location of instruments and vocals. Saxophone on "Jazz at the Pawnshop" had an excellent sense of presence, the sax standing clearly apart from the other instruments on the stage. Drums at right rear had perfect placement, and

 RAVE REVIEW

Ultra High Current Power Amplifier

there was a nice feeling of left and right, up and down, as the drummer worked his way around the drum kit. But this is the area of finesse that I referred to earlier, and the very area where the Allegro kicks into another dimension. The Allegro reproduces its input with slightly better focus of individual sound. The silence between the sounds with the Allegro is somehow more quiet while still capturing all of the ambient information created in the original recording venue. The electronic curtain at the rear of the sonic stage, out of which the music emanates, is a little further back on the Cantata and a little less a part of the recorded event, a condition that may be attributable to the total non-use of negative feedback in the Allegro and the minimal amounts used in the 2200. The differences between the two products really aren't that great, and to some persons will be of no consequence, but they are there and that alone is reason to report on them. Forgive me if I'm being a little picky here, but no product is perfect (regardless of what the simpletons say) and I'll find fault in every case if only to reassert the point.

In spite of that, this amp has some pretty remarkable abilities when it comes to reproducing the feeling of a live event in the listening room. Resolution of inner detail was natural and very revealing, without seeming hyped or exaggerated. Images at the back of the stage were crisp and easy to locate, particularly so, when the 2200 was used with the Cogan-Hall EM interconnects, Cary SLP-70 preamp and the NEAR 50M loudspeakers; a combination of similarly priced products that excel when used together. (Throw in the Deltec "Little Bit" ODAP and you are really cookin'). As a final point let me say that the 2200, after several months of use, continues to improve in its sonic capabilities, making me wonder if this review and my criticisms might be somewhat premature. I'll keep you informed for as long as Parasound lets me play with this neat little toy.

CONCLUSION. When I first listened to the Parasound 2200 I got a funny feeling inside, a queasiness, if you will, regarding how to evaluate it. I'm sitting here with the Allegro Cantata and the Krell KST-100 thinking how *they* defined high-end performance at prices that were starting to be accessible to "Blue Collar Audiophiles", even if it was still a stretch dollar-wise. The Kaye amplifiers have always been a favorite and the Muse amps will forever represent good sounds, solid build, quality and value. How then do I tell you that there is another amplifier that **deserves nothing short of a rave review,** without BFS appearing to belong to the amp of the month club? Is it possible that there exists more than one exceptional amplifier out there? After all, some reviewers feel a need to tear things down once in a while if only to put fear into the hearts of those manufacturers that they deal with. How do I maintain a sense of credibility with readers when I know for a fact that many of you will go into certain audio retailers only to be told that Krell stinks, Coda is a dog, Kaye is a looney or that Parasound is strictly mid-fi? Some have gone so far as to insinuate that we write positive reviews because we like everything we get for evaluation and don't want to hurt the feelings of contributing manufacturers. True, I don't like to hurt the feelings of others by being overly critical of a product that doesn't sound very good. But we at the Newsletter absolutely refuse to write an untrue word, sometimes much to the chagrin of the manufacturer.

Due to space and time limitations we will not be devoting extensive editorial space to products that do not deserve it. For example, I have at my disposal a pair of B&K mono-blocks just like those raved about by Sam Tellig (Tom Gillette) of Stereophile. I have never cared for the sound of the amps and would put them somewhere above the AVA Fet-Valves, and below the Parasound 1200 or Soundcraftsmen Pro Power One (a true sleeper). I will not be reviewing the M-200 from B&K. If they come up with a new product that seems to me to be of value, I will look at it or have one of the other contributors look at it. Adcom has only made one good product in my opinion, that being the 535, no need to review the rest. A friend has the Aragon 4004, but it sounds soft and too laid back to be accurate. Most tube products don't have accurate highs and color the sound considerably, and I have been disappointed by two (Melos & MFA), while being pretty happy with two others (Cary & Dynaco). Yes, we look at quite a few products from Counterpoint, Parasound, Muse, Krell and mas, but that's for a reason — these products consistently sound ACCURATE while providing a value; not because they advertise, or give us things for free. I make a conscientious effort to print reviews of products that offer something to you, the readers. For that reason, I will continue looking for and examining products of quality and value so that we can talk about them on these pages, and yes, I prefer talking about Parasound and Fried products over Apogee loudspeakers and Air Tight tube amps because the Parasound and Fried are **not aimed at people with more money than brains.**

So this is how I'm going to approach the review of the Parasound 2200 power amplifier. I want you to add it to the list of truly fine products that have something special to offer in terms of value regardless of what it's compared to or what anyone else says about it. It stands on its own in terms of build and performance, being basically as good (accurate) as any amplifier that I am aware of, and better (more accurate) than most. Sonically, it is mildly different though not necessarily superior in every respect to the Krell KST-100, the Allegro Cantata, the Coda 10, and the new Counterpoint amp, each of which has its own special set of strengths and weaknesses intertwined with a strong sense of direction towards absolute transparency as the ultimate goal. As far as I'm concerned, these products are still the cream of the affordable amplifier crop and I'll make no excuses for a single one of them, nor will I make excuses for any future additions.

- Martin DeWulf—

Reprinted with permission from Bound For Sound, *November 1991.*

The system reproduced spacious hall sound with solid instrument placement while not diminishing the magnificent piano sound.

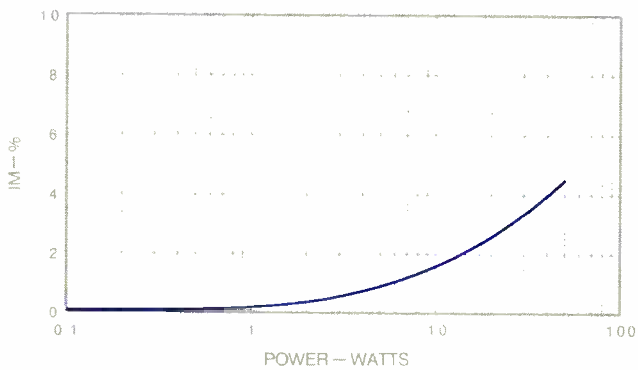


Fig. 15—IM distortion on 440 Hz (A_4) produced by 41.2 Hz (E_1) mixed in one-to-one proportion.

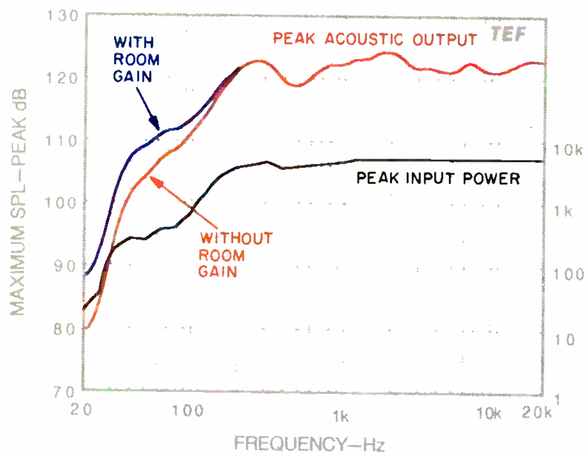


Fig. 16—Maximum input power (calculated for standard 8-ohm impedance) and maximum peak sound output vs. frequency at 1 meter on axis.

The higher order harmonics were significant only at the highest power levels. At 41.2 Hz, the system generates 96 dB SPL at 1 meter for 50 watts input.

The A_2 (110-Hz) harmonic data is shown in Fig. 13. The third harmonic reaches only a very low value of 1.1% at 50 watts, and the second harmonic reaches only 0.23%. The higher order harmonics are not significant. At 110 Hz, the system generates 101 dB SPL at 1 meter for 50 watts input.

Figure 14 shows the A_4 (440-Hz) harmonic distortion data. The second harmonic reaches only 2.9% at full power, followed by the third at the low value of 0.8%. At 440 Hz, the system generates 101 dB SPL at 1 meter for 50 watts input.

Figure 15 displays the IM distortion on a 440-Hz (A_4) tone created by a 41.2-Hz (E_1) tone of equal input level. At 50 watts, the IM distortion reaches only 4.2%. The three-way configuration of the system contributes to the relatively low values of IM. The midrange mainly handles the upper frequency, while the woofer handles the lower. Overall, the 2Ci exhibited quite low values of distortion in the harmonic and IM tests.

Figure 16 shows the system's short-term, peak-power input and output capabilities versus frequency, measured with 6.5-cycle tone bursts having third-octave bandwidth. Here again, the peak input power was calculated by assuming that the measured peak voltage was applied across the standard 8-ohm impedance. The maximum peak electrical input power-handling capacity of the 2Ci is shown in the lower curve.

The peak input power rises smoothly with frequency; above 1.25 kHz, input reaches 190 peak volts, equivalent to about 4,500 watts into the 8-ohm load for which my scales are calibrated (actually, 5,160 watts into 7 ohms). From 20 to 30 Hz, the peak input power rises rapidly and then reaches a short plateau of about 300 watts just above the 38-Hz box resonance. Peak input power rises again above 100 Hz, after which a slight decrease is noted at about 400 Hz, just below the lower crossover.

The upper curve in Fig. 16 shows the maximum peak sound pressure levels the 2Ci can generate at a distance of 1 meter on axis for the input levels shown in the lower curve. Also shown on the upper curve is the "room gain" of a typical listening room at low frequencies. This adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz. The peak acoustic output rises rapidly with frequency up to 40 Hz, and then increases less rapidly up to about 250 Hz, where a level of about 123 dB is reached. Although the system's sensitivity is on the low side, its relatively high power handling results in high peak outputs. With room gain, the system exceeds 110 dB SPL above 55 Hz and 120 dB SPL above 180 Hz. At 32 Hz, it generates a very usable 102 dB SPL with room gain.

Use and Listening Tests

The 2Cis come with an excellent and very extensive 16-page use and operation manual that covers many different topics, including connections, placement, amplification, associated equipment, service, packing, and warranty. Also included is a very useful two-page "power-handling notice" written in an easy-to-understand question-and-answer style. The manual devotes three pages to a section on speaker placement and sound-room design, the most extensive coverage I've seen in the manuals of any speakers I've reviewed. Also included are instructions for accurately tilting the system back, using the supplied spikes, for situations where your ears are above the designed 36-inch listening height.

In the connections section, the manual goes into much detail on the methods that can be used to attach the systems to the amplifier(s), including bi-wiring and "vertical biamping." (The latter is defined by Vandersteen as using a pair of identical stereo amps, one per speaker, with no external crossover. The amps then feed identical, wideband signals into their assigned speakers' bass and midrange/tweeter crossover sections. This lets you position each amp close to its speaker, with short cables, and keeps the amp grounds for the two stereo channels separate.) Vandersteen

Enter No. 19 on Reader Service Card

The 2Ci packs a quite considerable amount of accuracy and musicality in a reasonably priced, good-looking design.

Construction shared by Vandersteen 2Ce (shown) and 2Ci. See text.

specifically designed the 2Ci for bi-wire or vertical biamp connection, stating, "The performance of the Model 2Ci is compromised by a mono-wire connection. The speakers should be bi-wired or biamped as soon as possible."

I did most of my listening in the bi-wire mode, using a dual set of 3-meter Straight Wire Maestro cables. The connection at the speaker side was complicated by having to directly insert the cable's spade lugs into the wire holes in the double-banana plugs. I definitely would prefer a conventional terminal arrangement to the rear-mounted banana jacks, which *have* to be used with banana plugs. I used conventional, single wiring for casual listening; to do this, I put a double-banana plug into each double-banana jack, than paralleled the two plugs by running 2-inch, sixpenny nails through their wiring holes. I then put another double-banana plug on my cable and plugged that into the paralleled array I'd just made.

My equipment lineup consisted of my usual Jeff Rowland amplifier and Onkyo CD player. An additional CD player was the new Rotel RCD-965BX, which has one-bit D/A converters. The Vandersteens were placed about 10 feet from the sofa in my listening room and separated by 8 feet. This placed them about 6 feet from the short rear wall and 4 feet from the side walls. The systems were canted in toward the listening position but not tilted back. The optional metal bases were filled with lead shot; they were very heavy and added a great deal of stability to the systems. Listening was done both with and without the supplied spikes. Most listening was done before the measurements.

My initial listening revealed a smooth, faithful, very listenable character, with just slightly less sensitivity than my reference B & W 801s. I did most of my listening with the driver level controls in the mid, or "0 dB," position. This yielded a balance closest to that of the 801s. Compared with those reference speakers, the Vandersteens exhibited similar high-frequency balance but somewhat less low-bass response. The level of existing bass, however, was quite ample and lent a solid foundation to organ music and double bass. The imaging and spatial characteristics of the Vandersteen systems were first-rate. All these comments apply only to the sound of the Vandersteens for listeners who are sitting down, however. When I was standing, I noticed significant tonal shifts in the upper midrange, as well as image shifts, both of which were quite detrimental to the find sound I heard when seated.

The systems reproduced the spacious hall sound on the CD of Piano Trios of Brahms and Dvořák, played by the Rembrandt Trio (Dorian DOR-90160), quite realistically while not diminishing the magnificent sound of the difficult piano passages. In addition, instrument placement was good and solid. The systems' smooth low end was exercised by the acoustic bass material on Rob Wasserman's *Duets* (MCA MCAD 42131, a super CD of just Wasserman's bass and the vocals of an incredible assortment of contemporary singers). Through the 2Cis, Jennifer Warnes, on track 6, never sounded better.

On third-octave, band-limited pink noise, the Vandersteens started coming on strong at the third octave centered on 31.5 Hz, and were fully running at 40 Hz. At 20 and 25 Hz, the systems generated harmonics only when driven hard. On mono pink noise, the center image was quite stable and of minimal width. Fairly major tonal changes in the middle and upper middle ranges were heard on pink noise when standing up. For serious listening, you should be sitting down.

The systems handled the complex orchestration of *The Spielberg/Williams Collaboration* (Sony Classical SK 45997) cleanly and provided a solid bass foundation. They did justice to the bass drum whack on the *Jaws* theme on track 5. The 2Cis imparted some slightly bothersome tonal changes in the mid and upper ranges of some material that my reference systems handled better.

The Vandersteens played loud and clean, with sufficient bass for rock music. This was apparent when I played Phil Collins singing "I Can't Dance" on the Genesis CD *We Can't Dance* (Atlantic 7 82344-2). On David Chesky's *Club de Sol* (Chesky JD33), the cabaça that comes in at 1:58 on track 6 is incredible and appears to hang in midair just to the right of center.

All things considered, the 2Cis pack a quite considerable amount of accurate performance and musicality in a reasonably priced and good-looking package. Their gentle impedance characteristics make them an easy load for virtually any amplifier. The Vandersteens can be used with inexpensive amplification yet speak their best when coupled with top-quality equipment. Although they won't shake your windows on heavy bass (pedal organ, for example) and are sometimes fussy with respect to listening height, overall they yield a lot of bang for the buck. *D. B. Keele, Jr.*

CONRAD-JOHNSON PREMIER SEVEN-A PREAMP AND EVOLUTION 2000 AMP

Manufacturer's Specifications

Preamp

Frequency Response: RIAA, ±0.25 dB, 20 Hz to 20 kHz; band-pass, 2 Hz to beyond 100 kHz.
Gain: Phono, 40 dB; line, 29 dB.
Phono Overload: 150 mV at 1 kHz.
Distortion at 1 V Out: Less than 0.25% THD or IM.
S/N: Phono, 84 dB below 10 mV input; line, 97 to 98 dB below 2.5 V output.
Maximum Output: 20 V rms.
Output Impedance: Less than 200 ohms.
Dimensions: Control unit, 19 in. W × 7 in. H × 16 in. D (48.3 cm × 17.8 cm × 40.6 cm); power supply, 19 in. W × 3½ in. H × 15¾ in. D (48.3 cm × 8.9 cm × 40 cm).
Weight: 60 lbs. (27.3 kg).
Price: $8,950.

Amp

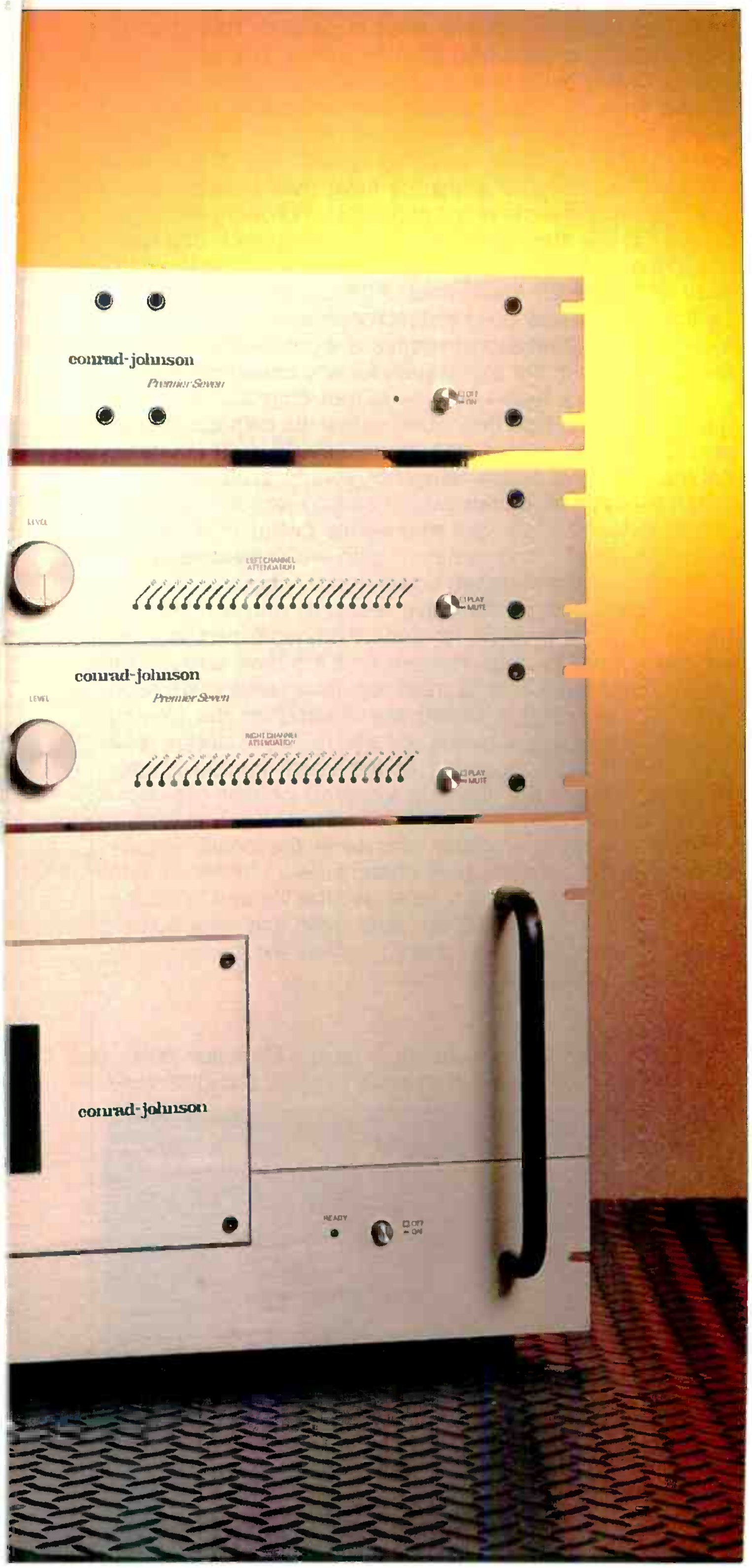
Power Output: 200 watts rms per channel from 20 Hz to 20 kHz at no more than 1% distortion, both channels driven into 8 ohms.
Frequency Response: 20 Hz to 20 kHz, ±0.5 dB.
Sensitivity: 900 mV for full output.
S/N: 96 dB below full output.
Input Impedance: 100 kilohms.
Dimensions: 19 in. W × 10½ in. H × 22½ in. D (48.3 cm × 26.7 cm × 57.2 cm).
Weight: 114 lbs. (51.8 kg).
Price: $4,995.

Company Address: 2800R Dorr Ave., Fairfax, Va. 22031.
For literature, circle No. 93

I was filled with pleasurable anticipation when I received these current top-of-the-line conrad-johnson components. The Evolution 2000 is a hybrid power amp using tubes for the front-end and MOS-FET semiconductor devices for the transformerless output stage. The Premier Seven-A preamp uses all-tube amplification and solid-state power-supply regulation. Both components have thick, gold-anodized front panels and are very attractive, well-made pieces of gear.

The Evolution 2000 amplifier looks like, and is similar in size to, conrad-johnson's previous all-tube models but with an obvious front-panel difference: A window that shows the front-end tubes, so you can bask in their warm glow when the unit is running. The front panel also sports a pushbutton power switch, a red LED pilot light, and a pair of handles. Most of the amplifier's rear surface is taken up by heat-sink fins, with a vertical space between them for connections. From top to bottom are a pair of Tiffany phono connectors for signal input, a row of four fuse-holders for the positive and negative rails in each channel's output stage, a row of four five-way binding posts for speaker connection, and finally, at the bottom, the power cord and line fuse. Things are a little tight when connecting thick speaker cables, but it can be done relatively easily.

The Premier Seven-A comes in two pieces—preamp and external power supply. This is a *big* preamp! Both the preamp and power supply are dual mono, with separate a.c. line cords and power-supply interconnect cables for the individual channels. Front-panel controls for each channel include signal selectors for input and tape output, a stepped-attenuator volume control, and a "Mute" pushbutton at the far right. Volume-control settings for each channel are shown by horizontal rows of LED indicators. On the rear panel, for each channel, are Tiffany phono connectors for input and output, a multi-pin connector for the cable to the power supply, a gold-plated binding post for ground, and a phono-loading selector switch. Looking at the rear of

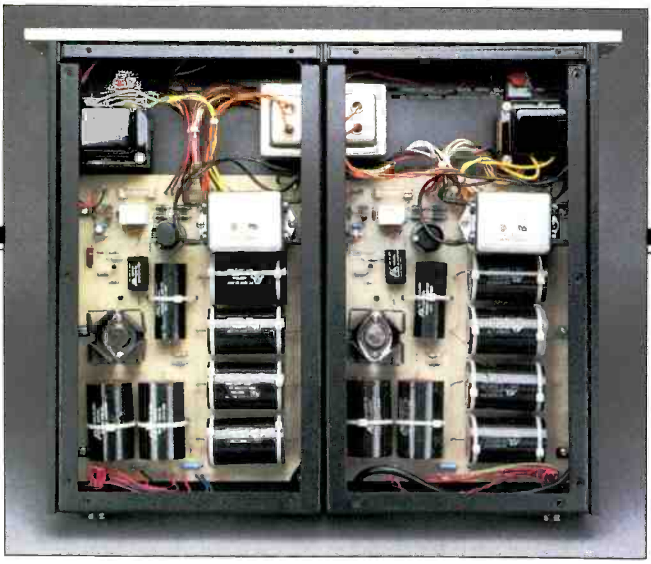


the preamp makes its dual-mono construction obvious: There is a gap between the bottom plate of one channel and the top plate of the other. In fact, if the side plates were unbolted, the two channels could be separated.

Internal construction of the preamp is a bit unusual. The signal circuitry is mostly on one p.c. board that takes up about half the internal area. This board is mounted to a metal frame that forms walls around it and is shock-mounted to the sides of the actual chassis. The manufacturer uses only film capacitors for coupling, filtering and bypass duty, and they take up most of the board area. A number of solid-state regulators on the main board provide separate, regulated sources for each stage of the circuit. Four 6GK5 high-transconductance triodes are mounted on the main signal board with what appear to be large rubber grommets slipped over each tube to reduce vibration and microphonics. Two of these tubes make up the output amplifier, while the other two are used in the phono section. The phono section's input stage uses a pair of 6CW4 Nuvistors (small, metal-enclosed vacuum tubes with ceramic seals where the connecting pins emerge) mounted on a small sub-board above the main board. Another small p.c. board is mounted toward the rear of the unit, on a bracket that mounts to the left side and rear panels. This board interconnects the signal inputs and outputs with the selector switches and carries the output muting relays and associated circuitry. The selector switches and volume-control attenuator are mounted to this board's mounting bracket; the control shafts pass right through the surrounding metalwork on their way to the front-panel knobs. All in all, an unusual but quite logical construction technique.

Like the preamp itself, the Premier Seven-A's power supplies are separate mono units, in this case attached, side by side, to the front panel and to shared top and bottom covers that further strengthen the assembly. Each supply contains two power transformers, one for the tube heaters and the other for the high-voltage plate supply. A number of large film capacitors are used for the high-voltage filter capacitors. No electrolytics allowed here! However, in a concession to conventional practice, an electrolytic capacitor is allowed for the heater supply and time-delay circuit. A Sprague a.c. line filter and an a.c. line fuse are mounted on the p.c. board, as are a number of solid-state devices, including rectifier diodes, small transistors, and a high-voltage series pass transistor on a heat-sink.

At the rear of the Evolution 2000 amp are four full-height, vertical p.c. boards that mount all the supporting parts for five MOS-FET output devices. These boards and the output devices mount to the heat-sinks. The space in front of the boards holds four 59,000-μF, 75-V filter capacitors for the main output stage and a very large potted power transformer for the solid-state output stage. Between them is a small power transformer for the tube front-end supply, topped by a p.c. board for the line-voltage selector. The remaining area behind the front panel is taken up by a p.c. board that mounts the front-end tubes and associated signal and power-supply circuitry. A high-current relay, mounted to the front panel near the tube window, turns on the power transformer in the output stage. The relay comes on with a very impressive "clunk."



Damping factor at 8 ohms was 30 at all frequencies, its uniformity a testament to the amp's stability.

Circuit Description

The Evolution 2000 amplifier has the simplest possible signal circuitry. The front-end uses all four elements of two dual triodes, paralleled in a common-cathode configuration and capacitor-coupled to the voltage gain of one solid-state output stage. There is no overall loop feedback, although some cathode feedback is used in the tube stage and local feedback is implicit in the output stage's cascaded voltage-follower topology.

The preceding would suggest that the amplifier is simple in a total sense; nothing could be further from the truth. For example, to elaborate on the output stage, the five pairs of MOS-FET output devices are driven by a pair of MOS-FET drivers, forming a Darlington-connected source-follower topology. While the supplies in the output stage are unregulated, the drains of the driver devices have their own supplies, each fed from a discrete complementary voltage regulator of appropriate polarity. This regulator design is used in virtually all conrad-johnson products. It consists of a current source feeding a zener-diode shunt regulator, which in turn feeds a Darlington-connected voltage follower that delivers the regulated output. These voltage regulators are fed unregulated positive and negative d.c. that is full-wave rectified and filtered from a separate winding on the power transformer of the output stage.

I could fill pages describing similar details. For example, the output drivers' gates are each fed from bias supplies that can be individually adjusted to control idling current in this stage and minimize d.c. offset in the output.

In the Premier Seven-A preamplifier, Messrs. Conrad and Johnson again use good-sounding amplifying devices. These devices have well-chosen operating points, are configured in a common-cathode connection (common-emitter or common-source for bipolar and FET devices) with cathode feedback, and are usually followed by a similar device set up as a voltage follower. This type of gain block is always powered by conrad-johnson's usual solid-state voltage regulators.

In the phono preamp, the first stage is a pair of Nuvistor tubes in parallel, configured—you guessed it—in common-cathode mode but without the ensuing follower stage. The plate output of this stage is capacitor-coupled to a passive interstage RIAA equalizer terminating in a common-cathode second stage. This stage does have a cathode follower, which buffers the preceding tubes' plate circuit and drives the selector switches, volume attenuator, and tape out jacks when phono is selected. The polarity of the phono circuit is thus noninverting.

High-level inputs are fed into the "Source" and "Record" output selectors, which are wired in parallel. This arrangement leaves the possibility of a feedback loop (potentially destructive to ears, power amps, and speakers) via connected tape recorders or external processors when both selector switches are on the same "Tape 1" or "Tape 2" setting. Conrad-johnson cautions against this in their owner's manual, but other preamps have dual selector-switch arrangements that prevent it altogether. Following the signal selector is the stepped attenuator, a multi-deck Stackpole unit that switches in resistor pairs for signal attenuation and also selects which front-panel "Attenuation" LED will light. Switching in resistor pairs instead of picking off various taps along a string of resistors in series is a good idea, as it puts fewer resistors in the signal path for any attenuator setting.

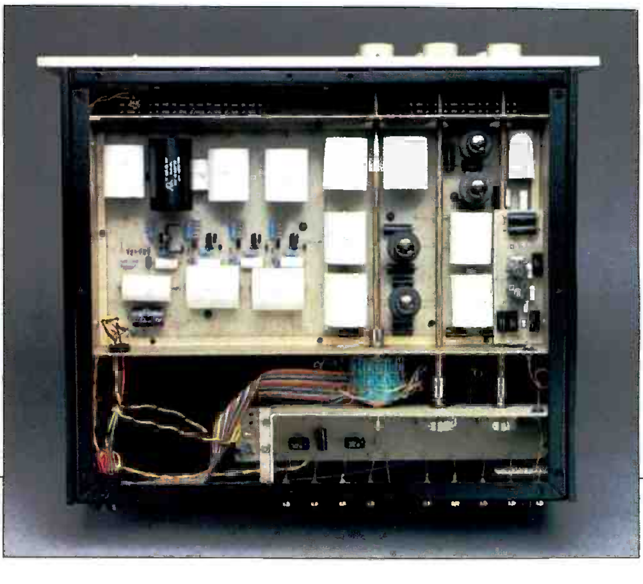
The preamp's high-level line output amplifier is another gain block of the type described earlier. Its cathode follower provides a low output impedance to drive interconnect cables. The line output amplifier inverts polarity, so the preamp inverts all signals (which conrad-johnson spells out plainly in the manual)—but so does the Evolution 2000 amp, making a noninverting system if both are used together.

Each channel's separate power supply contains the high-voltage plate supply (full-wave rectified, with film filter capacitors specially made for conrad-johnson) and the low-voltage supply for tube heaters and the time delays. The high-voltage regulators (a main regulator feeding subregulators for each signal block) are located on the preamp chassis. The heater supplies are also full-wave bridge rectified, filtered, and regulated in the usual conrad-johnson way. Ah, to be a tube heater in a conrad-johnson preamp—I'd sound good too!

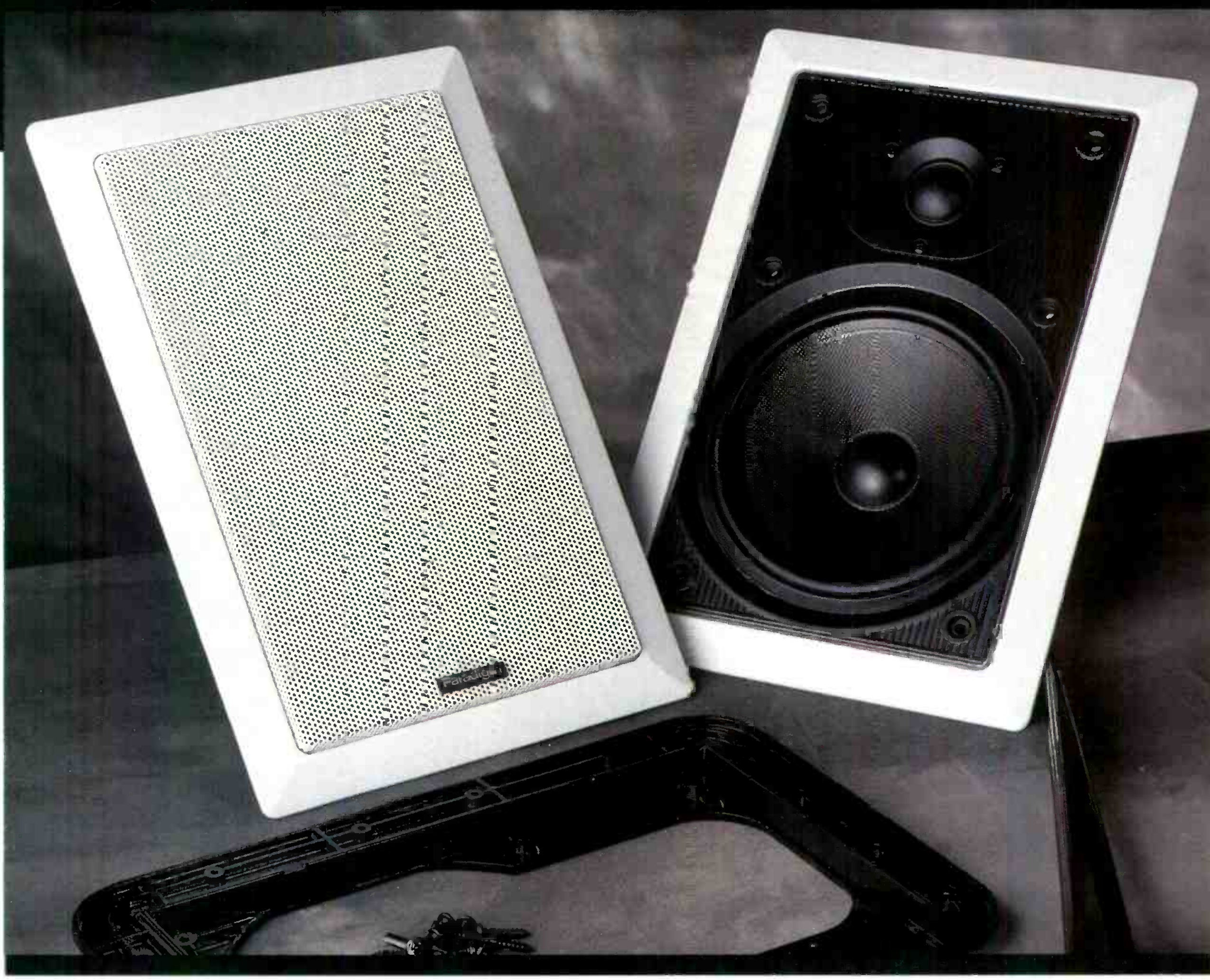
There are two time-delay circuits in the power supply. One delays B+ until the tube heaters are up to temperature (a nice touch that probably extends tube life and is seldom seen today). The other keeps both main and tape outputs muted (another rare, nice touch) until all the preamp's circuits have settled out.

Measurements

Starting with the measurements for the Evolution 2000, I found voltage gain into 8-ohm loads to be 30.5 and 30.4 dB,



The Finest In-wall Speaker.



WHAT DOES IT TAKE to build the finest in-wall speaker? Quite simply, better design execution.

Better in-wall performance demands better materials. So, rather than flimsy plastic parts, we use a rigid aluminum diecasting that combines the main chassis, mid/bass driver chassis and tweeter faceplate into a single unit. Instead of inadequate mounting hardware made of plastic parts, metal clips etc., we use a rigid diecast-aluminum full-perimeter mounting flange. Add PARADIGM's renowned driver technology and seamless dividing networks, and the performance results are amazing! Articulate and transparent, these speakers simply reveal more of the musical and spacial reality of the live event.

EVEN MORE ASTONISHING IS THE PRICE! For the same or even less than conventional in-wall speakers, *you can own the best*... PARADIGM ARCHITECTURAL MONITOR SERIES speakers.

You won't find PARADIGM ARCHITECTURAL MONITOR SERIES speakers everywhere. A product this good requires the expertise of a qualified audio specialist. So, before you buy any in-wall speaker, visit your AUTHORIZED PARADIGM DEALER and listen to the finest of in-wall speakers.

FOR MORE INFORMATION CALL 1-800-553-4355 Ext. 41274 or write: AUDIOSTREAM, MPO Box 2410 Niagara Falls, NY 14302. In Canada: PARADIGM, 569 Fenmar Drive, Weston, ON M9L 2R6.

Sound&Vision
Critic's Choice Award

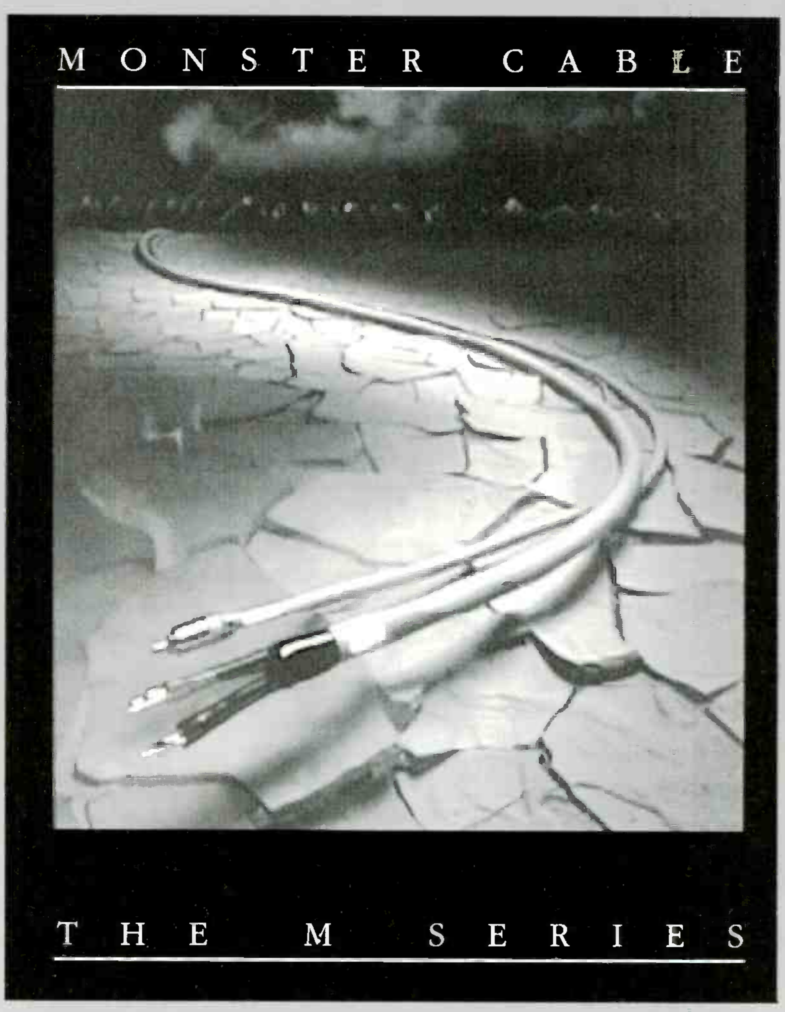
For More Information

41274

Call 1-800-451-2248

Paradigm®

Enter No. 31 on Reader Service Card



Listening Has It's Rewards

Audition an M Series® cable by Monster Cable® at a dealer near you and get a free poster. Experience the incredible sound of M Series.

California (Northern)
Audio FX Sacramento, CA 916-448-3779
Boots Audio Vidio Fresno, CA 204-432-0446
Catania Santa Rosa, CA 707-526-7555
Century San Jose, CA 408-998-7474
Gluskin Stockton, CA 209-466-5686
Sound Advice Eureka, CA 707-442-4462
Sound Distinction Walnut Creek, CA 510 944-0503
Sounding Board Berkeley, CA 510-843-7031
Sounding Board Concord, CA 510-825 0700
The Stereo Image Davis, CA 916-756-4196
Water Street Stereo Santa Cruz, CA 408-427-1604
World of Sound San Francisco, CA 415-928-3101
California (Southern)
Audio Concepts Long Beach, CA 310 597 5450
Audio Concepts San Gabriel, CA 818-285 0011
Audio Video City Culver City, CA 213-838-8889
Royal Sound Los Angeles, CA 213-733-3400
Sound Factor Encino, CA 818-501-3548
Sound Factor Pasadena, CA 818-577-4945
Sound Factor North Hollywood, CA 818-980-1161
Connecticut
Audio Design Fairfield, CT 203-336-4401
Audio Etc New Haven, CT 203-562-4617
District of Columbia
Myer - Emco Washington, DC 202-342-9200
Florida
Behrens Audio Lab Jacksonville, FL 904-721-1860
Sound Advice Ft. Lauderdale, FL 305 564 4434
Sound Advice Orlando, FL 407-894-4434
Sound Ideas Gainesville, FL 904 378-0192
Stereo by Design Miami, FL 305-232-1812
Hawaii
Honolulu Audio & Video Honolulu, HI 808-973 3311
Sam Sung Electronics Honolulu, HI 808-944-9191
Illinois
Absolute Audio Rockford, IL 815-395-1000
Paul Heath Audio Chicago, IL 312-549 8100
Team Electronics Peoria, IL 309-692-2720
Iowa
Audio Odyssey Davenport, IA 319-355-6565
Griggs Music Davenport, IA 319-391 9000
Kansas
Accent Sound Overland Park, KS 913-642-5111
Louisiana
Alterman Audio New Orleans, LA 504-834 5400
Art Colley's Audio Video Baton Rouge, LA 504 926-0244
Maryland
Absolutely Sound Rockville, MD 301-424-8955
Gramophone Ellicott City, MD 410 465-5500
Gramophone Lutherville, MD 410 821-5620
Myer - Emco Beltsville, MD 301 595 7900
Myer - Emco Rockville, MD 310-468 2000
The New Audio Buys Galthersberg, MD 301-840-9180
The New Audio Buys Rockville, MD 301-762-3701
Soundscape Baltimore, MD 410 889-1134
Soundscape Baltimore, MD 410 727 1134
Massachusetts
Audio Studio Boston, MA 617-267-1001
Natural Sound Framingham, MA 508-879-3556
Sound & Music Northampton, MA 413-584-9547
Michigan
Almas Metro Detroit, MI 313-584-1860
Gramophone Metro Detroit, MI 313-642-9777
Minnesota
Audio King Edina, MN 612-920-4272
Audio King Rosemnis, MN 612-636-3686
Audio King St. Cloud, MN 612-253 5099
Audio Perfection Richfield, MN 612-866-0083
Nebraska
Custom Electronics Omaha, NE 402-397-4434
Custom Electronics Lincoln, NE 402-486-3311
New Hampshire
Camera Shop Hanover, NH 603 643-4545
Cookin' Manchester, NH 603-622-6000
New Jersey
Hal's Lawrenceville, NJ 609-883-6339
Hi Fi Connection Deptford, NJ 609-228-0002
Hi Fi Connection Marlton, NJ 609-983 0002
Professional Audio Consultant Millburn, NJ 201-467-1950
Sassafras Audio Cherry Hills, NJ 609 751-1900
Woodbridge Stereo Woodbridge NJ 908-636 7777
New York
Altair Audio Albany, NY 518-452 3525
Audio Den Lake Grove, NY 516-360-1990
Clark Music Syracuse, NY 315-446-7020
Continental Sound Rego Park, NY 718-459-7507
Cosmophonic Sound New York City, NY 212-734-0459
Harvey Electronics New York City, NY 212-575-5000
JSG Audio Binghamton, NY 607-723-2212
Longplayer Stereo Goshen, NY 914-294-3000
Lyric HiFi (All Stores) New York City, NY 212-439-1900
Rowe Photo Audio / Video Rochester, NY 716-442-8230
Sight and Sound Morristown, NY 201-267 6700
Sound by Singer New York City, NY 212-924 8600
The Sound Mill Mt. Kisko, NY 914-241-1230
Speaker Shop Buffalo, NY 716-837-1557
Unicorn Audio Batavia, NY 716-343 6470
North Carolina
Audio Video Systems Charlotte, NC 704-535-6868
North Dakota
Music Hut Dickson, ND 701-225-6885
Ohio
Atlantis Home Entertainment Cleveland, OH 216-381-6700
Audio Corner Canton, OH 216-493-5770
Audio Etc. Dayton, OH 513-429-4434
Audio Force Sandusky, OH 419-626-6114
Jamieson's Toledo, OH 419-282-2571
New Image Electronics Westlake, OH 216 892-1111
Stereo Lab Columbus, OH 513-772-7840
Stereo Lab Cincinnati, OH 614-457-6800
Stereo Lab Cincinnati, OH 614-294-4743
Oklahoma
Audio Dimensions Oklahoma City, OK 405-752-1115
Pennsylvania
Listening Post Pittsburgh, PA 412-361-8440
Listening Post Pittsburgh, PA 412-681-8433
Listening Post Pittsburgh, PA 412-856-1199
Sassafras Audio Abington, PA 215 887-4687
Sassafras Audio Bryn Mawr, PA 215-527 6894
Sassafras Audio Exton, PA 215-594 8880
Sassafras Audio Montgomeryville,PA 215 362-2180
Sassafras Audio Whitehall, PA 215-776 1941
Stereo Post Harrisburg, PA 717-652-3656
Stereo Post Harrisburg, PA 717-652-7656
Stereo Post Lancaster, PA 717-397-7091
South Dakota
Sound Pro Rapid City, SD 605-348-6161
Texas
Audio Insights Dallas, TX 214-437-4167
Audio Video College Station, TX 409-696-5719
High Fidelity Austin,TX 512-476-5638
Hillcrest High Fidelity Dallas, TX 214-397-7636
Preston Trail Audio Dallas, TX 214-248-9104
San Antonio Audio Concepts San Antonio, TX 512-614-3333
Sheffield Audio Houston, TX 713-789 1180
Woody's Car Audio Ft. Worth, TX 817-737-7311
Vermont
Audio Den Burlington, VT 802-863-4398
Virginia
Audiotronics Roanoke, VA 703-774-5757
Digital Sound Virginia Beach, VA 804-424-5850
Myer - Emco Falls Church, VA 703-379-8800
Myer - Emco Tyson's Corner, VA 703-893-0700
The New Audio Buys Arlington, VA 703-525-1889
The New Audio Buys Falls Church, VA 703-578-3033
The New Audio Buys Fairfax, VA 703-385-4464
The New Audio Buys Manassa, VA 703-968-7513
The New Audio Buys Springfield, VA 703-971-1060
Wisconsin
Flanner & Hafsoos Milwaukee, WI 414-476-9560
Hi Fi Heaven Green Bay, WI 414-494-8999
Sound World LaCrosse,WI 608 781-1444
Specialized Sound Madison, WI 608-271-7744

Canada

Alberta
National Music Edmonton, ALBT (403) 452 4810
Ontario
Brack Electronics Toronto, ONT (416) 366-3636
Kennedy HiFi Toronto, ONT (416) 752-2065
Liptons Toronto, ONT (416) 868 7133
Quebec
Piemar Quebec City, QUE (819) 357 7377
Britsh Columbia
A & T HiFi Center Vancouver,B.C. (604) 688-5502


THE LIMITS OF INTERCONNECT CABLE PERFECTION
NEED NOT BE THE LIMITS OF YOUR POCKETBOOK.
Every M Series® interconnect cable incorporates a refined design combining advanced Time Correct™ windings with our patented Bandwidth Balanced® multi-gauged conductor technologies, our latest Multi Twist™ construction and IsoTec™ vibration dampening. All M Series® cables are terminated with our revolutionary Turbine Design® RCA connector, providing a high mass, high pressure contact for the best sonic connection available. Balanced XLR's are available on every M Series® cable. For all of its technology, the final result of M Series® is great music. Pure and simple. For those striving for audio cable perfection—at any price level—we invite you for a close audition of the new M Series® interconnect cables at your exclusive M Series® dealer. You will find no limits.
INTRODUCING
THE CABLES FOR
PERFECTIONISTS.
M1500®
M1000® MK III
M850®
M550®
M350®
MONSTER
M SERIES
Advancing The Art Of Listening
MONSTER CABLE
274 Wattis Way, South San Francisco, Ca 94080-6761
We invite you to hear our new M Series® cables. Please call to find the dealer nearest you. (800) 776-6001
Distributed in Canada by EVOLUTION AUDIO INC.
Telephone (416) 847-8888 Fax (416) 847-7408
M Series® Patent #'s 4,932,897/4,808,130/4,777,324/4,752,259/4,742,912/4,743,712/4,731,506/4,538,023/ 468,083/29097/29689/043361/M8964242.5/ND-25095
Enter No. 27 on Reader Service Card

The Premier Seven-A's distortion with an IHF load is the same as with an instrument load, up to 20 V— this baby can drive!

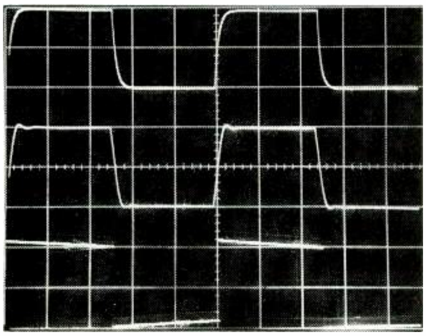


Fig. 1—Square-wave response, Evolution 2000 amp, for 10 kHz into 8 ohms (top), 10 kHz into 8 ohms plus 2 μF (middle), and 40 Hz into 8 ohms (bottom). Scales: Vertical, 5 V/div.; horizontal, 20 μS/div. for 10 kHz, 5 mS/div. for 40 Hz.

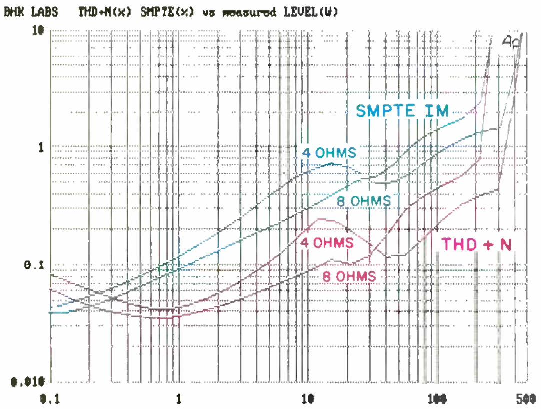


Fig. 2—Distortion vs. power output.

Table I—Gain and sensitivity, Premier Seven-A preamp.

	Gain, dB			
	LEFT		RIGHT	
	Instr. Load	**IHF Load**	**Instr. Load**	**IHF Load**
AUX to Main Out	29.9	29.7	29.7	29.7
AUX to Tape Out	0	0	0	0
Phono to Main Out	68.6	68.5	68.0	67.9
Phono to Tape Out	38.8	38.2	38.4	37.8

	IHF Sensitivity	
	LEFT	RIGHT
AUX to Main Out	16.3 mV	16.6 mV
AUX to Tape Out	500 mV	500 mV
Phono to Main Out	188.4 μV	200.0 μV
Phono to Tape Out	6.2 mV	6.46 mV

respectively, for left and right channels. Corresponding input sensitivities for an output of 1 watt into 8 ohms were 84.5 and 85.0 mV.

Small-signal frequency response hardly varied as I changed from open-circuit to 8- and 4-ohm loads. In all cases, response was ruler-flat from 10 Hz to 10 kHz, with a slight hint of roll-off visible at 20 kHz and a 3-dB-down point at about 80 kHz. The closely matched results for each loading give some idea of the output regulation or output impedance (the more the measurements agree, the lower the output impedance). The Evolution 2000's behavior was very good here, in that the output impedance was fairly low and the frequency response was unaffected by the value of the resistive loading.

Figure 1 illustrates the square-wave response of the Evolution 2000. The top trace is for 10 kHz into an 8-ohm load. In the middle trace, a 2-μF capacitor has been paralleled across the 8-ohm load; the amount of ringing and change in shape of the waveform with the added 2 μF is exceptionally low. The bottom trace shows satisfactorily minimal low-frequency tilt with a 40-Hz signal. In view of the uniformity of frequency response, the rise- and fall-times, not surprisingly, do not vary with changes in the resistive load; they measured about 4.2 μS. Waveshape remains exponential (like the top trace) from small-signal up to high-power levels.

Figure 2 shows both THD + N and SMPTE-IM distortion for 4- and 8-ohm loading. The curves' characteristics are typical for tube amplifiers. The slight irregularities in the curves from 10 to 20 watts, especially with 4-ohm loading, may be associated with the onset of device cutoff as the circuit leaves the Class-A condition. Distortion stayed relatively unchanged as a function of frequency at any particular power output, for both 8- and 4-ohm loading, though at lower power levels it did rise a bit above 10 kHz. Harmonic distortion residue at the 10-watt level at 1 kHz was fairly low (0.09%) and uncomplicated with an 8-ohm load but was higher (0.18%) and more complex into 4 ohms.

Damping factor for 8-ohm loads was 30 at all frequencies from 10 Hz to 20 kHz. This uniformity is a testament to the amp's stability over the audio frequency range.

Measurements of dynamic clipping headroom yielded dynamic power levels of 233 and 420 watts, respectively, at the visual onset of clipping into 8- and 4-ohm loads. Since power is rated at 200 watts per channel into 8 ohms, the corresponding dynamic headroom is 0.66 dB. Steady-state clipping at visual onset of clipping occurred at 230 and 400 watts for 8- and 4-ohm loads, respectively. Clipping headroom for 8-ohm loads worked out to 0.61 dB. It's notable how close the dynamic and steady-state clipping measurements are, a good indication of the excellent regulation of the output stage's power supply. Clipping at 20 kHz was perfect, with no "sticking" effects observed.

Noise was slightly higher in the right channel, which yielded an IHF S/N ratio of 87.5 dB versus the left channel's 89.7 dB. Output noise figures for the two channels were 450 and 240 μV wideband and 235 and 198 μV from 22 Hz to 22 kHz. The A-weighted figures were 120 and 93 μV for the right and left channels, respectively.

I suspected the input capacitance might be on the high side because the four paralleled tube elements' plate-to-

The conrad-johnson amp and preamp combination gave me some of the best sound I have heard in my setup in some time.

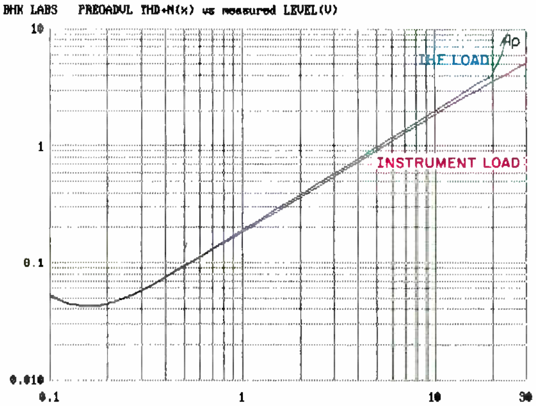


Fig. 3—Premier Seven-A line section THD + N vs. output level and load.

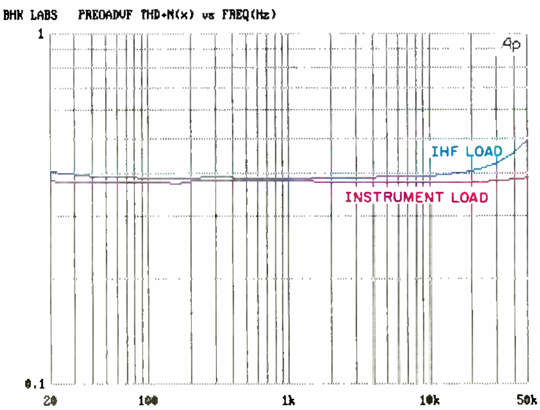


Fig. 4—Line section THD + N vs. frequency and load at 2 V out.

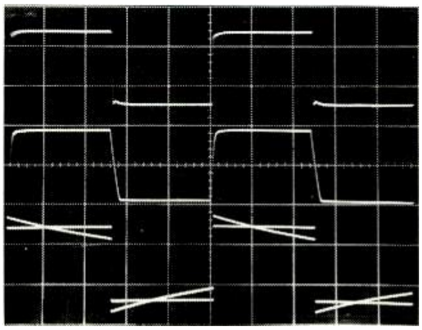


Fig. 5—Line section square-wave response for 20 kHz into instrument load (top), 20 kHz into IHF load (middle), and 20 Hz into both instrument and IHF loads (bottom; traces superimposed). Scales: Vertical, 5 V/div.; horizontal, 10 μS/div. for 20 kHz, 10 mS/div. for 20 Hz.

grid capacitances would be multiplied by the Miller effect (i.e., by the stage gain). It measured 590 pF—not a problem when the input is driven by the normally low output impedance of a preamp, but it did cause some extra high-frequency roll-off (beyond that caused by my long interconnect cables) when I used my reference signal selector/switched attenuator unit. The a.c. line draw of the Evolution 2000 at idle was about 2.6 amperes.

Now we move on to the Premier Seven-A preamplifier, whose measured gain and input sensitivities are listed in Table I. The output line amplifier's frequency response, with volume controls set at maximum, was perfectly flat from about 10 Hz to 200 kHz with instrument loading. Notably, there was little change in response when driving the 10 kilohms and 1,000 pF of the IHF load—just a roll-off of a fraction of a dB from about 50 to 200 kHz and of about 1 dB at 10 Hz.

Further evidence of the Premier Seven-A's ability to drive an IHF load is shown in Figs. 3 and 4. Figure 3 is a plot of output voltage versus THD + N at 1 kHz, with instrument and IHF loading. The instrument load of about 100 kilohms is what most tube preamps like to drive. With the IHF load, note that the distortion is about the same up to 20 V. This baby can drive! Distortion is almost pure second harmonic over most of the range. Figure 4 is THD + N at 2 V output as a function of frequency and loading. Again we have substantially constant distortion over the audio range and relatively little change for the IHF load.

Rise- and fall-times at 2 V peak to peak and with volume at maximum were 350 nS with the instrument load and increased to about 650 nS with the IHF load. With volume turned down to the −6 dB setting, rise- and fall-times increased to 800 nS with the instrument load.

Square-wave response through the Premier Seven-A's line amplifier, with the volume controls at maximum, is illustrated in Fig. 5. The output level shown is about 10 V peak to peak. The top trace is for 20 kHz with an instrument load. The edge transitions are very fast and a mild high-frequency compression (or shelf roll-off) is in evidence, as the steady-state peak-to-peak amplitude is greater than the fast edge transitions. In the middle trace, you can see positive-going edge transitions being slowed down and some slewing in the negative direction, both due to the IHF load's 1,000-pF capacitance. However, the slewing only starts at about 4 V peak to peak—a signal level that would drive most power amplifiers into clipping. This is due to the single-ended cathode follower's inability to drive a capacitive load fast when the tube is being turned off. The effect of the IHF loading on square-wave tilt at low frequencies is depicted in the bottom, 20-Hz. trace of the figure. The amount of tilt with the instrument load is exemplary, and the amount with the IHF load is quite acceptable in view of the relatively low capacitance (4 μF) of the polystyrene output coupling capacitors.

Channel-to-channel tracking of the separate volume controls versus the panel's attenuation markings was quite good, off by less than 0.6 dB. The channel-to-channel differences were generally on the order of half this amount.

Noise levels of the output amplifier are enumerated in Table II. The noise is quite satisfactorily low. Output imped-

"There is an inherent quality of ruggedness, reliability, and sonic integrity that has always impressed me favorably when I have had the opportunity to test and listen to Soundcraftsmen products."

Leonard Feldman, **Audio**

SOUNDCRAFTSMEN UTILIZES ITS LEGENDARY CRAFTSMANSHIP AND RELIABILITY TO PRODUCE THE FINEST LINE OF AUDIO ELECTRONICS AVAILABLE.

MADE IN THE USA AND CRAFTED TO EXACTING TOLERANCES, SOUNDCRAFTSMEN ELECTRONICS ARE AMERICAN INGENUITY AT ITS HIGHEST LEVEL.

MODELS SHOWN ARE THE A400, P100, AND T100

MTX SOUNDCRAFTSMEN
Technical Assistance: 2200 S Ritchey, Santa Ana, Ca 92705,
Phone 714-556-6191
Sales Support: 555 W Lamm Rd, Freeport, IL 61032,
Phone 815-232-2000

Tonal balance was neutral, definition and space were very good, and the overall sound was engaging.

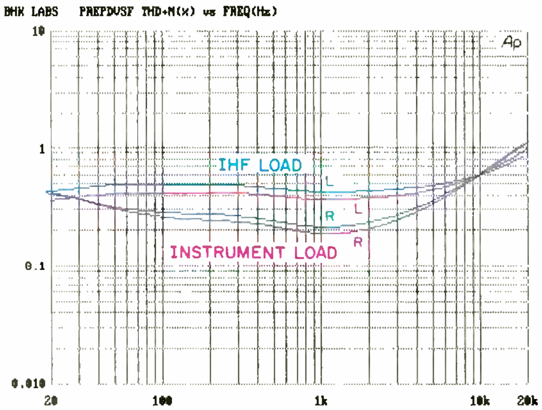


Fig. 6—Phono section THD + N vs. frequency and load at 2 V out.

Table II—Output noise, referred to input, of Premier Seven-A line amp section, with volume controls at maximum and input terminated by 1 kilohm. The IHF S/N ratios were 85.1 dB for the left channel and 83.0 dB for the right channel, for a 500-mV input and output and with volume controls at −29 dB.

Bandwidth	**Referred Input Noise, μV** LEFT	RIGHT
Wideband	8.2	9.7
22 Hz to 22 kHz	1.7	2.7
400 Hz to 22 kHz	1.4	1.6
A-Weighted	1.1	1.2

Table III—Phono section noise, referred to input, with 100-ohm input termination. The IHF S/N ratios were 62.2 dB for the left channel and 62.4 dB for the right channel.

Bandwidth	**Referred Input Noise** LEFT	RIGHT
22 Hz to 22 kHz	1.26 μV	1.12 μV
400 Hz to 22 kHz	376 nV	376 nV
A-Weighted	394 nV	385 nV

ance of the line section measured about 175 ohms. Interchannel crosstalk was greater than 110 dB from 10 Hz to 50 kHz and consisted more of output amplifier noise than of crosstalk per se. Any other result would be suspect due to this preamp's dual mono nature.

The phono section's RIAA equalization was very good, varying by only about 0.1 dB over the audio range with instrument loading. The IHF load had little effect except for a small level drop, slightly more than 0.5 dB, and some low frequency roll-off (less than 0.5 dB at 20 Hz) caused by the preamp's output coupling capacitor combining with the 10-kilohm load to form an RC high-pass filter. The level drop was due to the attenuation of the 10-kilohm resistance of the IHF load against the phono stage's equivalent output impedance of some 700 ohms.

Phono overload, as represented by the 3% THD point, was attained for instrument loading at a 1-kHz input level of about 0.2 V and an output level of about 10 V; for IHF loading, the figures were about 160 mV and 8 V, respectively. These results are for the left channel; the right channel put out some 60% more. For either load, the behavior remained pretty constant at all frequencies to about 5 kHz, dropping gradually by about 2 V at 20 kHz with instrument loading and dropping a bit less with IHF loading. Since the distortion rise versus output level is rather gradual in this circuit, it is a little less precise to cite overload versus frequency at an admittedly arbitrary distortion level of 3% than it would be with the usual feedback circuits, which clip or distort more abruptly.

When I tested the phono section with 1-kHz, pre-equalized square waves, the two channels behaved more alike than in the sine-wave overload test. Performance here was pretty good, with about 1 V peak to peak attainable before asymmetry set in.

Total harmonic distortion versus frequency and load, at an output of 2 V for both channels, is plotted in Fig. 6. As mentioned earlier, the right channel has lower distortion. Distortion at 1 kHz was generally about 0.1% or less at working levels, especially with moving-coil pickups. It increased gradually with output, to 2% or 3% at the 10-V level.

Input-equivalent noise levels, along with phono IHF S/N ratios, are listed in Table III. Relative to the output of a typical moving-magnet cartridge, the noise levels are quite satisfactory. Relative to typical moving-coil output levels, the noise is marginal and would likely be audible at high volume settings when the arm is off a record.

Phono interchannel crosstalk was measured. As with the line amplifier, it was better than 100 dB down and was dominated by random noise in the input stage.

Use and Listening Tests

My first listening tests were made with the Evolution 2000 amplifier powering the electrostatic panels of Martin-Logan Monolith speakers. A McIntosh 2600 solid-state amp was used to drive the woofers in this speaker system. I was immediately impressed with the musical honesty of the conrad-johnson amp. At the time, I was mainly using Carver Silver Seven tube power amplifiers in this service, with superb results. My feeling was that the c-j amp was very good, in many ways comparable to the Carvers' excellence.

A professor couldn't tell them apart.

"The world's most accurate loudspeaker" a magazine reviewer claimed.

So, a well-known television programme decided to put us to the test.

A professor of musicology sat before a performer and a pair of Sovereigns.

So real was their sound reproduction, the professor couldn't tell where the live performance left off and the recording began.

It was, perhaps, the toughest test any loudspeaker has faced and a very credible indication of the sound quality you can expect from the entire Duntech range.

Yet our engineers continue to push the edge of technology in our quest for perfect sound reproduction.

Visit an authorised Duntech retailer soon and judge our success for yourself.

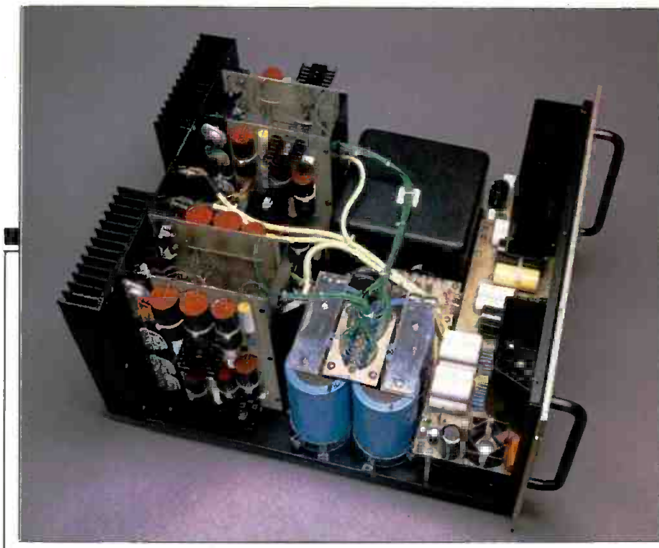
DUNTECH

APPLIED INTELLIGENCE

USA: Sounds Like Music, Phoenix AZ Ph (602) 993 3351 • Christopher Hansen Limited, Beverley Hills CA Ph (213) 858 8112 • Stereo Design, San Diego CA Ph (619) 573 0060 • Soundings, Denver CO Ph (303) 759 5505 • Ideal Acoustics, Starkville MS Ph (601) 324 1020 • CSA Audio Design, Upper Montclair NJ Ph (201) 744 0600 • Sound By Singer, New York NY Ph (212) 924 8600 • The Discriminating Ear, Great Neck NY Ph (516) 627 4456 • The Listening Room, Scarsdale NY Ph (914) 472 4558 • Audio Images, Wescosville PA Ph (215) 391 1200 • Galen Carol Audio, San Antonio TX Ph (512) 805 992 • Sound By Design, Gainesville TX Ph (817) 665 7130
CANADA: Taylor Marketing Inc, Vancouver BC Ph (604) 531 7666

DUNTECH AUDIO P/L, 60 JACOBSEN CRESCENT, HOLDEN HILL, SOUTH AUSTRALIA, AUSTRALIA 5088. TEL (618) 369 0600, FAX (618) 369 0604

Enter No. 13 on Reader Service Card



The sound I got from either piece alone, and certainly from the combination, was quite musically satisfying.

I then tried the Evolution 2000 in full-range use with other speakers over a period of time. Again, I generally thought the results were very good, affording well-balanced tonality and a high degree of musical satisfaction.

For the preceding tests, I used a Quicksilver Audio tube preamp and a Vendetta Research phono preamp. Next, I put the conrad-johnson preamp into the system. I again set up the Monoliths with the Evolution 2000 driving their electrostatic panels. Now, here was good sound! I listened to this combination for weeks and got some of the best sound I had heard in my setup in some time. Tonal balance was very neutral, definition and space were very good, and the overall sound was quite musically engaging.

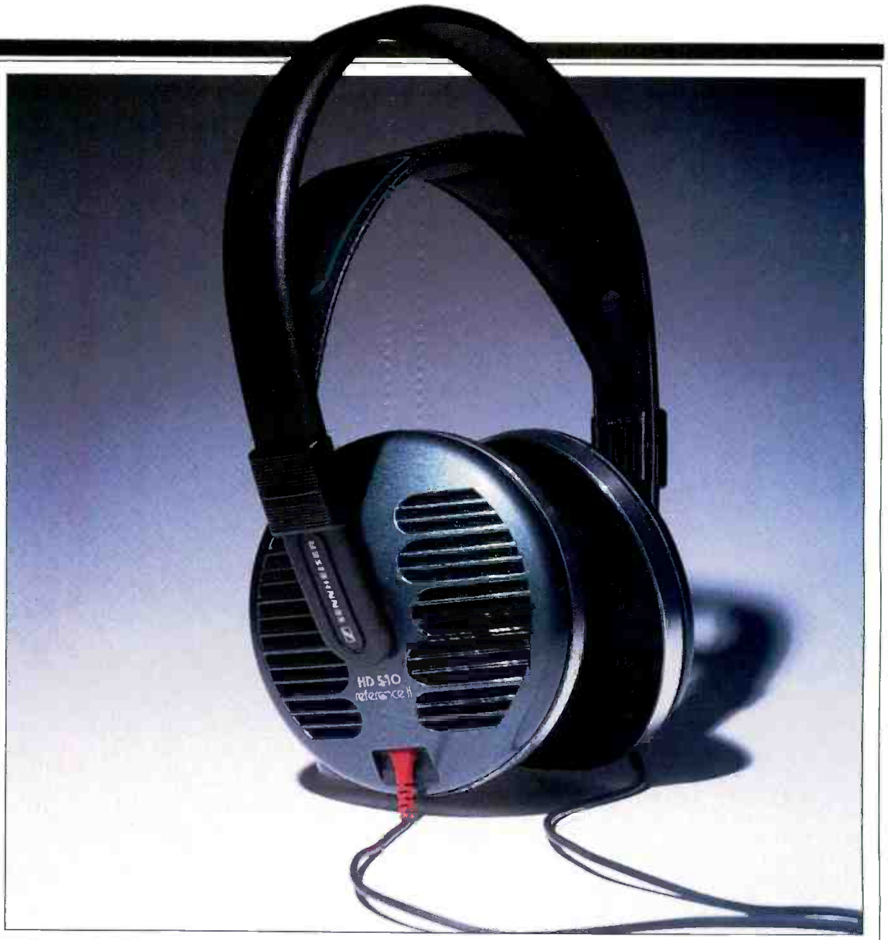
Finally, to get a point of reference, I hooked up the Carvers to drive the panels with the Premier Seven-A as the preamp and proceeded to listen. I still preferred the Silver Sevens overall but again came to the conclusion that the Evolution 2000 is one very fine power amplifier. I am very glad that I had the chance to experience it and the Premier Seven-A in my system. Judging by the overall results I got using the preamp, I think it is one of the best-sounding preamps I have had in my setup.

Both pieces of gear operated flawlessly, but I have one nit to pick about the volume controls on the preamp. Since the Evolution 2000 has relatively high gain and the line output amplifier of the Premier Seven-A also has higher than normal gain, my high-level sources required that the volume controls be set down near the bottom of their range for my normal listening levels. In some cases, even the minimum volume setting was louder than I wanted. When playing records without a step-up device, I had the volume controls up much higher in their range, where I could adjust them with greater resolution. Some hiss could be heard at normal levels when the arm was off the record, but it was not high enough to distract from the music.

To sum up, the sound that I got from either piece alone, and certainly from the combination, was quite musically satisfying. I enjoyed music with these conrad-johnson components a lot and strongly recommend that prospective buyers of equipment in this price range give the Evolution 2000 and Premier Seven-A an audition. *Bascom H. King*


ENTER SERIES 3
The Legendary MATRIX 801 & MATRIX 802 monitors have been revised for even purer performance. The permanent attachment of the bass and midrange enclosures provides improved midrange and high frequency transparency. Crossovers have been completely redesigned to avoid electrical and magnetic interaction between the drivers. And a new tweeter registers perfect response to well beyond audibility without the need for protection circuitry.
Elevated in performance and, remarkably, reduced in cost, these monitors once again establish new standards for flawless music reproduction. Their continued supremacy in world esteem is thus assured.
B&W LOUDSPEAKERS
B&W Loudspeakers of America, P O. Box 653, Buffalo, NY 14240
Tel: (416) 771-6611 Fax: (416) 882-8397
Enter No. 5 on Reader Service Card

SENNHEISER HD-540 REFERENCE II EARPHONES



Transducer Design: Dynamic.
Coupling to the Ear: Circumaural.
D.c. Resistance: 290 ohms.
Absolute Polarity: Positive.
Cord: 9 feet long; straight, light, and flexible; runs from both earcups; stereo mini-plug connector with ¼-inch adaptor.
Adjustments: Headband slides in bail, which has detents.
Weight: 6 oz.
Price: $199.
Company Address: 6 Vista Dr., Old Lyme, Conn. 06371.
For literature, circle No. 94

Sennheiser originated the idea of "open-air" earphone design, and following this tradition, the HD-540 Reference II does not have a tight seal at the rear or front of the diaphragm. The first commercially successful earphone designed to be used without a tight seal between the transducer elements and the ear was, as I recall, the Sennheiser HD-414. It had small foam ear cushions that sat on the outer ear, or pinna. I wondered how it could produce any bass and still remember my surprise when I tried it on. I had always thought that a tight seal was necessary to obtain good bass, but the HD-414 changed my mind forever. The lack of a tight seal usually reduces bass output, but Sennheiser designed the dynamic transducers of the original HD-414 to account for this; now they have done it for the transducers in the HD-540 Reference II. Since these earphones are not sealed, the attenuation of outside sound is negligible, and it is quite easy to hear outside noises and conversations.

EARPHONE EVALUATION

PARAMETER	RATING	COMMENTS
Overall Sound	Very good	
Bass	Very good	"Solid bass" and "Not boomy"
Midrange	Good	"Recessed slightly" and "Clear"
Treble	Excellent	"Clear" and "Transparent"
Overall Isolation	Poor	
Bass	Poor	"No isolation"
Midrange	Poor	"Outside conversation easy to hear"
Treble	Fair	"Outside highs are reduced"
Comfort	Very good	"Ear cushions are excellent"
Value	Very good	

GENERAL COMMENTS: Good adjustment to head; very comfortable for long-term listening; clear and open sound with slightly recessed upper range.

The Sennheiser HD-540 II earphones are very light, weighing in at only 6.0 ounces. The plastic bail, like many other current designs, is made as one continuous molding. The headband, of simulated-leather vinyl with stitching along the outside edges, has seven foam-filled sections on the side that sits against your head; it is attached to a plastic piece on each side of the bail. Near each earcup, the bail has horizontal ridges which act as detents and hold the sliding plastic pieces in place after a comfortable position has been selected. As with other earphones that use this type of system, earcup positioning is most easily adjusted by removing the earphones, sliding the plastic pieces, and then trying them on again. There are no markings on the earcups to show which channel is which, but the connectors that plug into the 'phones are marked "L" and "R," and the plug for the right channel is red.

The plastic earcups are very good-looking, with a band that looks like

DEEP BASS

SUBWOOFERS

MK

MILLER & KREISEL SOUND CORPORATION

Push-Pull Dual Driver Powered Subwoofers

MX-100, MX-90, MX-80, & MX-70

10391 Jefferson Boulevard
Culver City, CA 90232
(213) 204-2354
In Canada: (604) 873-4475
Fax: (604) 872-1210

Musical Articulation. Detail. Elusive qualities of superior sonic reproduction that are *rarely* found in even the most expensive subwoofers.

Until now!

M&K's new MX subwoofers bring you these high-performance qualities—in a smaller cabinet and at a lower price.

In a cabinet the size of a bookshelf speaker, two new proprietary 12" subwoofer drivers produce the massive amounts of bass only expected from much larger cabinets. Better yet, M&K's Push-Pull design produces a much higher quality of bass by virtually eliminating even-order harmonic distortion.

MX-100, MX-90, MX-80 & MX-70

Four MX models, with internal amplifiers between 75 and 200 watts RMS, provide an ideal match for your system.

Building On Excellence

Seventeen years of M&K experience in Satellite-Subwoofer systems comes together *again* to create a new subwoofer performance standard. And with the 18" x 10" x 13.5" MX-70, M&K creates a new *compact* subwoofer standard.

The Ideal Choice

The unprecedented musical articulation and "ultra quick" sound of the MX subwoofers make them the perfect choice to complete any audio or audio/video system.

Enter No. 22 on Reader Service Card

For long-term listening, the Sennheisers are an excellent choice, and their price makes them an excellent value.

brushed chrome separating the gray outside part from the velvet ear cushions. The outside part has slots that allow the rear of the transducer to be open to the air. The slots are covered by black cloth that keeps dust and dirt from entering the earcups. The earcups have a recessed area at the bottom, just below the raised nameplates, to allow the wire to exit; the wires have strain reliefs and join together, after about 6 inches, into one cable.

The ear cushions have a ring of velvet that sits against your head, and a soft cloth covering at the inside and outside edges. The cloth allows an open path between the earphone transducers and the outside air. I liked the feel of these ear cushions, and they were very comfortable. The inside diameter of the ear cushions was large enough for them to fit easily over my ears and sit against my head without pinning my ears. I remember how the HD-414s used to irritate my ears after 15 or 20 minutes, so I really appreciate the comfort provided by the large, around-the-ears cushions of the HD-540 IIs. They were still comfortable after an hour or more of listening. The HD-540 II can swivel enough to fit your head properly, and the tension of the plastic bail, which holds the earcups against your head, is very light. After a few moments, you almost forget you are wearing these earphones.

The subjective sound qualities of the Sennheiser HD-540 II were rated by members of a listening panel against those of the Stax SR-Lambda Pro. The panel members listened to a variety of program material and were asked to write down their comments. Measurements that I had made earlier showed that the Sennheiser's bass output was very extended, with no prominent bump to exaggerate the bass. Below 80 Hz was a gentle roll-off of 6 dB per octave. Comments by panel members—such as "not boomy," "good bass," and "very extended"—correlate well with my measurements. Comments about the middle register being "less recessed than the reference," "very good on voice," and "articulate" correlate with measurements that I made with the B & K HATS manikin. (See the article "As Close As You Can Get" in the April 1991 issue.) Sennheiser has designed the HD-540 II earphones to have a diffuse-field response that is similar to the B & K measuring system's. The SR-Lambda Pros, which I use as reference, showed a dip at 2.8 kHz when measured with the B & K system's diffuse-field response (see review in the April 1991 issue), and the listening panel all commented that the HD-540 IIs sounded a little brighter than the reference earphones.

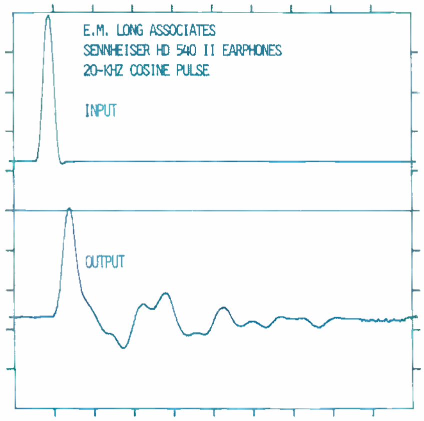


Fig. 1—Output vs. time (bottom) for 20-kHz cosine pulse (top).

The listening panel's comments of "a little bright" and "zippy" regarding the upper middle register also correlate well with the way the Sennheiser earphones reproduced a 500-Hz square wave: In the output spectrum, the natural harmonics at 3.5, 4.5, and 5.5 kHz were accentuated. The harmonics at 11.5 and 12.5 kHz were also a little prominent compared to those below and above them, which may have contributed to the "zippy" comment being made. The shape of the 500-Hz square wave was excellent, although a slight tilt showed some low-frequency phase shift; the initial part of the square-wave response indicated that there is some high-frequency phase delay.

Figure 1 is the output of the HD-540 II earphones for a 20-kHz cosine input. The output, after the input has stopped, correlates with the listening panel's overall impression that the Sennheisers were very good but not as open and clear as the reference earphones. There seems to be a little too much output around 5 kHz compared to the upper range, which causes the otherwise excellent response in the upper range to be slightly obscured. The output pulse from the HD-540 IIs also shows that they produce a positive acoustical ouput for a positive electrical input. Absolute polarity was easy to hear with these earphones, especially on voice.

I measured frequency response with a Fast Fourier Transform (FFT) analyzer by using the same 20-kHz cosine pulse with a B & K 4133 condenser microphone directly in front of the earphone element. The frequency response showed a rise at around 5 kHz and some sharp dips at around 7 and 14 kHz; the phase response also showed irregularities at 7 and 14 kHz. I couldn't find anything obvious that might have caused this; the ear cushions and other exposed parts are cloth-covered foam, which should provide excellent absorption of any reflected sound. The relationship between the amplitude and phase-transfer responses of the output show that the response is minimum phase, so these dips are probably not as bad as they might appear to be.

The HD-540 II produced a very smooth sound when reproducing pink noise. I would describe it as being like a spray of water from a garden hose rather than the sound of a waterfall and its accompanying low-frequency roar.

The impedance of the HD-540 II earphones is about 300 ohms, so the response shape and output level are affected hardly at all by the source impedance which supplies the signal to them. These earphones are relatively sensitive and produce very high sound levels with very little input power.

The listening panel and I found the HD-540 II earphones very comfortable; it is easy to forget that you are wearing them. The panel gave the Sennheisers a rating of "very good" for overall sound quality and also a "very good" for physical attributes. I think that they share some of the qualities of the Stax electrostatic reference earphones, with a slightly less analytical quality and a very slight veiling of the sound. For long-term listening, the HD-540 IIs are excellent. Considering the level of musical enjoyment they provide and how comfortable they are, their price makes them an excellent value.

Edward M. Long

A Revolution in Evolution.

Artistic creation is the culmination of unique inspiration and enlightenment—a process of evolution. The most shining achievements, however, are sparked by no less than a revolution.

This is the driving force behind the Genesis III loudspeaker. And the essence of everything we at Genesis are about. With Genesis III, we have entirely redefined the sonic landscape.

Every aspect—every minute factor—has not only been examined, but intensely evaluated in terms of its contribution to the whole.

From the unerring exactness of its Kevlar/polypropylene woofers, to the light, coherent fidelity of the titanium/silicon carbide midrange dome and the transparent musicality of the exotic planar film/foil ribbon tweeter, this stunning 5-way tower uniquely blends technological esoterica with decisive engineering.

Imagine a precisely-rendered holographic soundstage, where the musicians are audibly visible. Imagine rediscovering your music, realizing sonic dimensions you never knew were there.

Give Genesis III a personal audition. It will convince you to join this remarkable revolution.

Genesis
Evolution In Progress

953 So. Frontage Rd. • Vail, CO 81657
(303) 476-3012

Enter No. 14 on Reader Service Card

TWO SCORE AND MORE

Illustration: Rick Tulka

Mozart: The Symphonies. Prague Chamber Orchestra, Sir Charles Mackerras.
Telarc CD 80300, 10 CDs; DDD; 12 hours, 15 minutes.

Can a young reader understand what an extraordinary artifact this immense (but compact) album represents? In 200 years, since Mozart died, how many musicians, how many music lovers, have ever heard *all* the known Mozart symphonies? *Virtually none.* Nor have today's musicians.

Do not think I am all the way through this set yet. I am deliberately listening from start to, no, *not* finish, but up to the later and familiar symphonies. This, for many of us, is the significant impact of the recording. And a fascinating experience it is, immeasurably aided by the wise and experienced Czech musicians who have learned to play these short but not easy works with infinite polish and style, no matter how unfamiliar.

Mozart's list runs to some 40 compared to Haydn's more than 100. But the chronology is very different. Haydn was a late starter, yet an innovator from the beginning, when he was more than 30 years old. Mozart was simply the ultimate genius, absorbing uncritically the musical styles he heard around him, surpassing every model he chose with the greatest of ease.

So far I have played three discs, running from Symphony No. 1 through No. 15, and among others I found No. 14 in A a marvel of expression and good taste, somewhat in the manner of the much later "Eine Kleine Nachtmusik" familiar to all of us. It was composed when Mozart was a fully mature and enormously proficient musician, equal to any of his contemporaries and mostly surpassing them. He was 16.

Symphony No. 1, at the beginning, has a curiously baroque sound to it, with plenty of sequences—the same pattern repeated at different levels. It is faultless in execution, if not very varied. The piece was composed in England when papa Leopold Mozart was seriously ill with strep throat or similar—he could not have provided any assistance at all. Instead, the older sister, Nannerl Mozart, helped copy out the parts, but neither was allowed to touch a piano due to the father's illness, and so it was done entirely in the head. Mozart was eight years old.

I sense in these fine performances that Sir Charles Mackerras wisely goes along with the innate knowledge and experience of the Czechs who play the music. Never forget that "Bohemia," then part of the Austrian Empire, was the very center of Mozart appreciation, even more than Salzburg and Vienna, where his acclaim was, shall I say, spotty. Those traditions have lasted, straight through all recent political changes, as you may easily hear. Telarc was wise in its choice of recording musicians.

All of the 10 CDs but one are well over 70 minutes long, and as long as 78:28 on the first. Don't let the "TT"—total timing—discourage you. Don't even think about the time—just listen.

Edward Tatnall Canby

Mahler: Songs from Rückert and Des Knaben Wunderhorn. Siegfried Jerusalem, tenor, and Siegfried Mauser, piano.
Virgin Classics VC 7 91114-2, CD; DDD; 56:08.

Say "the two Siegfrieds" to the average music lover, and he or she is apt to think of the roles of that name in the two final operas of Wagner's *Ring*. Siegfried Jerusalem has sung them both with equal aplomb—as witness the Metropolitan Opera broadcasts. Here he teams with another Siegfried (Mauser) to sing very different fare, but again there are two Siegfrieds that complement each other.

If the last word on any vocal record must be the singer's, the first word here is Mauser's. With the opening notes he not only sets the song's mood perfectly, but he suggests that an exceptionally colorful palette will prevail throughout, as it does from both artists. If you think of Jerusalem as another tenor with "resonance where his brains ought to be," you haven't heard him sing. He is a thorough and thoughtful musician who also happens to have a fine, full-bodied tenor voice. His emotional (and dynamic) range is extremely broad.

Nor is Jerusalem a singer to let beauty of tone interfere with expression. There are moments when, in the heat of emotion, he permits himself downright ugly sounds—even faulty intonation. For him it obviously is Mahler's texts (in *Wunderhorn*, very much reworked by the composer) that take precedence over his music as such. Or, rather, it is the music that grows out of the texts, which contain some ideas too disturbing to be papered over with

TIPS FOR MAIL ORDER PURCHASERS

It is impossible for us to verify all of the claims of advertisers, including product availability and existence of warranties. Therefore, the following information is provided for your protection.

1. Confirm price and merchandise information with the seller, including brand, model, color or finish, accessories and rebates included in the price.
2. Understand the seller's return and refund-policy, including the allowable return period and who pays the postage for returned merchandise.
3. Understand the product's warranty. Is there a manufacturer's warranty, and if so, is it from a U.S. or foreign manufacturer? Does the seller itself offer a warranty? In either case, what is covered by warranty, how long is the warranty period, where will the product be serviced, what do you have to do, and will the product be repaired or replaced? You may want to receive a copy of the written warranty before placing your order.
4. Keep a copy of all transactions, including cancelled checks, receipts and correspondence. For phone orders, make a note of the order including merchandise ordered, price, order date, expected delivery date and salesperson's name.
5. If the merchandise is not shipped within the promised time or if no time was promised, 30 days of receipt of the order, you generally have the right to cancel the order and get a refund.
6. Merchandise substitution without your express prior consent is not allowed.
7. If you have a problem with your order or the merchandise, write a letter to the seller with all the pertinent information and keep a copy.
8. If you are unable to obtain satisfaction from the seller, contact the consumer protection agency in the seller's state or your local U.S. Postal Service.

If, after following the above guidelines, you experience a problem with a mail order advertiser that you are unable to resolve, please let us know. Write to Nick Matarazzo, Publisher of Audio Magazine. Be sure to include copies of all correspondence.

David Starobin's guitar performance is relaxed and confident, showing the thought that he puts into this excellent music.

mere vocal technique. Listeners accustomed to a more lyrical approach may be taken aback by the intensity.

Those used to the more usual orchestral versions of these songs (though two of them exist in piano autographs only) may also be taken aback by the piano versions. The notes make an urgent plea that they be viewed as independent compositions, not as sketches for the orchestral versions, and the point is well taken. Virgin's usual, high standards of sonic cleanliness prevail, but the performances (aided by full texts in German, English, and French) are so preemptive you may not notice the engineering. *Robert Long*

Mauro Giuliani: Solo Guitar Music Performed on 19th Century Guitar. David Starobin, guitar.
Bridge BCD 9029, CD; AAD; 48:22.

Repertoire for classical guitar—especially from the 19th century—has often been accused of being shallow. There are many reasons for this, including the instrument's political and structural association with "folk" music as well as its quiet, parlor-sized voice and its coincident existence outside the mainstream of classical pedagogy. Of the many 19th-century composers for the guitar, however, Mauro Giuliani stood alone in his consistent display of compositional and emotional depth.

The Italian-born Giuliani (1781 to 1829) spent the majority of his brief but productive career in the musical hothouse of Vienna, where he established his reputation in Europe. While other recordings of Giuliani's works have appeared, David Starobin's *Mauro Giuliani: Solo Guitar Music Performed on 19th Century Guitar* is the first I'm aware of to draw on the wealth of the composer's complete collected works that were first published between 1985 and 1989 in 39 volumes.

Some of this material is now familiar, such as the rousing and very operatic Grande Ouverture, Op. 61, with its stately introduction and demanding virtuosic variations building to a Beethovenesque climax. Most is new to me, and a real treat. Take, for example, the very atypically chromatic Preludes adapted by Giuliani from five-string guitar works by Antoine l'Hoyer, sounding more like they were written in the 1960s than in the early 1800s. Or the highly ornamented parlor cameos, so popular at the time, "Le Jasmin," "Le Romarin," and "La Rose," sweet miniature jewels full of poetry and subtle drama. Starobin concludes his program with another well-known grand opus, the scintillating "Variazioni Sulla Cavatina Favorita: De Calma oh Ciel," Op. 101, based on Desdemona's part in Rossini's *Otello*.

Starobin, better known for his performance of new music, plays this recital on a reproduction Staufer guitar from Vienna at about Giuliani's time, a delicately voiced instrument that is able, particularly with the help of recording techniques, to handle the wide dynamic range of the dramatic music. Starobin's performance is relaxed and confident, communicating his enthusiasm and the thought he's put into this excellent guitar music.

David Starobin's *Mauro Giuliani* provides a wonderful glimpse into the fertile Viennese musical garden where so many revered composers matured, revealing a first-rate 19th-century composer for the guitar. *Michael Wright*

Schubert: Octet. Atlantis Ensemble.
Virgin Classics VC 7 911202.

Atlantis embraces musicians from both sides of the Atlantic dedicated to historically informed performance (HIP), convened in this instance in a Cologne church with the Dutch HIP high priest Jaap Schröder on first (gut-stringed) fiddle. If Schubert had lived to hear this masterpiece, he would have heard it—with great luck—as it sounds on these instruments. The American Lowell Greer, blowing a valveless horn with every note bang on pitch, defies belief. *Paul Moor*


ORIGINAL MASTER RECORDING™
ULTRADISC™
UDCD 557
UDCD 2-558
UDCD 559
New Release
WHO ARE YOU
UDCD 561
mobile fidelity sound lab
a division of MFSL, INC.
The Great American Audio Company™
Mobile Fidelity Sound Lab continues to set the gold standard, from our careful selection of original master tapes to our meticulous proprietary mastering techniques and customized pressing of each compact disc using 24 karat gold.
Mobile Fidelity Sound Lab—Setting the audiophile standard since 1977.
For a free catalog, call 800-423-5759
Enter No. 26 on Reader Service Card

RECOGNITION DEPT.

I Am the Cosmos: Chris Bell
Rykodisc RCD 10222, CD; AAD; 54:18.

Sound: B+ Performance: A

Live: Big Star
Rykodisc RCD 10221, CD; AAD; 48:49.

Sound: C+ Performance: B

Third Album/Sister Lovers: Big Star
Rykodisc RCD 10220, CD; AAD; 55:15.

Sound: B Performance: B+

To the uninitiated, Big Star was a great Memphis pop band of the early '70s that had all of the music but got none of the breaks. Despite a host of record company problems, myriad personal catastrophes, and a penchant for bad timing, the band did succeed in becoming critics' darling but little else.

Yet Big Star has posthumously received at least some of the recognition that eluded the band when it was active. They were a pop group ahead of their time, playing short melodic songs when such music was desperately unfashionable. Currently, they have near-legendary status among progeny such as The Posies, R.E.M., The Bangles, Teenage Fanclub, Grapes of Wrath, and The Replacements, to name but a few. The marriage of Chris Bell's optimism with Alex Chilton's dark side made for a disparate songwriting collaboration that only really lasted through one album, their 1971 debut, *#1 Record*. Perhaps if Big Star had achieved a fragment of commercial success in their day, it would be a dismissable artifact, but they never had the chance to sell out. At the time, radio shunned them, and the public didn't buy them, even though they had been put on a pedestal by the "alternative" scene.

The person most usually identified with Big Star is singer/songwriter/guitarist Alex Chilton, the common denominator in all of the three Big Star studio albums. However, the result of Ryko issuing these particular recordings simultaneously may well be the vindication of Chris Bell as an equal (and perhaps superior) talent. Bell's career was cut short by a fatal car accident in 1978. Although Big Star was originally a quartet formed by Chris, they split after the first record was released due to personality clashes between Chris, Alex, and bassist Andy Hummel.

Shortly after Alex began recording a solo album, which became Big Star's sophomore effort, *Radio City*, the band reformed; Chris was not to be part of this, although several of his songs were. As Chris' influence diminished, so did the melodic pop side of the band. Alex's approach to recording was to use the process to purge himself of his demons.

The two Big Star discs Ryko has issued, *Live* and *Third Album/Sister Lovers*, are less than essential. *Live* is from a radio show recorded shortly after the departure of Andy Hummel, and the band is dispirited. *Third* was subsequently recorded during a period of depression and chemical excess best documented by Chilton's song "Downs." There still is a beauty to Chilton's work, but the lack of popularity and Alex's personal indulgences definitely affected this work negatively.

The gem of this collection, however, is Chris Bell's *I Am The Cosmos*, which presents his post-Big Star recordings to the world for the first time (although a small label, Car Records did issue two of these tracks on a single back in 1977). Whereas Chilton's joy was in finding beauty in the depths of decadence, Chris' gift was in trying to relieve his despair by seeking something spiritual in nature. The results speak for themselves in gems like "Get Away" (mistitled "I Don't Know"), "Make A Scene," "You And Your Sister," and the title cut. I believe Chris recorded a total of 23 songs after he left the band, so perhaps if there's enough interest Ryko will release the rest.

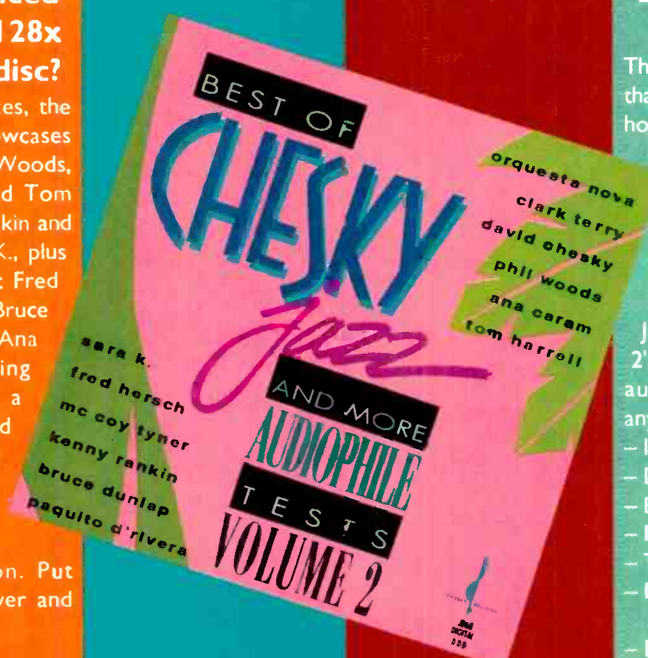
The liner notes are informative but a bit incomplete—no mention of the live Big Star reunion of 1976, or Chris' collaboration with Tommy Hoehn and Van Duren, and not a word about the jealousies that tore Big Star apart—no matter. The important thing is that this material is finally available to the general public. It's some of the most inspired music made during the early '70s, and it's certain to spur on another generation. While the two Big Star CDs have their musical moments, Chris Bell's solo steals the show. It's far more interesting to hear the sound of one man taking off than to hear another man crashing. *Jon & Sally Tiven*

BEST OF CHESKY JAZZ AND MORE AUDIOPHILE TESTS VOLUME 2

TWO CD's IN ONE

Have you ever experienced the sound of a Chesky 128x oversampled compact disc?

Containing 12 audiophile showpieces, the first part of this two part CD showcases Jazz virtuosos McCoy Tyner, Phil Woods, Paquito D'Rivera, Clark Terry and Tom Harrell, Pop Vocal stylist Kenny Rankin and new artist singer/songwriter Sara K., plus the brilliant musicianship of pianist Fred Hersch and David Chesky guitarist Bruce Dunlap, Brazilian guitarist/singer Ana Caram and the unique and stirring Orquesta Nova. Place them in a natural acoustic environment and record them with Chesky's customized electronics, 128 times oversampling convertor and minimalist miking techniques, and you have a winning combination. Put the Jazz Sampler on your CD player and *hear the difference.*



Literally a prescription for your stereo system

The second half of this CD contains more than 50 listening tests which you can use at home to set up your stereo system.

Plagued by audio gremlins...some recordings sound dramatically worse than others? Fed up with these inadequacies?

The Solution

Chesky Records' new "Best of Chesky Jazz and more Audiophile Tests Volume 2" (JD68) will help you solve most of your audio confusion. For the first time anywhere, definitive tests for :

- IMAGE DEPTH (3' TO 70')
- DYNAMIC AMPLITUDE
- BASS RESONANCE
- IMAGE HEIGHT
- THREE DIMENSIONALITY
- DIFFERENCES IN DIGITAL CABLES
- RESOLUTION OF ANALOG TO DIGITAL CONVERTERS
- AUDIOPHILE SOUND EFFECTS

HEAR THE DIFFERENCE

Chesky Record CDs are available in Fine Audio and Record Stores, or order direct with Visa/MasterCard by calling 1-800-331-1437 or 212-586-7537 or send check or money order: CD's $ 4.98 plus $3.00 postage and handling (add 8.25% sales tax in NY State) to CHESKY RECORDS Radio City Station, PO Box 1268, New York, NY 10101

CHESKY RECORDS/YOU CAN HEAR THE DIFFERENCE

Recorded using minimalist miking techniques and without overdubbing or artificial enhancement to ensure the purest and most natural sound possible.

CHESKY RECORDS

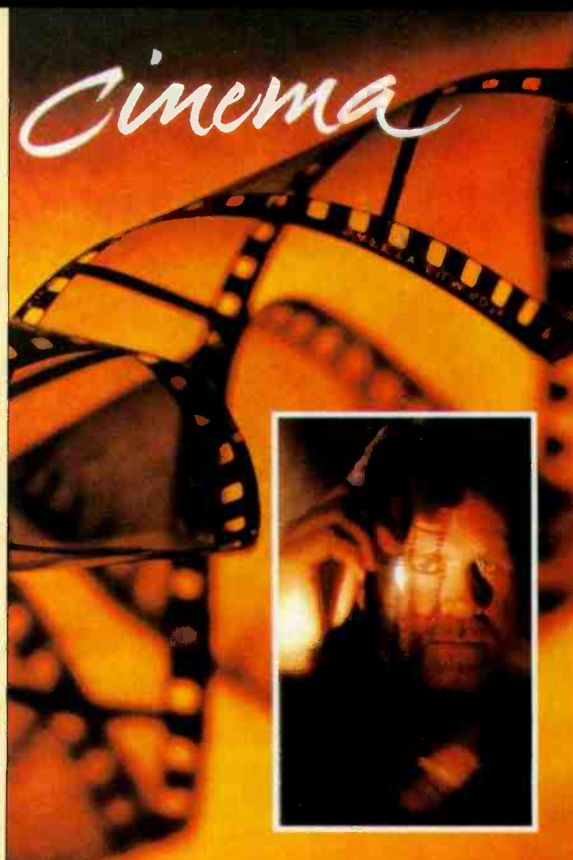
From the rich spectrum of musical sources absorbed in his native New Orleans, pianist Henry Butler's musical palette has successfully integrated jazz, gospel, blues, R&B, funk, and the classics. In *Blues & More, Volume 1,* Henry churns out the blues —both traditional and original. Dangerous blues on Windham Hill Jazz.

AVAILABLE WHEREVER MUSIC IS SOLD

BLUES AND MOVIES

An impressionistic journey through some of film's most celebrated scores. In this collection of emotive piano solos straight from the glorious big screen, pianist Philip Aaberg rediscovers music from **Cinema Paradiso, Diva, Awakenings, My Brilliant Career, Belizaire the Cajun,** and many others.

AVAILABLE WHEREVER MUSIC IS SOLD



PHILIP AABERG

SOLO PIANO

CINEMA PARADISO

DIVA

MY BRILLIANT CAREER

AWAKENINGS

THE STORY OF NAOMI UEMURA

HEAVEN'S GATE

ROMEO & JULIET

BELIZAIRE THE CAJUN

OUR TOWN

THE SHAKER FILM

A variety of musical styles helps Garland Jeffreys make a powerful message on race relations on his latest, *Don't Call Me Buckwheat.*

Don't Call Me Buckwheat: Garland Jeffreys. **RCA 61112-2.**

By all rights, New York-native Garland Jeffreys should be a major pop music figure in America. A great talent who is considered a star in places such as Italy, he has come close to conquering his native land on at least three occasions. But luck hasn't exactly been in his corner. Epic Records released Jeffreys' last album, 1983's *Guts for Love* on the very same day that it released Michael Jackson's *Thriller*. Thus, *Guts for Love* fell through the cracks and was neglected by the Epic promotion machine. Fortunately, Jeffreys has reemerged with one of his best records ever—self-produced and full of the thoughtful angst that has become his trademark.

Don't Call Me Buckwheat is a meditation on race relations, with Jeffreys referencing a wealth of first-hand experience that makes this album much more than a lecture. Complementing his powerful message is the music, in which he uses different styles (rock, reggae, and urban pop to name a few) to help him make his case. Standout songs include "I Was Afraid of Malcolm," which features Vernon Reid on guitars, and "Color Line."

For Jeffreys, *Don't Call Me Buckwheat* will be difficult to follow. Let's hope radio and video outlets find a place for one of America's greatest living rock poets. *Jon & Sally Tiven*

The Jimmie Rodgers Library. Rounder 1056 to 1063.

Quite simply, it is impossible to overestimate Jimmie Rodgers' importance to country music. In a too-short recording career, from 1927 to 1933, he recorded a magnificent body of work.

This collection of eight separate volumes (there are no plans for a boxed set) is every bit as important to country music as Columbia/Legacy's sensational Robert Johnson project was to the blues and rock 'n' roll. Like the Johnson collection, the Rodgers Library includes previously unissued alternate takes—music virtually unheard in 60 years. Rodgers' biographer, Nolan Porterfield, served as compiler and annotator, and his work is truly a labor of love. This is a treasure trove of great songs of the highest historical importance. Don't miss it. *Michael Tearson*

JUST GETZ BETTER

Photograph: Gorm Valentin

people time: Stan Getz and Kenny Barron
Verve/Gitanes 314 510 823-2, two CDs; DDD; 1:55:38.

Sound: A Performance: A+

The late Stan Getz (who died on June 6, 1991) and Kenny Barron—both separately and together—shared much gorgeous music with the public over the last two years. I have been particularly taken with Getz's recent quartet recordings on EmArcy, which include pianist Barron, bassist Rufus Reid, and drummer Victor Lewis.

Furthermore, during this same time period (1989 to the present), Barron has been appearing as a sideman and leader on a plethora of other sessions, the most recent being *The Moment* (Reservoir Records), a trio date with Reid and Lewis. That each of Barron's several discs remains fresh is a testament to the pianist's artistic depth.

people time, a magnificent live duet album, showcases Getz's tenor and Barron's piano during a four-day engagement at the Cafe Montmartre in Copenhagen, recorded in March 1991 (Getz, as a former expatriate, resided in Copenhagen for many years). It is the apparent culmination of their concentrated, decade-long association. Adding significance to this project is the fact that this session was Getz's last recording. Getz, it turns out correctly, was justified in giving up on doctors who wrote him off to cancer years earlier, yet he knew his life would close shortly. But, as exhibited here, people do some of their best work when they know the end is upon them.

Ultimately, *people time* is an incredible recording because Getz and Barron, in their respectively illustrious careers, have never played better. There are scores and scores of gorgeous passages—seemingly a never-ending stream of them—in solos and ensemble work alike, that eclipse predecessors. *people time* just gets better and better, richer and richer.

If Getz's solo on Charlie Haden's brilliant "First Song (for Ruth)" doesn't move you, then Barron's Tatum/Monk-driven playing on "(There Is) No Greater Love" will. His thoroughly enjoyable romps can aptly be described as toe-tapping escapades. And Barron's intros stunningly set a seamless and subtle table for Getz, so the saxophonist can't help but land squarely and attack the music; the energetic "Night and Day" is a perfect example.

Taken as a whole, the communication between Barron and Getz on *people time* is nothing short of soul stirring. This is a crisp and cleanly recorded live date, the kind of document that everyone will want to play over and over again, not because it's Getz's last recording, but rather because it's a tribute to human spirit and capability.

Jon W. Poses

Living in the Danger Zone: Son Seals
Alligator ALCD 4798, CD; AAD; 52:04.

Sound: B+ Performance: A

A "cutting contest" is the blues-world equivalent of a back-alley street fight. There, musicians square off after hours in clubs to outplay their supposed rivals.

Put your money on Son Seals every time. Other guitarists may boast fancier technique or greater subtlety, but album after album, tour after tour, Son Seals delivers the grittiest, rawest Chicago blues this side of Muddy Waters. *Living in the Danger Zone* isn't blues as an excuse for guitar pyrotechnics, or a nostalgic throwback to a bygone era. This is blues as it was meant to be—a shout of anger at the world to keep demons at bay.

Fortune has rarely followed fame in the blues world. Son's tales of near misses and commercial errors will prove familiar to many blues fans. At 48, he's released five albums, which garnered justifiably good press. While he's remained in demand in clubs around the country (don't miss him!), *Living in the Danger Zone* is his first real release in seven years.

Time hasn't smoothed Son's rough spots, it's honed them to a razor's edge. He specializes in state-of-the-art Chicago blues, played with a sheer brute force and power that rock fans will find easy to understand. Son always seems to have that "something extra"—just when you think his solo has peaked, he reaches down and wrenches out another couple of searing notes. They don't call him "bad axe" for nothing.

Living in the Danger Zone features Son's well-drilled road unit on four tracks. The remainder feature a typically fine Alligator studio band, with Johnny B. Gayden a standout on bass. The best tracks follow the typical Seals pattern; the drummer bashes away at a

BEFORE YOU BUY...CALL US!
BEST SELECTION, BEST PRICE & EXPERT ADVICE
1 • 800 • 542 • SAVE

NHT
ALL MODELS IN STOCK
CALL FOR PRICES

Brand Name 130W Pro Logic Receiver

- 195W for front L/R & center
- 30W or rear channel
- CD direct playback
- DSP soundfield

Originally $599 Now On Sale **$399**

a/d/s/ FREE Remote w/Purchase

R4 Receiver
The R4 is rated at 65W/ch. It combines outstanding audio circuitry & proprietary computer technology in an easy to use component.
Orig $1000 **$569**

HUGHES AUDIO PRODUCTS (●) MODEL **AK-100** SOUND RETRIEVAL SYSTEM

"Perhaps the most effective stereo enhancement system, one that even simulates full surround sound." Len Feldman, Video Review March 1991
"The sound spread was so startling that I was certain additional speakers had been turned on-but they hadn't." Len Feldman, Audio April 1992
NOW ONLY $329

Rockford Fosgate A Division of Rockford Corporation
RF 2000 Power Amplifier
- Powerful, musical, and musically accurate
- 325 watts into 8 ohms, 565 watts into 4 ohms
- 16 MOSFET output devices per channel
- 1150 watts dynamic power into 2 ohms

ORIG. $1198 **$799**

RF 200 Pre Amplifier
"The RF200 met or surpassed all its specifications in our tests." Julian Hirsch, Stereo Review
ORIG. $699 **FREE** WITH PURCHASE OF RF2000 AMP
Does Not Apply To Any Previous Purchases

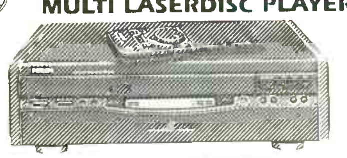
BBE Sound Inc. Reveals all the Sound You've Never Heard!

BBE1002 Sonic Maximizer
A REAL IMPROVEMENT!
3012 CAR UNIT NOW ONLY $139
NOW ON SALE **$189**


LUXMAN Design Series
Modest Size, Maximum Performance
A-007 - 40W/ch Integrated Amp Digital direct (optical or coaxial)
T-007 - Digital Synthesized AM/FM Tuner Built in timer, 20 randomly selected presets
D-007 - Digital Exclusive CD Player 16 program selections
K-007 - Auto Reverse Double Cassette Deck Dolby® B/C, HX Pro, Double-speed dubbing
5 YEAR LUXMAN WARRANTY
LAST CALL
ORIGINALLY $2400 **$799**

Hafler A Division of Rockford Corporation

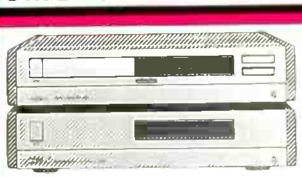
SE130 AM/FM Stereo Tuner
AM/FM stereo tuner features seek, scan, mono, mute buttons, signal strength & distant station indicators, AM/FM station presets
ORIG. $349 **$169**

PHILIPS CDV600 MULTI LASERDISC PLAYER

- Bitstream PDM 1-bit digital to analog conversion system w/256X OS & 4 DAC digital differential mode
- 50 button jog/shuttle remote • S-Video output • FTS
- Digital frame memory w/ freeze strobe and picture recall

ORIGINALLY $1100 **$788**

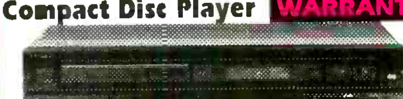

ORIGINALLY $2000 NOW ON SALE **$1798**

PHILIPS LHH500 REFERENCE SERIES CD PLAYER
- New Philips Bitstream Pulse Density Modulation 1-bit 256 times oversampling digital to analog conversion
- 4 DAC digital differential mode
- 700+ selection Favorite Track Selection lifetime memory programming
- 31 key full-function infared remote control transmitter
- Motorized, push-to-close disc tray
- Display Off feature cancels front panel display indication
- Automatic Music Scan for quick disc contents ovrview
- Random/Shuffle Play automatically plays all selections in totally random order
- A-B playback or Delete Playback automatically repeats


ORIG $4000 NOW ON SALE **$2499**

PHILIPS LHH1000 REFERENCE SERIES CD PLAYER

- State-of-the-Art Reference Standard dual chassis CD player system with unsurpassed performance
- Dedicated broadcast quality CDM-1 radialinear transport mechanism
- Digital-to-Analog converter section uses eight 1 grade D/A converter chips & digital filter with 4X oversampling
- Philips Jitter Elimination circuitry
- Audiophile attention to detail on all digital and analog circuits
- Extensive input and output capabilities
- LCD/Learn remote can command up to 10 different components

LUXMAN Compact Disc Player 5 YEAR LUXMAN WARRANTY

DZ-92 Remote Compact Disc Player
Features dual D/A converters • 4X Oversampling digital filter • 3-beam laser • 20 selection program play • All metal chassis & housing • Multi-function remote control • STAR circuitry & more
Orig $280 NOW ON SALE 1/2 Price **$139**

Sound CITY
MEADTOWN SHOPPING CENTER
ROUTE 23 SOUTH
KINNELON, N.J. 07405
VISA • MasterCard • DISCOVER • AMERICAN EXPRESS

INFORMATION 201•838•3444
CUSTOMER SERVICE 201•838•1180

Factory Authorized For All Brands We Sell • Not Responsible For Typographical Errors • Some Pictures For Illustration Purposes Only • Absolutely NO Refunds on Video Equipment or Installed/Opened Car Stereo Products • 10 Day Defective Exchange From Date Of Receipt (Must call for authorization before return) • All Returns For Refund Must Be Made Within 10 Days of Receipt of Merchandise and Are Subject to A 10% Restocking Fee. Products Returned Must Be In Original Condition and Packaging.

Enter No. 36 on Reader Service Card

Living in the Danger Zone shows that time hasn't smoothed Son Seals' rough spots, it's honed them to a razor's edge.

steady rhythm, the bass percolates, and Son rips out a whirlwind solo. When he frames his work through effective dynamics on "Bad Axe" or "Tell it to Another Fool," it's impossible to deny that he's one of the major living blues guitarists. He may not be a great lyricist, but "Don't give me no computer/I can't do a damn thing with it" is as close to truth as the blues can come.

Son is destined for glory as a standard bearer for Chicago blues. When others have gone to the next trend, he'll still be battling demons with his guitar, both for himself and for us. Bet on Son in that fight. *Roy Greenberg*

Lost in the Blues: Otis Rush.
Alligator ALCD 4797.

Chicago blues legend Otis Rush's last studio album, *Troubles, Troubles*, produced by Sam Charters and cut in Stockholm in 1977, gets a sprucing up for its American debut. Remixed with newly added piano and organ tracks (as Rush had originally wanted) courtesy of Lucky Peterson, Rush's marble-grained voice wavers and glissandos through nine classic covers, including "Little Red Rooster" and "Got To Be Some Changes Made," while his guitar cries, bursts, and bends with its own distinctively vocal quality. Guaranteed to please lovers of the Chi-town sound.

Michael Wright

For The Shelf

Here are several recent blues releases that sound good enough to my ears to recommend to you, listed according to my likes, that is, most-liked first:

Snooks Eaglin: *Country Boy in New Orleans*. Arhoolie CD348. Wonderful, essential.

Big Joe Williams: *Shake Your Boogie*. Arhoolie CD315. Twelve songs recorded in October 1960, another dozen in 1969. Big Joe's at the top of his game.

Lightning Hopkins: *Texas Blues*. Arhoolie CD302. A "best of" from the '60s and a fine intro.

Big Joe Williams: *Classic Delta Blues*. Milestone OBCCD-545-2. From 1964, has Muddy's "Rollin' and Tumblin'," Robert Johnson's "Hellhound," "Crossroads," and "Walking Blues," etc. Yes, a classic.

Living Chicago Blues, Vols. 1 to 4. Alligator ALCD 7701-4. Reissues from 1978 and '80 of 18 groups including Carey and Lurie Bell, Jimmy Johnson, Lonnie Brooks, Magic Slim Holt, Pinetop Perkins, Luther "Guitar Junior" Johnson, et al. Do it!

Blue Rider Trio: *Preachin' the Blues*. Mapleshade 512696W. Young musicians playing urban versions of, mostly, country blues, but more chops than a pork store.

Clifton Chenier: *Louisiana Blues and Zydeco*. Arhoolie CD329. Previously, I had trouble hearing Chenier's work as anything other than dance music for a one-legged man, but this one convinced me. *E.P.*

AUDIO ON-SALE AT THESE FINE STORES

AUDIO DEALER LISTING

ARIZONA

Phoenix
Sounds Like Music
2734 W. Bell Road - Suite 1306

CALIFORNIA

Los Angeles
Good News Etc.
2830 S. Robertson Drive

Henry Radio
2050 S. Bundy Dr.

San Diego
Stereo Design
9353 Clairmont Mesa Blvd.

COLORADO

Boulder
Listen Up Inc.
2034 Arapahoe Street

Colorado Springs
The Sound Stop
528 South Tejon

CONNECTICUT

Milford
Starlander Beck
354 Woodmont Rd.

DELAWARE

Newark
Hale Corp.
70 E. Main Street

FLORIDA

Miami
Joe's News
1549 Sunset Drive

Oakland Park
Commercial Audio/Video
2904 N.E. 8th Terr. #203

INDIANA

Portage
Who's Your Entertainment
P.O. Box 22

LOUISIANA

Baton Rouge
Art Colley's Audio Specialists
711 Jefferson Hwy

MARYLAND

Lutherville
Gramaphone Ltd.
10801 Tony Drive

MASSACHUSETTS

Otis
Custom Audio Works
Route 8

MICHIGAN

Dearborn
Little Professor
22174 Michigan Ave.

Rochester
Rochester Book Center
1410 Walton Blvd.
Rochester Hills Plaza

NEW JERSEY

Morris Plains
J.S. Audio
643 Speedwell

Springfield
6th Avenue Electronics
22 Rt. 22 West

Verona
Audio Connection
615 Bloomfield Ave.

NEW MEXICO

Albuquerque
Page One
11200 Montgomery NE

NEW YORK

Hicksville
Avtronics Ltd.
260 Old Country Road

Lake Grove
Audio Den Ltd.
Smith Haven Plaza
2021 Nesconset Hwy

Merrick
Stereo Exchange Inc.
194 Mercer Street

Orchard Park
Stereo Chamber Inc.
Union & Orchard Pk. Rds

NORTH CAROLINA

Bollington
America Multimedia
P.O. Box 215 A

Durham
CD Superstore
5410 N. Highway 55

OHIO

Dayton
Parts Express
340 E. First St.

Toledo
Leo's Book & Wine Shop
330 N. Superior Street

Warrensville Hts.
Hoffmans House of Stereo
23031 Emery Road

OKLAHOMA

Oklahoma City
Contemporary Sounds
10327 North May Ave.

TEXAS

Arlington
Texas Audio
4211 S. Cooper Ste. 111

Dallas
Omni Sound
19020 Preston Rd.

Houston
Home Entertainment
5310 Kirby St.

McAllen
Showery Stereo
320 S. 10th

WASHINGTON

Seattle
Bull Dog News
4208 University Way N.E.

Definitive Audio
6017 Roosevelt Way N.E.

MANITOBA

Winnipeg
Brian Reimer Audio
1053 C Street Mary's Road

Stereo Master Ltd.
1793 Portage Avenue

Dealers interested in Audio should call 1-800-221-3148

DEALER SHOWCASE

NEW YORK

SAVANT AUDIO

Providing the Ultimate
In Products & Services

Consultancy • Custom Systems
Acoustic Treatment • Installation
Home Theater • Retail • Worldwide

Air Tangent • Allego • Apex
Arcici • Athena • Audio Note
Audio Prism • AudioQuest
Audiostatic • Basis • Benz
Bitwise • Cardas • Chesky
Clarity Audio • Creek • CWD
Delos • Dorian • EAD
EKSC • Electron Kinetics
Eminent Technology • Ensemble
Epos • Essence • First Sound

Fosgate • Geman Acoustics
Harman Video • Harmonia Mundi
Kinergetics • Klyne • Last
Lectron • Magnan • Merrill
Mod Squad • Mogami • Morch
Nestorovic • Neutrik • Nimbus
Opus3 • Power Wedge
Presence Audio • Pro Ac
Proprius • QED • Rega
Reference Recordings • Roksan
RoomTune • Rotel • Sequerra
Sheffield Labs • Sims • Sumiko
Symphonic Line • Tara Labs
Target • Tice Audio • Wadia
Water Lily • WBT
and More

In New York & New Jersey
800-628-0627 609-799-9664

NEW YORK

THE DISCRIMINATING EAR

- Acoustat
- Acurus
- Aragon
- Audio Alchemy
- B&K
- Canton
- Carver
- Celestion
- Conrad Johnson
- Counterpoint
- Duntech
- Enlightened Audio
- Harmon Video
- Jadis
- KEF
- Lexicon
- Monitor Audio
- NHT
- Pioneer Elite
- Runco
- Sonographe
- Straightwire
- Synthesis
- Tice
- VPI
- Wadia
- XLO

& Much More

Hrs: Mon.–Sat. 11:30 AM–6 PM

973 Northern Blvd.
Great Neck, NY 11021
Phone & Fax (516) 627-4456

NEW YORK

ALPHA STEREO

Quality Components, Professional Installation & Service

"We are known for the companies we keep"

Adcom, NAD, Rotel, Onkyo, Denon, Mission, B&W, Soundstream, Audioquest, Paradigm, Monster Cable, M&K, Ortofon, AKG, Stax, Polk Audio, Sharp Vision, Sony ES, Target, Atlantic Technologies, Audio Alchemy, Beyerdyamic

Northern NY's oldest & most renowned dealer.

345 Cornelia St., Plattsburgh, NY 12901

518-561-2822

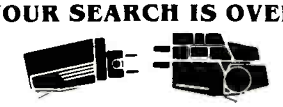
Fax: 518-561-2961

Monday-Friday 10am-8pm. Saturday 10am-6pm
Mastercard, Visa, Discover, Amex

NEW YORK

GRADO • audio-technica • Tweek • Dynavector • Bang&Olufsen • PICKERING • TIPTOES • LAST • MONSTER CABLE • ortofon • SHURE • STANTON

YOUR SEARCH IS OVER!



We specialize in hard to find phono cartridges and original replacement styli only!!

(800) 221-0906

CALL TOLL-FREE FOR FREE PRICE QUOTES AND VISA/MC ORDERS
N.Y. STATE (516) 599-1112

SEND SELF ADDRESSED STAMPED ENVELOPE FOR OUR FREE CATALOG.

LYLE CARTRIDGES
115 South Corona Avenue
Valley Stream, N.Y. 11582

Phones Open Mon-Sat 9 am-8 pm

OHIO

small town
BIG SOUND
for home & auto
DENON & YAMAHA
MITSUBISHI • JVC
PHOENIX GOLD
KLIPSCH
&
MITSUBISHI HOME THEATER

O'Brien's
Photo Center & Sound Room
132 Putnam Street • Marietta, OH 45750
614-373-6737

PENNSYLVANIA

PHILADELPHIA AUDIOPHILES

Acoustic Energy	Kimber Kable	Rega Planar
Altis Audio	Kinergetics	Roksan
Audible Illusions	Klyne	Rotel
Audio Alchemy	Koetsu	Snell
Audiolab	Maplenoll	SOTA
Audioquest	Meridian	Soundcraftsmen
Bitwise	Micromega	Sound Lab
B&K Components	Mission/Cyrus	Stax
Celestion	MIT	Straightwire
Classe	M&K Sound	Sumiko/SME
Counterpoint	Monitor Audio	Target
Duntech	Muse	Unity Audio
Dynavector	Music Reference	VAC
Eminent Tech.	NAD	Van Den Hul
Ensemble	Oracle	VPI
Genesis	Parasound	Well Tempered
Jadis	PS Audio	Wheaton
J.A. Michell	PSB	XLO Electric

DAVID SEROTA AUDIO
At Sound Service Company
8010 Bustleton Ave. Philadelphia, PA 19152
(215) 725-1177 Bank Cards Accepted

VERMONT

Here in Vermont, people demand value.
We don't waste customers' money,
and neither do these folks:

Adcom AudioQuest B&W Dual
Grado Hafler Luxman MIT
ModSquad MonsterCable Onkyo
Oracle Rotel Signet Sumiko
SME Tannoy Thorens Wharfedale

Five-year warranties on all new equipment
100% financing available
Free installation in Connecticut River Valley & NYC

Scientific Stereo
800-456-4434
802-257-5855
128 Main St Brattleboro VT 05301

Dealers...

Just as you're reading this ad,
so are thousands of potential customers.

For complete information on placing your ad,

Call 800-445-6066

For advertising rates—please call 800-445-6066 (9am-5pm e.s.t.).

PARTS AND ACCESSORIES

AUDIOPHILE QUALITY KITS AND SUPPLIES: ST-70 upgrades, passive/buffered linestages, phono preamps, and power supplies. Volume controls, resistors, capacitors, transformers, tubes, wire, connectors and more! Wonder-Caps, WIMA, RAM Tubeworks, WBT, Monster, Vampire, TEC-200 Film, Strongbox, etc. Plus QWIK-CAD software. $2 for **1992 Catalog: WELBORNE LABS.** 6836 S. University Blvd., #70, Littleton, CO 80122.

STOP CHOKING YOUR EQUIPMENT. Cheap recepticles limit power! We carry the finest hospital grade outlet in the world. Stainless-steel, bronze/nickel contacts. The ultimate connection. Better power, tighter bass, increased definition. $27.95 CK MO. REVELATION AUDIO ACCESSORIES, 209 McTavish Lane, Winston-Salem, NC 27103. (919) 659-8591.

BUSINESS OPPORTUNITIES

DISTRIBUTORS NEEDED: HOTTEST NEW AUTO-RELATED PRODUCT. HIGH INCOME POTENTIAL (MLM). DRAMATIC DEMONSTRATION! SAMPLE: (518) 372-6198.

ANNOUNCEMENTS

ACT AUDIO gives good sound!
A professionally designed listening room costs less than some CD's. Send SASE for details. ACT AUDIO, 619 Moon Clinton Rd., Coraopolis, PA 15108.

UNIVERSITY AUDIO SHOP, MADISON, WI... Best sound for dollars? We have many solutions! Dealer: B&K, KEF, Paradigm, Vandersteen, Parasound, Micromega, AudioAlchemy, Rega, Roksan, AudioQuest, Symphonic Line, Modsquad & others. (608) 284-0001.

AUDIO-BLOW OUT SALE!!
NAD 5100 CD PLAYER $500 NOW $199, KEF 102 SPEAKERS $850 NOW $498, PROTON AV-300 RECEIVER $450 NOW $199, DENON PMA-250 INTEGRATED AMP $250 NOW $99! Call us for many **below cost prices** on CARVER, HK, LUXMAN, AR, ONKYO, NAKAMICHI and many more. (414) 727-0071.
100'S OF CLOSE-OUTS! CALL US!

TRAIN AT HOME FOR CAREER IN PHOTOGRAPHY. Unique videotape-audiotape instruction from America's largest photo school. FREE CATALOG. No obligation. NEW YORK INSTITUTE OF PHOTOGRAPHY. Founded 1910. 1-800-351-6100, Operator C1.

AUDIO UNLIMITED in Colorado offers the finest values in the Rocky Mountain area. Authorized dealer for : Acoustic Energy, Acrotec, AirTight, Aural Symphonics, Benz-Micro, Bitwise Music System One MKII & Zero, Chario, CODA, Dynavector, The Ensemble System products, Ikeda, JM Labs, Lazarus, Magnum Dynalab, Musical Design, Muse 100/150 amps & Model 18 subwoofer, Roomtunes, SOTA (the Stellar Cosmos!), Tice, Wheaton triplanar arm & more... Call John Barnes, 2343 W. Yale Ave., Englewood, CO 80110. 303-698-0138, or Fax 303-922-0522.

CASH for USED AUDIO EQUIP. BUYING and SELLING by PHONE. CALL for HIGHEST QUOTE. **(800) 388-9443.** The Stereo Trading Outlet, 320 Old York Road, Jenkintown, PA 19046.

NEW AND USED PROFESSIONAL DJ/BAND EQUIPMENT—WHOLESALE PRICES. LIGHTING, FOGGERS, P.A., CLUB INSTALLATIONS—CALL FOR 50-PAGE BOOKLET/CATALOG. (502) 782-1172.

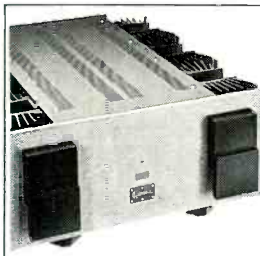
CA$H PAID FOR AUDIO & VIDEO **EQUIPMENT.** AUTHORIZED: **DENON**, ENERGY, SIGNET, HARMON KARDON, SUMO, ROTEL, AUDIOQUEST, MONSTER, NILES, ETC. **STEREO CLASSICS,** 75 CHURCH ST., NEW BRUNSWICK, NJ 08901. (908) 220-1144, FAX: (908) 220-1284.

ANNOUNCEMENTS

ELECTROSTATIC SPEAKERS
Latest technology, full range design. "Risk free" thirty day home trial. Uncompromised performance at factory direct pricing. West coast dealer inquiries invited. DAVID LUCAS, INC., 924 HULTON ROAD, OAKMONT, PA 15139. (412) 828-1967.

High-end and hard-to-find audio components. All types. Best prices! Exclusive: Available now. New lines of European tube electronics and turntables. AUDIO AMERICA (Virginia). Call 1-703-745-2223.

TEFLON® CAPACITORS! Presenting **the** preeminent audiophile capacitor: 400 & 600V film/foil Teflon® capacitors by Component Research. Unqualified superiority. Capacitor Specialty, 226 Westcourt Place, Waterloo ONT, Canada N2L 2R7; (519) 746-8520.



HI-FI HEAVEN

- KRELL CD-1
- PS AUDIO DELTA 250 MONO AMPS
- B&W 800
- MIRAGE M-1Si
- PIONEER LD-S2
- CALIFORNIA AUDIO SIGMA TUBE D/A
- FROX
- SOUNDSTREAM/ KRELL CAR CD CHANGER/DAC
- MIT BALANCED PROLINE CVT/ TERMINATOR

2781 S. ONEIDA ST.
GREEN BAY, WI 54304
(414) 494-8999

AUDIOPHILE GRADE PARTS

For the last 4 years, SONIC FRONTIERS INC. has been offering audiophile hobbyists from around the world, the highest quality electronic parts for their audio electronic projects. We have continued to expand our line of parts and components to satisfy the needs of our demanding clientele. We are pleased to feature the following lines:

CAPACITORS:

MIT MultiCap - Film /Foil or Metallized.
World's best FILM CAPACITORS!

WONDER CAP - new Series "B", wonder wire leads
REL- CAP – film/ foil polystyrene, axial leads
WIMA - compact metallized and film/foil polypropylene, radial lead
SOLEN - metallized polypropylene, up to 200uf at 400VDC!
SIEMENS –metallized polypropylene from 51pf to D1uf at 630VDC.

RESISTORS:

VISHAY - utilizing a proprietary *BULK FOIL* technology, these high precision resistors are the best available! We have a limited range of *VTA* series (axial lead, 0.5%) values in stock. Also,we are pleased to introduce the *S102K* series (radial lead, 0.25%) resistors which are available in any value up to 250K, in any quantity, in under 2 weeks!
HOLCO - 5% 50ppm metal film resistors, non-magnetic construction. We stock a comprehensive range of values in 1/4, 1/2 and 1 watt ratings.

ADDITIONAL PRODUCTS:

GOLD AERO - offering tested and selected tubes in 3 grades (Standard, Gold and Platinum) for the discriminating tubeophile. 4 month warranty!; **RAM** TubeWorks, **CARDAS** RCA jacks, plugs, hookup wire and shielded cable. **WBT**, **TIFFANY**, **EDISON PRICE** Music Posts; **ALPS, BOURNS** Volume and Balance Controls, **NEUTRIK** XLR plugs; **GRAYHILL** rotary switches, **TEFLON** wire (many gauges and colours), **ANALOG DEVICES** AD827JN, AD847JN, **PEARL** Tube Coolers, Iso-Sockets, **CAE** (Curcio Audio Engineering) DANIEL PreAmp Kits (MKI and MKII) and DYNACO Rebuild Kits, **SONIC FRONTIERS** mono ladder attenuator kits (20K, 50K, 100K, 250K), best volume control available!; plus tube sockets, semiconductors, electrolytic capacitors etc.

SPECIALIZING IN INTERNATIONAL SHIPMENTS

DISCOUNTS UP TO 30% AVAILABLE!

Please **CALL**, **WRITE** or **FAX** for our *FREE* **1992 PRODUCT CATALOGUE!**

SONIC FRONTIERS
I N C O R P O R A T E D

760 PACIFIC ROAD, UNIT #19, OAKVILLE, ONTARIO, CANADA L6L 6M5
TEL (416) 847-3245 **FAX (416) 847-5471**

ANNOUNCEMENTS

ABSOLUTELY THE ULTIMATE IN HIGH-END AUDIO BRANDS! (See Oct. '91 AUDIO pages 356 & 360). Competitive Pricing! Unbiased, Expert Advice! Best Trades Offered! Call For Extensive Used/Demo List. **Audio Classics Enterprises. 1-(405) 842-3033.** COD/Visa/MC.

AUDIO CLASSICS

Buys-Sells-Trades-Repairs-Modifies. AMPLIFIERS: Accuphase P300 $499; Adcom GFA535 $225; Aragon 2004II $1099, 4004II $1399; Audio-Research D115 $1395; Berning EA230 $399, EA2100 $2099; Cary SLA70DLH $1075; Classe DR8 $1999; conrad-johnson MF80 $899, MF200 $1399, MV50 $1099, Premier 5 $3999; Counterpoint SA12 $899, SA220 $2549; Dynaco 120 $199; Forte 3 $899; Hafler XL280 $349; Heath W4AM $199; Krell KSA80 $2545, KSA250 $4699; Lazarus H1 $499, H1A $1050; Marantz 8 $999, 15 $395; McIntosh MC50s $558, MC75s $2499, MC240 $799, MC250 $429, MC275 $4-5000, MC754 $675, MC2125 $1299, MC2150 $1299, MC2250 $1099, MC2500 $2500, MC2600 $3995; Motif MS100 $1999; Precision Fidelity M7A $399; Quad 306 $599; SAE A205 $499; Sonograph SA120 $599; Soundcraftsman ProPower 10 $799. **CD PLAYERS:** Adcom GCD575 $359; Arcam Delta Black Box $299; B&O 4500 $499; Denon DCD1500 $230; Kinergetics KCD40 $1499; Krell MD2C $2375, SBP32X $2775; McIntosh MCD7000 $749, MCD7005 $1099; NAD 5240 $249. **CROSSOVERS:** Kinergetics SW200 $499. **EQUALIZERS:** McIntosh MQ101 $149, MQ104 $225. **HEADPHONES:** Stax Demos ED1 $639, Lambda $199, Pro1 $475, Sigma $379; Signature $1499, SR34 Pro $149, SR84 $149. **INTEGRATED AMPLIFIERS:** McIntosh MA6100 $499, MA6200 $1099; Soundstream RA100 $349. **LINE CONDITIONERS:** Tripp Lite LC1200a $129, LC1800 $149-249, LC2400 $199, LCR2400 $399, LX600b $75, LX600 $95. **PRE-AMPLIFIERS:** Berning TF10 $699; Classe DR5 $1499; conrad-johnson PF1 $999, PV5 $749, PV8 $999; Counterpoint SA2000 $1195; Denon DAP2500 $600; Dynaco PAT4 $149; Forte 2 $799; Hafler SE100 $287; Levinson 26 $3499; Marantz 7T $495; McIntosh C11 $600, C20 $599, C22 $1900, C24 $335, C26 $299, C27 $599, C28 $499, C31V $1199, C32 $999, C33 $1575, C504 $550; Mod Squad Line Drive Deluxe $699; Phase Linear 4000 $249; Motif MC9 $799; Reference Line 1000 $249; Theta A $199. **PROCESSORS:** ads 10 $399; Burwen DNF1201A $169; dbx 117 $99; Philips DAC960 $499, LHH1002 $699. **RECEIVERS:** B&O 3000 $299; McIntosh MAC4100 $999, MAC4280 $1499; Nakamichi Receiver 1 $599, SR3A $449, TA3A $599. **RECORD CLEANERS:** VPIHW16.5 $375. **SPEAKERS:** Apogee Centaurus $1099, Diva $6666, Majors $2999, Minors $899, Stage $1499; B&O 5000 $999; JBL D123 $125, 4406 $369, 4408 $499; JSE 1.8A $1499; KEF C85 $599, 103/4 $1099, 104/2 $1459, 105/3 $2399, 107/2$4195; Magnepan MG2.5R $1099; Martin Logan CLSIIa $2200; McIntosh ML1C $550, ML2C $800, XR3 $449, XR5 $499; Proac Minitower $1299, Studio 1II $899; Ryan MCL3 $899; TDL Studio 1 $999, 3 $1095; Velodyne ULD15II $1495. **TAPE DECKS:** B&O 2000 $249, 3300 $299; Nakamichi 1000II $599. **TEST EQUIPMENT:** McIntosh MI3 $749, MPI4 $1399; Sound Technology 1000A $600, 1400A $500, 1700B $1999. **TUNERS:** Amber 7 $125; Creek T40 $299; SE130 $265; Magnum Dynalab FT11 $375, FT101 $465; Marantz 10B $1699; McIntosh MR55 $199, MR65B $299, MR71 $899, MR77 $749, MR78 $1199, MR80 $1299, MR510 $799, MR7082 $1199; Phase Linear 5000 $199; Sansui TUX701 $299; Yamaha TX400U $75. **TUNER PREAMPS:** McIntosh MX110 $499, MX112 $449, MX113 $550, MX117 $1199. **TURNTABLES:** B&O RX2 $129; VPI HW19II $695, HW19III $889. **FREE Catalogue. 8AM-5PM EST Mon.-Fri., AUDIO CLASSICS**, POB 176 AAA, Walton, NY 13856.

607-865-7200

Hardbound AUDIO, annual bound volume editions, just like the ones in the Editor-in-Chief's office. Various years available in limited quantities, $30.00 each. Also available: Hardbound October Annual Equipment Directories. Years 1990, 1989, 1987, 1985, $15.00 each, and hardbound May Car Stereo Directories for years 1991, 1990, 1989 and 1985, $8.00 each. All prices include postage and handling. All orders postpaid. Check or money order only payable to AUDIO MAGAZINE. Send orders to AUDIO, 1633 Broadway, New York, NY 10019. Attn: Michael Bieber. Or call 212/767-6301 for further information.

TRIPPLITE POWER CONDITIONERS, LC-1800, $269.95, LC-2400 $349.95 and rack mount LCR-2400 $369.95 will protect your system from surges, high/low voltage situations and line noise. Call for pricing on other line filters and conditioners. CABLE CONCEPTS, P.O. Box 417, Powell, Ohio 43065. (614) 761-8933 or Fax (614) 761-8955.

FOR SALE

ARIEL...SPECIALIZING IN COST EFFECTIVE HIGH-END: B&K, ProAc, Musical Concepts/Design & More. Authorized Dealer. Carmel, IN. Visa/MC. (317) 846-9766, 5-10PM.

FOR SALE

REPLICA WATCHES & ORIGINALS PREOWNED: Lowest Prices Nationwide! Exact Weight & Color! 18K Goldplated! Moneyback Guaranteed! (404) 963-3872.

DESIGN & INSTALL

YOUR OWN CUSTOM A/V or MULTIROOM SYSTEM with our informative catalogue of installation supplies. Complete Systems, Parts, Text, Diagrams, & Full Technical Support.— Cataloge $3.00. R. Gladwin, P.O. Box 221666, Carmel CA. 93922 or Call: 510-655-6653.

IN HOUSTON, TEXAS

STEREOWORKS offers friendly service & outstanding values on Sound Lab, Music & Sound, Legacy, Forté, Threshold, Well Tempered, van den Hul, Tara Labs, & more. By appointment. **STEREOWORKS (713) 492-2202.**

FOR TWENTY YEARS WE HAVE BEEN THE SOURCE FOR ALL OF YOUR BLANK AUDIO/VIDEO TAPES AND ACCESSORIES, EVEN REEL-TO-REEL TAPES FOR STUDIOS, AT DISCOUNTED PRICES. CATALOG AVAILABLE. SOUNDD INVESTMENT CORPORATION, 3586 PIERCE DRIVE, CHAMBLEE, GA 30341. (800) 659-TAPE (8273), IN GA (404) 458-1679. FAX: (404) 458-0276.

AA/SOUND ADVICE

LOW PRICES/FAST DELIVERY! DENON, NAD, CELESTION, B&W, ADCOM, CARVER, NAKAMICHI, BOSTON ACOUSTICS, LUXMAN, HAFLER, ADS, M&K, ONKYO, B&K, PROTON, DCM, SNELL, BOSE, VELODYNE, POLK, SPICA, COUNTERPOINT, AND MORE! **414-727-0071.**

FULL WARRANTY!!
MOST ITEMS IN STOCK!!
OPEN SUNDAYS!!

CALL US!!

ADD SURROUND-EFFECT AUDIO TO YOUR VIDEO VIEWING WITH A NEW TECH APR-2 UNIVERSAL PROCESSOR AND SPECIAL HEADPHONES SYSTEM. $89.90. WRITE TO: RSR, SUITE J-6, 8723 WEST CHESTER PIKE, UPPER DARBY, PA 19082.

AUDIO CABLES & MORE

DON'T PAY EXORBITANT PRICES FOR TOP QUALITY. WE HAVE YEARS OF EXPERIENCE IN WIRE MANUFACTURING AND HAVE SIMULATED THE HIGH PRICED BRANDS. HIGH PRICED EQUIVALENTS AS LOW AS .35/FT. WE DEMYSTIFY WIRE TECHNOLOGY, SEND FOR EXPLANATION LITERATURE WHICH ALSO INCLUDES ALL OUR AUDIO PRODUCTS PRICE LIST OR CALL OUR LITERATURE REQUEST # (800) 321-2108, 24 HRS/DAY. **L A T INTERNATIONAL**, DEPT. A, 317 PROVINCETOWN RD., CHERRY HILL, NJ 08034.

1992 CARVER® AUDIO!!!

SAVE 25% ON RECOMMENDED CARVER MODELS: SILVER 9-t • TFM-45 • TFM-25 $525.00 • SD/A-490t • CT-17. ADVANCED AUDIO™, 7627 Woodside, Stockton, CA 95207. (209) 477-5045.

GAS EQUIPMENT OWNERS

From repairs and updates to complete rebuilds, we are the **GREAT AMERICAN SOUND** experts! Since 1977. **GASWORKS**, 8675 Northview Street, Boise, Idaho 83704. (208) 323-0861.

PAUL HEATH AUDIO

VIMAK, UNITY, AUDIOSTATIC, CONVERGENT AUDIO, PS AUDIO, MUSE, VAC, GENESIS, B&K, STAX, MERLIN, AUDIBLE ILLUSION, NEAR, MAPLENOLL, CROWN MACRO, MUSIC REFERENCE, QUICKSILVER, XLO, CARDAS, ENLIGHTENED AUDIO, SIMPLY PHYSICS, MFA, MAGNUM DYNALAB & MENTMOR. **217 ALEXANDER ST., ROCHESTER, NY 14607. (716) 262-4310.**

CLASS-A GLB CAR AMPLIFIER SALE! 800W CLASS-A **$260**; 400W CLASS-A **$220**; 200W CLASS-A **$160**; (CONVERT ABOVE AMPLIFIERS TO **HOME AMPLIFIERS**, ADD $100; PERSONAL CUSTOM-MADE ENCLOSURE ADD $300). 30 DAY SATISFACTION GUARANTEED! ADD $15 SHIPPING. HOME AND AUTOMOBILE AUDIO, BOX 212, MARYVILLE, MO 64468-0212. [MASTERCARD, VISA: (816) 582-8061.]

FOR SALE

ADCOM, B&K, HAFLER and CD MODS
...by **MUSICAL CONCEPTS** deliver elegant sound. Basic circuit redesigns for preamps and amps, inexpensive or "all-out"—Toroids, huge filter caps, **Dual-Mono** conversions. **MC-3T (Teflon®)** drop-in replacement preamp board for most Adcom, B&K, and Hafler! **NEW! PA-1** front-end boards for **HAFLER** amps—incredible musicality on a budget (kit available)! **SuperConnect IV** interconnect and **DigiConnect**—the best or your money back! We modify most **PHILIPS, ROTEL, MAGNAVOX, PIONEER** CDs, also **AUDIO ALCHEMY, ALTIS DACS.** MUSICAL CONCEPTS, 1832 BORMAN CT., SUITE ONE, ST. LOUIS, MO 63146. (314) 275-4925.

WEATHERS TURNTABLE— COLLECTORS ITEM, LOW PROFILE WITH PS-151 POLARIZING SUPPLY UNIT. BEST OFFER. CALL STEVE: (609) 582-2215, LEAVE MESSAGE.

Custom cables and terminations, Camacs, XLR balanced, hi-flexibility tonearm sets; custom Shallcross volume controls; MIT MultiCaps & Wonder Caps-solder-wire; Vishay & Holco resistors. all types audio connectors, tonearm and chassis wires; wide selection of high-end accessories/mod parts, $1 catalog ($3 overseas); MICHAEL PERCY, BOX 526, INVERNESS, CA 94937. (415) 669-7181.

CALL US
FOR QUALITY AUDIO
AT THE LOWEST PRICES
WITH FAST SERVICE,
EVEN ON ESOTERIC ITEMS

SOUND ADVICE . . . without the price

AUDIO OUTLET (914) 666-0550
P.O. Box 673
Bedford Hills, New York 10507-0673

25-35% OFF SUGGESTED RETAIL ON MOST BRAND NAMES

W.E.D.
World Wide Electronics
47 Gadsen Place, S.I., NY 10314
Hours Monday—Friday 10 AM-7PM
Sunday 12 PM-5 PM
"THE CALL THAT SAVES YOU MONEY"
718-370-1303
HIGH-END AT LOWEST PRICES

- WE MAINTAIN THE MOST REASONABLE PRICES ON 75 DIFFERENT BRANDS.
- CALL & LET US WORKOUT THE BEST DEAL FOR YOU.
- ALL PRODUCTS ARE AMERICAN MODELS.
- 7 DAY MONEY BACK GUARANTEE.

CAR & HOME STEREO

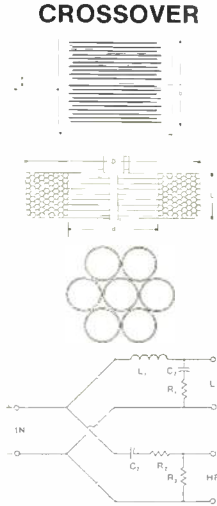
ABC	COUSTIC	ONKYO
ADCOM	DBX	ORION
ADS	DENON	PARADIGM
ADVENT	HAFLER	PHASE LINEAR
ALPINE	HARMON KARDON	PHILIPS
ALTEC LANSING	HIFONICS	PINNACLE
AR	INFINITY	PIONEER
AUDIO CONTROL	JBL	POLK
AUTOTECH	JVC	PRECISION POWER
BAZOOKA	KENWOOD	PROTON
B&K	KEF	PS AUDIO
B&O	KICKER	PYLE
B&W	KLIPSCH	ROCKFORD FOSGATE
BLAUPUNKT	LEXICON	SHERWOOD
BOSTON ACOUSTIC	LUXMON	SONY
BOSE	MARANTZ	SONYES
CARVER	MB QUART	SOUNDSTREAM
CELESTION	MIRAGE	SUMO
CERWIN VEGA	MTX	TECHNICS
CITATION	NAD	THORENS
CLARION	NAKAMICHI	YAMAHA
CONCORD	OHM	

ASK ABOUT FREE SHIPPING
All products covered by manufacturer or W.E.D. exclusive warranty.
Extended warranty available

SPEAKER COMPONENTS

CROSSOVER COMPONENTS

DAVIS ACOUSTICS
DYNAUDIO
ETON
morel
Peerless
polydax SPEAKER CORPORATION
scan-speak
seas
vifa



FAST CAPACITORS
Metallized Polypropylene (Non-Polarized)
Values from 1.0 mfd to 200 mfd.
Voltage Rating: 250 VDC / 150 VAC

SOLEN INDUCTORS
Perfect Lay Hexagonal Winding Air Cored
Values from .10 mH to 30 mH,
Wire Sizes from #20 AWG to #10 AWG

HEPTA-LITZ INDUCTORS
Seven Strands Litz-Wire Constructions
Values from .10 mH to 30 mH
Wire sizes from #16 AWG to #12 AWG

SOLEN CROSSOVERS
Custom Computer Design
Passive Crossover for Professional, Hi-Fi and Car Hi-Fi, Power up to 1000 Watt.

CROSSOVER, SPEAKER PARTS
Gold Speaker Terminals, Gold Banana Plugs
Gold Binding Posts, Crossover Terminals,
Power Resistors, Mylar Capacitors,
Plastic Grill Fasteners, Nylon Ty-Wraps
Grill Cloth, Car Speaker Grills, Misc. Parts.

SOLEN INC.
4470 Thibault Ave
St-Hubert, QC J3Y 7T9
Canada
Tel.: (514) 656-2759
Fax: (514) 443-4949

COMPUTER AIDED DESIGN FOR ENCLOSURE AND CROSSOVER AVAILABLE TO CUSTOMER

Product specifications and prices available upon request

FOR SALE

AAA—LOW PRICES—HIGH END EQUIPMENT!!! PS AUDIO, HAFLER, B&K, CARVER, NAKAMICHI, LUXMAN, THORENS, M&K, SNELL, ONKYO, PROTON, FRIED, SUMIKO, BOSE, PHILIPS, DCM, VELODYNE, ADS, VPI, JSE and any others you desire. AUDIO ELITE, (414) 725-4431, Menasha, Wisconsin.
OUR PRICES CAN'T BE BEAT!!!

AAA—AUDIO ELITE IN WISCONSIN!!! HAFLER, PS AUDIO, B&K, JSE, NAKAMICHI, PROTON, CARVER, ONKYO, ADS, VPI, DCM, FRIED, NITTY GRITTY, SUMIKO, THORENS, SNELL, M&K, LUXMAN, BOSE, PHILIPS, VELODYNE and any others you desire. (414) 725-4431.
CALL US WE CARE!!!

ABARGAIN: STAX SIGN/LAMBDA $1,395; **PRO** LAMBDA(#3) $799; PRO/LAMBDA(#1) $459; SIGN/LAMBDA SRD/7 $599; GRACE F9ERUBY $199; DENON DL305 $225; **FR1MK3F** $169; ALL UNUSED (212) 966-1355.

STORADISC™

Fine-furniture quality CD storage systems with angled shelves & non-slip surface that holds a single CD upright. Solid hardwoods & textured finishes. 360 & 576 capacity shown. Smaller sizes available. Write or call ***1-800-848-9811.***

Davidson-Whitehall Company
555 Whitehall Street Atlanta, Georgia 30303

FOR SALE

AAA-CALL US NOW!!! Luxman, Carver, ADS, Nakamichi, Denon, Boston Acoustics, NAD, Celestion, B&W, Adcom, Polk, Hafler, B&K, Onkyo, Proton, Snell, DCM, Counterpoint, Spica, M&K, Bose, VPI, Nitty Gritty, Sumiko, Thorens, Velodyne. 414-727-0071. FOR THE LOWEST PRICES!
FULL WARRANTY!!
MOST ITEMS IN STOCK!!
OPEN SUNDAYS!!

ATTENTION MUSIC LOVERS! Altis, Arcici, **Audio Static**, Boulder, Coda, Clavis, **EAD**, IDOS, Jadis, NBS, Power Wedge, **PS Audio**, Roksan, SimplyPhysics, Sound Labs, Soundwave Fidelity, Straightwire, VMPS, XLO, & more! Trade-in accepted. Call (313) 342-2475 or (313) 459-5454 for prices & info. Gil Morrison.

BEST TRADES OFFERED! WE BUY, SELL, TRADE, CONSIGN MOST HIGH-END PRODUCTS. AUDIO DOCTOR, 1518 W. COMMERCIAL, BUFFALO, MO 65622. (417) 345-7245. COD/VISA/MC.

AUDIO BY VAN ALSTINE = AUDIOPHILE QUALITY at affordable prices because we sell direct to you. Our new 500V/US slew rate Omega amplifier circuits, our patented **FET-Valve** hybrid tube-mosfet components, and our complete new **Super Pas Four** hybrid preamplifier kits are original engineering designs that eliminate transient distortion, are durable and rugged, and sound closer to live than anything else at a rational price. Our B&W crossover upgrades are famous—check with us if you want a much better 801 Matrix, 803 Matrix, or DM640. Complete wonderfully-musical factory wired amplifiers, preamplifiers, tuners, and CD players. **Dynaco owners** - our rebuild kits for all Dyna preamps and the St-70 are $195 each, including all new PC cards. Check our ratings in **Stereophile, The Absolute Sound,** and **Sensible Sound.** We design new circuits for most Dyna and Hafler solid-state components too. Now ultimate musical enjoyment is much less expensive. Write or call for our new illustrated catalog. Audio by Van Alstine, 2202 River Hills Drive, Burnsville, MN 55337. (612) 890-3517.

SAVE ON AUDIO!!

THE BEST NAMES AT THE BEST VALUE!

AUDIO RESEARCH • ACURUS • ARAGON • KRELL
ALÓN • B&W • CAL • VIMAK • SILTEC • JADIS
LUXMAN • MEITNER • NAD • POLK • MARANTZ
CARDAS • MARTIN-LOGAN • DAY-SEQUERRA • BASIS
WADIA • GRAHAM • KOETSU • PROAC • ENSEMBLE

CSA AUDIO UPPER MONTCLAIR, NJ **201/744-0600**

FOR SALE

SAVE 40% ON HIGH-END home speakers, subwoofers, amplifiers. FREE CATALOG, 3021 Sangamon Avenue, Springfield, IL 62702.1-800-283-4644.

BUY/SELL/TRADE IN THE AUDIO/VIDEO TRADER! Published monthly. FREE ADS! $15/year. Sample $1.00-S.A.S.E. 330 SO. MAIN STREET, DEPT. A, WAKE FOREST, NC 27587.

CALL TOLL FREE! 1-(800) 826-0520. NAD • ONKYO • HARMAN KARDON • CARVER • VELODYNE • HAFLER • M&K • LEXICON • CELESTION • AUDIOCONTROL • TARGET • ATLANTIC TECHNOLOGY • PROAC • ACOUSTAT • CWD • FRIED • MONSTER CABLE • NILES AUDIO • THORENS • STAX • GRADO • DAHLQUIST • KINERGETICS • NITTY GRITTY • PROTON • APATURE • TERK •. SOUND SELLER, 2808 CAHILL RD., MARINETTE, WI 54143. FAX (715) 735-5838, PHONE (715) 735-9002.

AUDIO BEST: LA, ORANGE, SAN BERNADINO, CALIFORNIA. HOT COMPONENTS: CELESTION 100, COUNTERPOINT, TARALAB, PS DIGITLINK; AUDIBLE ILLUSIONS; MODSQUAD; ACOUSTAT; SPICA; VMPS; MAGNUM; FOSGATE; B&K, SUPERPHON, MUSIC REFERENCE, SOUNDLAB, MAPLENOLL, SYSTEMDEK, GRADO, MONSTER, STRAIGHTWIRE, MUSIC CONCEPTS, (714) 861-5413, APPOINTMENT.

DYNACO ST70 UPGRADES: Gold EL34 Sockets, 1215 Microfarad on-board solid state B+, triode output, more. DoReTech Audio Services, Box 6054, South Hackensack, NJ 07606-4354. Phone/Fax: (201) 843-0488.

ECLECTIC AUDIO IS PLEASED TO PRESENT KLYNE AUDIO ARTS TO THE PUGET SOUND MUSIC LOVER. THIS INCLUDES THE NEW DRAGONFLY WINGS INTERCONNECTS. FOR A LISTENING AUDITION IN A RELAXED ATMOSPHERE CALL (206) 776-1158.

AUDIO NEXUS = QUALITY

Featuring legendary **VANDERSTEEN** loudspeakers & **ROTEL** CD Players.

Altis • Apogee • Audio Alchemy • Audioquest • B&K • Cary • Celestion • Counterpoint • Dynaco • Esoteric • Forte • Fried • Magnum Dynalab • Melos • PS Audio • Rotel • Jeff Rowland • Scientific Fidelity • SME • Sony ES • Sota • Stax • Target • Vandersteen • Vendetta • VPI • Wadia. **SUMMIT, NJ (908) 277-0333.**

ATTENTION AUDIO BUYERS!!!

AUTHORIZED DEALER FOR...ADS, ALPHASONIK, BAZOOKA, BOSE, CARVER, DENON, HAFLER, INFINITY, KICKER, KENWOOD, JVC, NHT, NILES, ONKYO, PIONEER, POLK, SONANCE, AND OTHERS. THE SOUND APPROACH, 6067 JERICHO TPKE, COMMACK, NY 11725. (800) 368-2344.

VMPS SPEAKER KITS/ASSEMBLED - Former VMPS employee - quality audio components/accessories also, irresistable prices, personal service, modifications. CUSTOM AUDIO (707) 765-1992.

60 YEARS IN BUSINESS...WE MUST BE DOING SOMETHING RIGHT. If it's a much-in-demand audiophile product, we're likely to have it for immediate shipment. Consult with one of our quiet experts or just order U.S. - warranteed components directly. VISA/MC. Ask for Steve K. or Dan W. SQUARE DEAL , 456 Waverly Ave., Patchogue, NY 11772. (516) 475-1857; (800) DEAL-441.

AUDIO DEN Authorized Sales and Service. ADCOM, ARAGON, ARCAM, B&K, CAL, CELESTION, CONRAD-JOHNSON, KINERGETICS, KLIPSCH, MAGNEPAN, MIRAGE, MIT, MONSTER CABLE, NAD, NAKAMICHI, PARADIGM, ROGERS, SHURE ULTRA, SONOGRAPHE, SOTA, STAX, THETA DIGITAL, VELODYNE, VTL & YAMAHA. **Audio Den**, 2021 Smith Haven Plaza, Lake Grove, NY 11755. **(516)360-1990.**

Cable TV Descramblers, Converters, Accessories. Name Brands. Lowest prices. Best service. Call CABLE READY COMPANY, (800) 234-1006 for FREE 16-page color catalog.

HI FI CLASSICS — USED HI END — HUGE SELECTION of components, cables, etc. Competent & helpful salespeople & the best prices around. WE BUY SELL & TRADE, INVENTORY LIST AVAILABLE. TEL: (718) 318-9618. FAX: (718) 318-9623.

THE NEW ROKSAN
ROK-DPI
CD TRANSPORT AND
ROK-DAI
DA CONVERTOR

ROKSAN

These fine Audiophile LP & CD available through the exclusive North American Distributor

For your copy of our catalogue contact:
MAY AUDIO MARKETING INC.
P.O. BOX 1048, Champlain, N.Y. 12919 Tel: (518) 298-4434 In Canada (514) 651-5707

FOR SALE

SALE! SALE! SALE! Acoustic Energy, ATC SCM-20, Audioquest, Audible Illusions, ASC, B&K Sonata, Classe Audio, Cardas Cables, Celestion, Coda Technologies, Esoteric by Teac, Ensemble, Entec, Genesis Technologies, Golden Dragon Tubes, Kimber, Lexicon, Meridian, Magnum Dynalab, Muse, Mission Cyrus, Niles, PSE Philips Audio Video, Rega Planar, Roomtune, Stax, Sonrise Cabinets, Sound Anchor, Tara Labs Cables & Electronics, Tesla, Tice Audio, Target, V.A.C. Valve Amplification Company, Velodyne, XLO. **NEW LOCATION:** J S AUDIO, 15454 OLD COLUMBIA PIKE, BURTONSVILLE, MD 20866. 301-989-2500. FAX: 301-989-2552. Visa/MasterCard/Amex.

301-989-2500

EXPERIENCED, FRIENDLY ADVICE! FREE SHIPPING! MIRAGE, PS, CWD, STAX, KINERGETICS, KEF, PHILIPS, AUDIOQUEST, FRIED, MONSTER, QUAD, SPICA, STRAIGHTWIRE, MORE!! READ BROTHERS, 593 KING, CHARLESTON, SOUTH CAROLINA 29403. (803) 723-7276.

HOSANNAGANZA!! MAC2120, MAC2505. ACCUPHASE-C200P300. NAKAMICHI-PA7. REVOX-B215 $1100. TECHNICS SEA3MKII (CLASS-A, 86 POUNDS, 300-WPC) $750. REVOX-B286 TUNER PREAMP. SONY-TAN77ES $700. TRADES GLADLY CONSIDERED. MUST MAN BE BORN AGAIN? JOHN 3:1-18. HOSANNA AUDIO (313) 471-1223.

CAR/HOME/VIDEO for: DENON, SONY, INFINITY, AUDIO CONTROL, VELODYNE, CWD, COUSTIC, BAZOOKA, MONSTER CABLE, KICKER, ADVENT & PRECISION POWER. Full line authorized dealer. Call (800) 321-0685 for prices and orders. (301) 729-3711 for info and consultations. C&C Audio/Video 11am-9pm Mon-Sat EST.

QUICKMOD IS A SIGNAL CONDITIONING MODIFICATION THAT IMPROVES BASS, MIDRANGE & HIGHS FOR AMPLIFIERS, INTEGRATEDAMPS & RECEIVERS. SOUND STAGING & DEPTH IS INCREDIBLE! QUICKMOD WORKS WITH POSTMODIFIED EQUIPMENT. FOR KIT $79 + $4 SHIPPING OR QUICKMOD WILL MODIFY YOUR EQUIPMENT FOR $149.95 + $14.95 SHIPPING. SEND CHECK/MO TO: 1235 ELPRADO, RIDGECREST, CA 93555. (619) 446-7621.

BANG & OLUFSEN, B&W, CARVER, REVOX, NAKAMICHI, ADCOM, DENON, H/K, YAMAHA, CELESTION, KEF, ADS, POLK, INFINITY, JBL, KLIPSCH, ETC. MANUFACTURER'S WARRANTIES. AUTOMATED PRICING 24 HRS, LIVE ASSISTANCE 10-6 ET. AMERISOUND SALES, INC. (904) 262-4000.

KLIPSCHORN SPEAKERS - $2050. MC2600 AMPLIFIER - $3900. MAC4200 RECEIVER - $1900. MCD7007 CD PLAYER - $1300. Recently purchased new. Original owner. All currently under factory warranties. Mint-condition, w/original manuals. (803) 269-5506 or (803) 269-3340.

BEST $1,000 SPEAKER Plus B&W + BANG & OLUFSEN + NAKAMICHI + DENON + ONKYO + VMPS + TRIAD + REVOX & Many More High End Lines—BARGAINS-HONESTY! TECH ELECTRONICS 904-376-8080.

MCINTOSH Bought-Sold-Traded-Repaired. FREE Catalogue. See our ad at the beginning of the classifieds. **AUDIO CLASSICS**, POB 176MB, Walton, NY 13856. 607-865-7200. 8AM-5PM EST Mon.-Fri.
—Audio Advertiser for over a Decade—

"STEVE'S AUDIO ADVICE." HUNDREDS OF GREAT PRODUCTS AT THE ABSOLUTE BEST PRICES. TALK DIRECTLY WITH STEVE. OVER 20 YEARS OF EXPERIENCE. ANNOUNCING SOLID STATE AMPLIFIER DESIGN. THE ASTOUNDING McCORMICK DNA I. ALSO FEATURING ROKSAN, B&K, PHILIPS, MAPLENOLL, MAGNUM, QUAD, CARY, CARDAS CABLES, MORDUANT SHORT, VMPS & MUCH MORE. CATALOG AVAILABLE. NATIONWIDE CALL 1-800-752-4018.

CLOSEOUT SPECIALS!! CALL FOR LISTING OF NEW AND DEMO SPECIALS ON OVER 100 BRANDS OF HIGH END AUDIO EQUIPMENT AND ACCESSORIES. ORDER LINE: 800-438-6040. INFORMATION LINE: 704-889-9223.

LOUDSPEAKERS

LOUDSPEAKER COMPONENTS-KITS. Dynaudio, Morel, Eclipse, Focal, Peerless, Eton, Vifa, more! Crossover parts--design books also. Catalog $2. Meniscus, 2442 28th St. S.W., Wyoming, MI 49509. (616) 534-9121.

CUSTOM ELECTRONIC CROSSOVERS, 6 to 36 dB/Oct. Also Snell, Magnepan versions. DB SYSTEMS, POB 460, RINDGE, NH 03461. (603) 899-5121.

VMPS factory assembled speakers. All models, low prices, shipped direct to you. Free price sheet. Arthur Morgan, 886 East Charing Cross CR., Lake Mary, FL 32746.

SPEAKER
CATALOG

Parts Express is a full-line distributor of electronic parts and accessories, geared toward the consumer electronics industry, and the technical hobbyist. Stocking an extensive line of speaker drivers and accessories for home and car. Send for your **FREE** 148 page catalog today.

Parts Express
340 East First Street
Dayton, Ohio 45402
1-800-338-0531

(800) 736-5533

CAR AUDIO

•Sherwood	•Sherwood	•ADS
•Alphasonik	•Audio Control	•Soundstream
•Yamaha	•Polk Audio	•Coustic
•Infinity	•Kenwood	•MB Quart

ALPINE
7915 .... $429
7914 389
7294 439
3331 199
3555 385
7292S 299
5957 439
7803 439
7802 379

ORION
XTR 12 .... $99 ea.
XTR 15 .... 115 ea.
XTR 12DVC .. 109 ea.

BOSTON
5.2 .... $279 pr.
6.2 .... 299 pr.
851 .... 165 pr.
861 .... 175 pr.
10.0LF .... 160 ea.

JVC
XLG2000 .... $229
KSRG4 239
XLMG800 279
XLG3500 299
KSRG8 .... Call

RADARS
Bell and Whistler

PPI
2050 AM $275
2075 AM 375
2150 AM 489
4200 AM 410

AUDIO CTRL
Eqx $239
Epicenter 169
EqL 169

KICKER
C15 .... $110 ea.
C12 .... 89 ea.
C10 .... 79 ea.

NAKAMICHI
CD 2 .... $645
CD 3 485
REC 1 765
CASS 1 685
CASS 2 325

PARADIGM
3se .... $239 pr.
9se II .... 535 pr.
5se II .... 349 pr.
7se II .... 389 pr.
11se II .... 639 pr.
Titan .... 160 pr.

YAMAHA
RXV 850 .... $649
RXV 1050 969
DSPA 1000 1199

CELESTION
Model 3 .... Call
Model 11 .... Call
SL 6 SI .... Call

AUDIO SRC
SS 3 .... $279
AMP 1 239
TUNER 1 185
VS one .... 89 ea.
Pre one 199

PARASOUND
HCA-800 II $339
HCA-1200 649
HCA-2200 1245
P/Fet-900II 350
C/PT-1000R 459

NAD
1600 .... $319
2400 THX 479
5060 359
7240PE 385
2100X 345
7225PE 265

PINNACLE
PN8+ .... $296 pr.
PN5+ .... 146 pr.
PN2+ .... 110 pr.
PN Sub .... 225 ea.

POLK
RTA-11TL .... $779 pr.
RM 3000 569
CS 100 149
M 12 .... 769 pr.
M 10 .... 579 pr.
M 3 .... 149 pr.
M 5 Jrt .... 280 pr.

INFINITY
Sm 112 .... $429 pr.
Ref 2 .... 239 pr.
Ref 5 .... 529 pr.
Ref 6 .... 659 pr.
RENAISSANCE

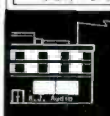
JVC
RX707 .... Authorized
RX1050 .... Dealer
AVX1050 .... Call
XLZ 1050 .... Call
Mini Systeme .... Call
TDV 541 .... Today

CARVER
CT-6 .... $450
CT-17 629
TFM 25 559
TFM 45 879
SDA 490t 559

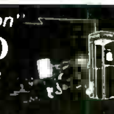
FRIED
Beta IV .... Authorized
R/4 .... Dealer
A/3a .... Call!!
Q/4 .... Call!!

AUDIO ALCHEMY

All products covered by manufacturer's warranty or B. J. Audio's exclusive limited warranty. Ask for full details at the time of purchase.



"The Quick Connection"
B.J. AUDIO
991 Beachmeadow Lane
Cincinnati, OH 45238
(513) 451-0112



VISA **Visa** **Mastercard** MasterCard

CHATEAUROUX
POLYPROPYLENE CAPACITORS

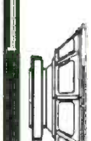
We are pleased to announce that we have in stock *CHATEAUROUX* **Metallized Polypropylene Capacitors** of exceptional quality and excellent price. This type of dielectric has been characterized by Walter Jung as "outstanding" when compared with all other dielectrics in the areas of:

- Dissipation factor @ 20 °C: <.01 %.
- Dielectric absorption factor at 20 °C: < .01%.
- Good self healing characteristics of polypropylene dielectric
- High Current Capacity
- Excellent Overvoltage and Pulse handling capability
- Low self inductance
- Excellent stability
- Leads: Tinned pure copper multistrand insulated sleeves, radial or axial as indicated.
- Superior high frequency characteristics
- Insulation resistance @ 20 °C :>100K megohms/mfd
- Temperature range: -25 °C to +85 °C.
- Working Voltage: 250 VDC or higher.
- Test Voltage: 2.15 times rated voltage
- Capacitance tolerance: +/- 5%: (grading of pairs to 1% available)
- These are ***"Fast Caps"***, a newer version of the Chateauroux with lower disapation factor, improved transfer function and lowered parasitics.

Dimensions in mm:					
2 µfd:	18D,	28L	50 µfd:	39D,	71L
4 µfd:	18D,	33L	60 µfd:	39D,	84L
8 µfd:	21D,	45L	70 µfd:	43D,	84L
12 µfd:	27D,	46L	80 µfd:	49D,	70L
15 µfd:	28D,	45L	100 µfd:	54D,	71L
25 µfd:	34D,	53L	120 µfd:	54D,	83L
35 µfd:	35D,	65L	150 µfd:	60D,	83L
			200 µfd:	60D,	110L

Audiophile Prices

1.0 µfd	$2.30	15.0	5.90
1.5	2.40	20.0	7.30
2.0	2.40	25.0	9.15
2.5	2.50	30.0	10.35
3.0	2.65	35.0	12.00
3.3	2.70	40.0	13.65
4.0	2.85	45.0	14.70
4.7	3.05	50.0	15.85
5.0	3.20	60.0	18.30
5.6	3.30	70.0	20.00
6.0	3.50	80.0	23.35
7.0	3.90	100.0	29.15
8.0	4.20	120.0	35.75
10.0	4.65	150.0	42.25
12.0	5.25	200.0	53.60



Madisound Speaker Components
Box 44283 (8608 University Green)
Madison, WI 53744-4283
Voice: 608-831-3433
Fax: 608-831-3771

LOUDSPEAKERS

CROSSOVER NETWORKS, PASSIVE. CUSTOM, STANDARD, WHOLESALE PRICES. FREE BROCHURE, DESIGN ASSISTANCE. DEALERS WELCOME. FERGITRON ELECTRONICS, BOX 674, LEVITTOWN, NY 11756. (516) 735-2019.

SPEAKER REPAIRS BY AST

Expert service most USA & British woofers 8"-18". VINTAGE SPEAKERS OUR SPECIALTY! Over 50 years of experience... **Authorized sales of pro sound equipment. AST, 250 W. Broadway, NY, NY 10013. (212) 925-8149.**

Sometimes Great Sonics Come in Small Packages!

The **MultiCap** from Music Interface Technologies offers

- *The lowest ESR & ESL* • *Lowest dielectric absorption* • *Lowest phase deviations* • *Most stable phase characteristics* • *Greatest transient performance* • *Reliable & consistent long-term performance and*

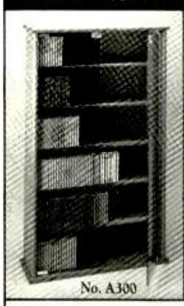
MORE USABLE BANDWIDTH

Musical Translation?
The greatest clarity across the frequency range.

MIT MultiCap
The most advanced capacitor in the world.

US Inquiries: **CVTL Inc.** 3037 Grass Valley Highway, Auburn, CA 95603 Tel (916) 823-1186 Fax: (916) 823-0810
Int'l Inquiries: **MIT Components** 760 Pacific Road Unit 19 Oakville Ont CANADA L6L 6M5 Tel (416) 847-3277 Fax (416) 847-5471

CD STORAGE+™



Store 300 CD's behind glass doors. Five adjustable shelves with brass bookends hold single & multiple CD's, Videos and Cassettes — in any combination. Comes in Solid Oak, Walnut, Teak or Cherry. Can stack or wall mount.

FREE Literature and Prices:
Call 1-800-432-8005
FAX 1-201-748-2592

SORICÉ P.O. Box 747-1 Nutley, NJ 07110

LOUDSPEAKERS

A & S SPEAKERS imports the world's finest speaker components, crossovers, and kits: Dynaudio, Scan Speak, Focal, Morel, MB Electronics, Peerless, Polydax, SEAS, LPG, Eton. We also ship VMPS systems and kits and Parasound Amplifiers. Free literature. 3170 23rd Street, San Francisco, CA 94110. (415) 641-4573; Fax (415) 648-5306.

BEST SELECTION & GUARANTY. 50 SPEAKERKITS for HOMES, SURROUND SOUND, CARS, PROS & SUBWOOFERS. JBL, DYNAUDIO, POLYDAX, MOREL, SEAS, ELECTROVOICE & VIFA. NEW & USED ELECTRONICS; AWARD-WINNING CROSSOVERS, ANALYZERS. 64p. CATALOG, $2. GOLD SOUND, 4285 S. BROADWAY, ENGLEWOOD, CO 80110.

BOSE, JBL REFOAMING QUALITY SERVICE ON ALL BRANDS SINCE 1977. CALL ABOUTOUR BOSE 901 UPGRADE/MOD., REFOAMING, REPLACEMENT PARTS. FAST SERVICE. **SPEAKERWORLD**. 813-544-3511. **800-359-0366**. MC-VISA-AMEX.

Japan's leaders think you can't read this.

The best sounding integrated amps are *NOT* made in Japan.

We build them in England.

ARCAM

Amplifiers from $399

Audio Influx Corporation

IMPORTERS OF AUDIOPHILE PRODUCTS
P.O. Box 381 Highland Lakes, NJ 07422 (201)764-8958

PURE TUBE COMPONENTS

We are proud to put on our product the highest lable

MADE IN U.S.A.

YM - 100
DUAL MONAURAL POWER AMPLIFIER

PY - 100
DUAL MONAURAL PREAMPLIFIER

5 YEAR WARRANTY !

Yakov ARONOV
Yakov Aronov Audio Laboratory Inc.
7418 Beverly Blvd. • Los Angeles, Ca 90036 • Tel. 213 653-3045 • Fax 213 937-6905

LOUDSPEAKERS

ABSOLUTE SATISFACTION guaranteed. We sell more high end speaker kits than anyone in the U.S. Eleven kits from $119/pr. Free catalog. 1-800-346-9183. Audio Concepts, Inc., 901 So. 4th St., La Crosse, WI 54601.

BOZAK SPEAKER REPAIRS, using original manufacturer's machinery, specifications, techniques and dies. Quality workmanship. NEAR 207-353-7308.

IT'S HERE! THE REFERENCE 2 - a gorgeous floor standing tower featuring the new Focal titanium tweeter! Free literature. ARIEL ACOUSTICS, P.O. Box 87261, Canton, MI 48187. (313) 981-7220.

WESCOTT AUDIO- ACOUSTAT Speaker mods, XLO, Discovery, VAC, Sumiko, Room Tune, **Muse**, Power Wedge, & the incredible **EAD** DSP-7000 Digital Processor & T-7000 Universal Disc Transport. Call 800-669-7574 to order or 814-692-7474 for info & expert consultation.

KOSS MODEL 1-A ELECTROSTATIC SPEAKERS. EXCELLENT CONDITION. $1280 OR BEST OFFER. PHONE AFTER 7PM EASTERN. 904-287-5155. LEAVE MESSAGE IF NO ANSWER.

PYLE DRIVERS — 48 ALL NEW woofer models. Also PIONEER OEM woofers, mids, tweeters and MCKENZIE prosound speakers. Dealer inquiries? MC/VISA. SRS, 318 South Wahsatch, Colorado Springs, CO 80903. (719) 475-2545.

LOUDSPEAKER COMPONENTS: The extraordinary crossover components used in many of the world's finest loudspeakers are now available through North Creek Music Systems. A Subscription to our quarterly catalog is $3.00. A complimentary issue may be requested. Satisfaction guaranteed. North Creek Music Systems, 500-A Route 8, Speculator, NY 12164. (518) 548-3623.

NEW! DYNAUDIO® FINALE Discover the SUPERIOR SOUND QUALITY of 1992 DYNAUDIO SPEAKER KITS. Catalog $2.00. ADVANCED AKUSTIC • 4555 Pershing STE-33184 • Stockton • California • 95207. (209) 477-5045.

COMPUTER DESIGNED LOUDSPEAKER KITS, HIGH-END PERFORMANCE, ALSO CUSTOM ENCLOSURES. CALL 715-479-7532 FOR FREE LITERATURE. SPEAKERWORKS, BOX 83A, CONOVER, WI 54519.

PROFESSIONAL FOAM REPLACEMENT! Guaranteed work—not a kit. Fast and inexpensive. Five year warranty. Dealers welcomed. Send stamped envelope for information to: **NEVISONICS,** 650-A Baxter Ave., Lousiville, KY 40204.

BANG & OLUFSEN, B&W, CARVER, REVOX, NAKAMICHI, ADCOM, DENON, H/K, YAMAHA, CELESTION, KEF, ADS, POLK, INFINITY, JBL, KLIPSCH, ETC. MANUFACTURER'S WARRANTIES. AUTOMATED PRICING 24 HRS, LIVE ASSISTANCE 10-6 ET. AMERISOUND SALES, INC. (904) 262-4000.

FOAM ROT!? Replacement of Foam Surrounds. Any Size, Any Brand. 3"-to-18" Two-Day Turnaround, Two-Year Warranty. Atlanta, GA. For FREE Estimates: **(404) 933-0101.**

SPEAKER CLINIC.

SPEAKER RECONING; Refoaming Kits; Crossover Kits, & Mods By "Van Evers"; Grills Made To Specs; Diaphragms, Mids & Tweets; New Speaker Test Lab Using L.E.A.P.-L.M.S. THE SPEAKER EXCHANGE, 1242 E. Hillsborough Avenue, Tampa, Florida 33604. (813) 237-4800.

OUTDOOR TOTALLY WATERPROOF AUDIOPHILE-QUALITY SPEAKER utilizing metal-alloy speaker cones for outdoor use. 5 year warranty. NEAR 207-353-7307.

MINI-SUB SYSTEM PHENOMENAL LOW FREQ RESP! 10" DUAL COIL VENTED DESIGN. ENCLOSURE 7" X 14" X 30", 45LBS! AVAILABLE IN STEREO OR DUAL MONO. CLEAN TIGHT BASS TO 38HZ X-OVER 120HZ, 7 YR. WARR. CUSTOM COLORS, $299 EA. MC, VISA, AMEX. **SPEAKERWORLD** 813-544-3511. **800-359-0366.**

DAT

Custom DAT tapes. Classic and theatre pipe organ digital master recordings: Brochure 50¢ & SASE. T-V RECORDING, BOX 70021, SUNNYVALE, CA 94086.

CD PLAYERS

MUSICAL CONCEPTS = CD MUSICALITY
"The Musical Concepts players are not about fancy faceplates, nor unsupportable hype, they're about satisfying musicality!"—**ENIGMA IV**, "The best CD value, period, outperforming $3000-$4000 transport/DACs", for only $595, **ERA IV**, "Rich, warm, delicate, tube-like liquidity" $795, **EPOCH IV**, "More musically natural than **any** transport/DAC combination—**breakthrough** naturalness and musicality!", $995. All players use 384X oversampling! Try our **CDT**—hear the difference a transport can make($595)! We modify most **Rotel, Philips, Magnavox, Pioneer**—plus **Altis** and **Audio Alchemy** DACs. MUSICAL CONCEPTS, 1832 Borman Ct., Suite One, St. Louis, MO 63146. (314) 275-4925.

COMPACT DISCS

DISCOUNT COMPACT DISCS

Telarc $11.99/cd; Chesky $10.99/cd; DMP, Reference & Sheffield $11.99/cd! Hundreds of other labels at low prices. Send SASE for catalog or your order with Visa / MC / Disc / Check + $4 shipping to: THE ACME COMPACT DISC COMPANY, P.O. BOX 7004, EVANSTON, IL 60204.

Compact Discs! Large Selection! Club Prices! Invoiced Accounts! Order: (9am-5pm): (800) 843-3472. NATURAL SOUNDS; 250 Beverly Boulevard; Suite A-106; Upper Darby, PA 19082-4506.

RECORDS

LV/CD/RECORD COLLECTOR'S SUPPLIES. Jewell boxes, record jackets, sleeves, storage boxes, 78 sleeves, dividers, much more! Free brochure: CABCO PRODUCTS, ROOM 663, POB 8212, COLUMBUS, OH 43201. (614) 267-8468.

THE GLIDING PLATTER™. Fits Nitty-Gritty & Record Doctor for effortless record turning! $15 PPD.
78-RPM BRUSH. Special "Stylus-size" filaments deep clean grooves! Waterproof. Maple handle. $17.95 PPD. Order today! CHK/MO: KAB Electro-Acoustics, Box 2922A-06, Plainfield, NJ 07062-0922. (908) 754-1479.

LPs & TAPES BY MAIL. CLASSICAL, OPERA & JAZZ. Write, Call or Fax for our current list. IRVINGTON MUSIC, 537 S.E. ASH 25, PORTLAND, OR 97214. TEL. 503-230-9210, FAX 503-230-9214.

AUDIOPHILE RECORDS

AUDIOPHILE RECORD WAREHOUSE! Out-Of-Print Direct-To-Disc, Halfspeed, Quiex II & Import Pressings. Great selection of In-Print Records & CD's. Quantity Discounts! Call for Free Catalog. Elusive Disc, 5346 N. Guilford Ave., Indianapolis, IN 46220. (317) 255-3446.

MAIL ORDER

THE BEST DISC AND TAPE STORAGE SYSTEM IN AMERICA. Stackable, portable oak units hold all recording formats. FREE Mailorder Brochure (please mention Audio). Per Madsen Design: (415) 928-4509. P.O. Box 330101, San Francisco, CA 94133.

AUDIO/VIDEO STORAGE

BUILD YOUR OWN CD STORAGE RACK. HOLDS 500 CDs—EZ PLANS. MATERIALS COST UNDER $50. SEND $10 TO: WOOD CREATIONS, P.O. BOX 566741, ATLANTA, GA 31156.

CUSTOM DESIGNS

$$-I want it ALL and I want it NOW-$$ at a price I can afford! So Audio Research and Krell are pretty good, right? But also pretty expensive. Try the best of both worlds in a price-busting way! Convert your Hafler, B&K, Adcom, or other amp to TUBE hybrid design. We convert into mono pairs too. 3 year warranty. Design by Greg Miller. 818-982-6477. **Lazarus Tube-Hybrid Conversions: $799.**

INVENTIONS WANTED

INVENTIONS / NEW PRODUCTS / IDEAS WANTED: Call TLCI for free information & Inventors Newsletter. 1-800-468-7200, 24 hours/day--USA/CANADA.

WANTED TO BUY

TOP PAYING FOR MCINTOSH, MARANTZ TUBE AMP McIntosh Solid state, Western, JBL, Altec, Tannoy, EV, Jensen, Speakers & Horn, EMT Turntable, Ortofon Arm, Temma--(516) 942-1212, (516) 496-2973.

Audio City Always Paying top for: Studer, Levinson, McIntosh, Marantz, CJ, ARC, Quad, Leak, Western Electric, Telefunken, Siemens, Neuman, Vintage speaker systems, raw units by Tannoy, W.E., EV, JBL, Altec, Jensen. Audio tubes by Telefunken, Genalax, etc. P.O. Box 802 Northridge, CA 91328-0802. Tel: 818-701-5633. David Yo.

HI-FI SUPPLIES--PAYS CASH FOR LEVINSON, ARC, C.J., KRELL, SPECTRAL, ROWLAND, THRESHOLD & OLD MARANTZ, MCINTOSH TUBE EQUIP. **(212) 219-3352,** 7 DAYS 10AM-6PM (NY).

MARANTZ, MCINTOSH, HARTSFIELDS, W.E., PATRICIANS, TANNOY, KRELL, LEVINSON, ARC, ETC. Call LAST for absolutely highest collector prices on mint equipment. Act before market weakens. N.Y.S.I. (718) 377-7282, 2-6 P.M., WEEKDAYS.

WANT — JBL Hartsfield, EV Patrician, Singles OK, McIntosh, Marantz & other tube equipment. Larry Dupon, 2638 W. Albion, Chicago, IL 60645. (312) 338-1042. evenings.

WANTED: WESTERN ELECTRIC, JBL, MARANTZ OLD EQUIPMENT. SUNLIGHT ENGINEERING COMPANY: 213-320-7020, 22130 SOUTH VERMONT AVENUE, #A, TORRANCE, CA 90502.

WANTED: USED AND DEMO HI-END AUDIO EQUIP. CALL ANYTIME. TEL: 714-861-1002, FAX: 714-860-8470. VICTOR.

A/D/S L1590 SERIES 2 SPEAKERS WANTED. MUST BE IN GOOD CONDITION. (414) 257-3933 TOM OR LEAVE MESSAGE.

COLLECTOR WILL TRAVEL, even long distance if necessary, to **pick-up:** tube MARANTZ, McIntosh, **PANNOY** Speakers, etc. **MONO**/Stereo. (718) 387-7316. NEW YORK.

CAR STEREO

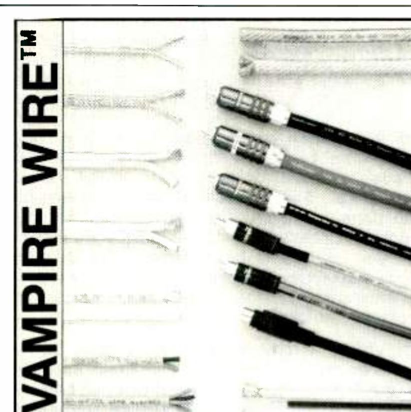
RETAIL OR CUSTOM SUBWOOFER ENCLOSURES TOO EXPENSIVE? ASSEMBLE ONE OF OUR PRE-FABRICATED KITS OR CONSTRUCT YOUR OWN FROM DETAILED PLANS. AFFORDABLE PRICES. FOR MORE INFORMATION SEND $1 TO: TYPHOON AUDIO TECHNOLOGIES, P.O. BOX 80006, LINCOLN, NE 68501-0006.

"STEREO WORLD" is your discount sound source with great deals on car and home stereo: Panasonic, JVC, Sony, Ultimate, Lanzar, Phillipssound Labs, Pioneer Sherwood, Hi-Fonics, Blaupunkt, MTX, Pyle, Orion, Kenwood, Scosche EFX, Autotek, JBL, Clarion, Avital Alarms and many others. We Carry alarms and a full line of installation kits. Please call or write for FREE catalog. FREE UPS in 48 states. Visa MC; COD accepted. P.O. Box 596, Monroe, NY 10950. (914) 782-6044.

PUBLICATIONS

MOVIESOUND NEWSLETTER. The state of film audio tracks in theaters and at home. $8/year (4-issues). Send $2 for two sample issues. P.O. Box 7304, Suite 269A, No. Hollywood, CA 91603.

ACTIVE ELECTRONIC CROSSOVERS
MODEL 120 CABINET & NEW 120-R "RACK AND PANEL" DESIGNS
Made to order in Butterworth bi-amp, tri-amp, or quad-amp configurations with optional level controls, subsonic filters, or summers. Filters, regulated power supplies, equalizers, are also available.
New catalog and price sheet. Free!
DeCoursey Eng. Lab.
11828 Jefferson Bl., Culver City, CA 90230
PHONE (310) 397-9668



...audible results with the finest in connecting components
SOUND CONNECTIONS INTERNATIONAL, INC.
203 Flagship Dr., Lutz, FL 33549 PH: (813)948-2707

What's new at *Esoteric Sound*? Counterpoint's New Products! Hear the Clearfield Speakers with the Solid 2 Amplifier and the DA10 DAC. The Excitement is Back!

Esoteric High End Components For The Audio Perfectionist

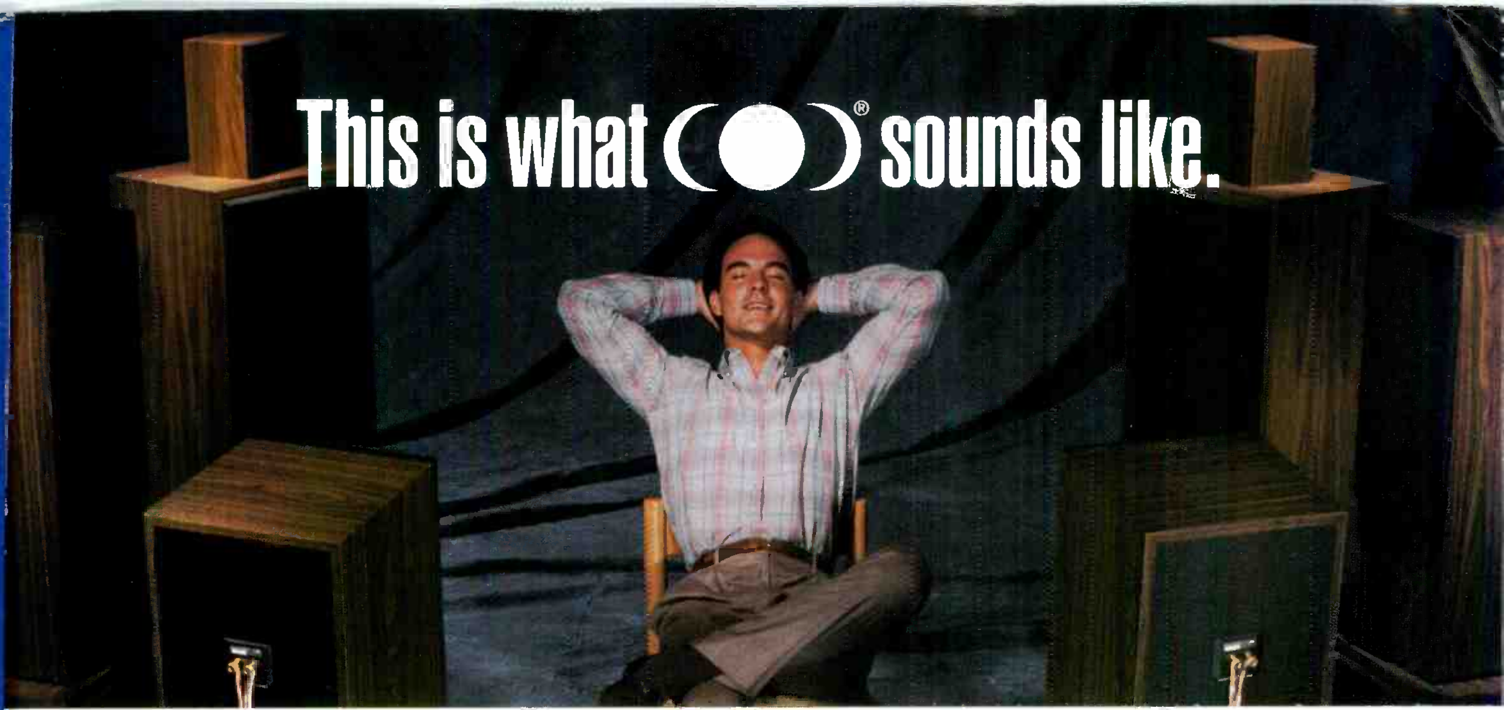
SOUND SYSTEMS LTD.
COVENTRY COMMONS Rte 347
STONYBROOK, N.Y. 11790
516/689-7444 FAX: (516) 689-7457

AUDIO ALCHEMY • AUDIO STATIC • CHAPMAN • CLEMENTS
COUNTERPOINT • ENLIGHTENED AUDIO • ESOTERIC • HARTLEY
JBL-XPL • LEXICON • McINTOSH • MELOS • PROCEED • ROTEL
JEFF ROWLAND • SHAHINIAN • SUMO • VAC • WADIA AND MORE

PUBLICATIONS

SERVICES

AD INDEX



This is what (●) looks like.

(●) is the symbol for the Sound Retrieval System that lets you experience true 3-D audio realism from two ordinary loudspeakers. And now, this amazing technology is available for hi-fi, as well as home theater applications.

The new AK-100 will immediately upgrade your investment in your entertainment system. It's easy to install and is compatible with mono, stereo and even surround-type coded material.

As Len Feldman said in Video Review/March '91, "Perhaps the most effective stereo enhancement system, one that even simulates full surround sound."

To experience the uncanny realism of this new kind of sound is...well, uncanny. You can get up and walk around the room and the sound image doesn't change. You don't have to stay in the "sweet spot", nor surround yourself with numerous speakers.

As Len Feldman wrote in Radio Electronics, "The demonstration was so dramatic and effective that people couldn't help but look for additional hidden speakers." Ken Pohlmann in Stereo Review, said "...the effect blew me away." Daniel Gravereaux, former president of the Audio Engineering Society said, "...knocked my socks off."

So forget expensive decoders and multi-speaker matrices. To restore 3-D audio realism, you don't need to discard your present hi-fi system or sacrifice a lot of living space for a room full of speakers. All you need is (●).

Hear (●) for yourself, today. Call HUGHES AUDIO PRODUCTS at 1-800-2-HEAR-3D.

HUGHES

Subsidiary of
GM Hughes Electronics

For more information, contact Hughes Microelectronic Systems Division, Audio Product Line, P.O. Box 7000, Rancho Santa Margarita, CA 92688.

Enter No. 16 on Reader Service Card