Audio

JUNE 1987 • $2.25

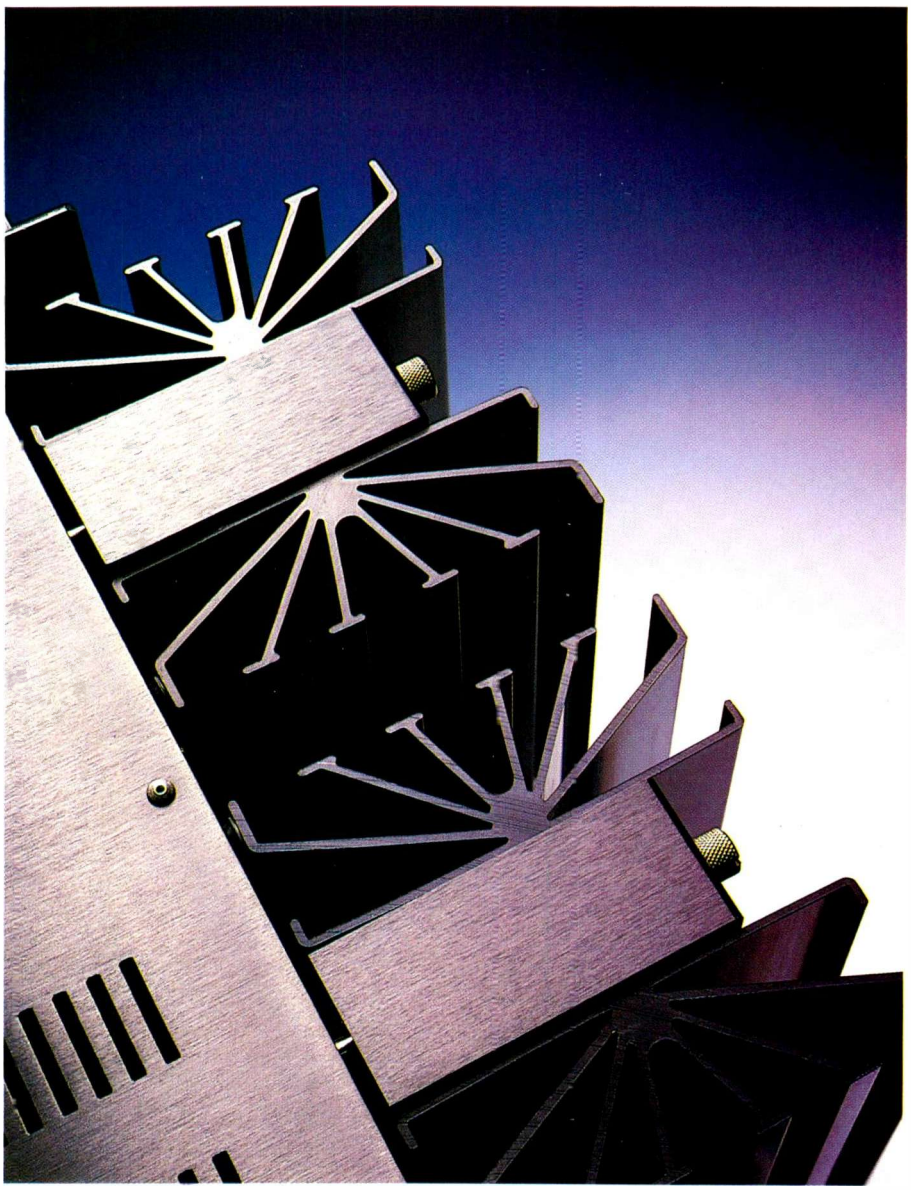
MAGNAVOX CD UPGRADE

INTERVIEW WITH GEORGE MARTIN
WHY THE BEATLES CDs ARE MONO

TESTED
ADS CD4 PLAYER
SUPERB PERFORMANCE
A.V.A. 250 TWO AMP
PLEASING SOUND

YAMAHA DSP-1
NEXT BEST THING TO BEING THERE

A VIEW FROM THE TOP



HEATSINK—July 1986

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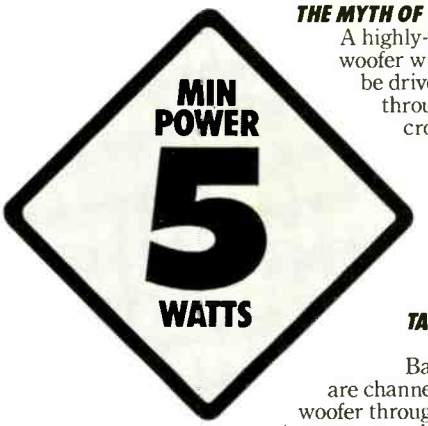

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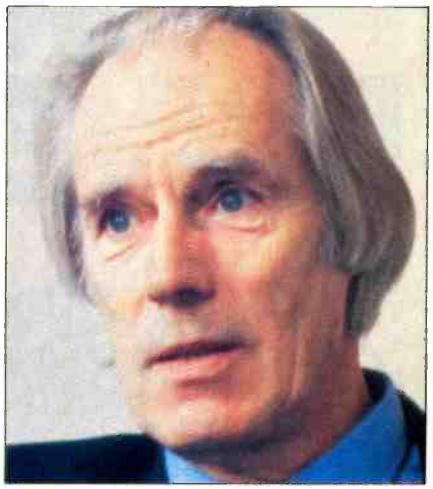

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FEATURES

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MUSIC REVIEWS

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SIGNALS & NOISE

Live-End/Dead-End Update

Dear Editor:

Regarding my two-part article on building a live-end/dead-end listening room (*Audio*, December 1986 and January 1987), it has come to my attention that there are acoustic products, manufactured or distributed by such companies as Acoustic Sciences Corp., Watkins Engineering, Monster Cable, Illbruck/USA, and others, which can be used to create the effect of a live-end/dead-end listening room. As completely pre-manufactured units, they can eliminate the need to hand-build panels, frames, etc. Use of these products, however, should still follow the applicable guidelines in the two articles.

Please note that some of these products use acoustic foam materials that can be very effective, depending on just how they are used. These materials are not generally available to the public and therefore were not mentioned in the articles themselves. Also, exact construction techniques employed in these products vary, and are used to meet the individual goals of the products' designers.

In addition, Watkins Engineering has patented and is manufacturing and selling a product similar to what I described in Part I of my article. There is no connection between Watkins Engineering and myself.

William R. Hoffman
Reno, Nev.

Save the LP!

Dear Editor:

I'm deeply concerned with the battle between the LP and the CD! Why are record companies and others in such a hurry to push aside the LP? I guess new technology hype and sales are the target. It saddens me to walk into a record store and see three-quarters of the shelves stocked with CDs and one-quarter with records. The public is being hypnotized into buying a CD player in order to keep up with the future. I'm not purchasing one, but instead I'm upgrading my present stereo system. I can't see spending twice as much on a CD as compared to an LP. *Long live vinyl* is my motto!

I'm so tired of hearing people praise the CD. Sure, the CD sounds great. But we must stop and think. Where would we be without the LP record? We can't stop the future, but we can save history!

All of us record collectors must stand together and fight to *save the record*. I've already made my stand by developing a "Save the Record" T-shirt. Join me in the fight! Time is running out! Don't let the record become the next endangered species. We must make people aware that this issue is of *major concern!*

If you would like to wear a "Save the Record" T-shirt, send $12 postpaid (U.S.) to: L. A. Schwartz, 249 North Brand Blvd., Suite 458, Glendale, Cal. 91203. (It's a red and black silkscreen design on white. Sizes: S, M, L, XL.)

Thanks for caring!

L. A. Schwartz
Glendale, Cal.

Be a Cassette-Pal

Dear Editor:

Many of your readers, especially those with elderly or shut-in friends or relatives, may be interested in a tape exchange group in which one may get to know people all over the world through audio cassettes. Information about this nonprofit group may be obtained from Mrs. Phyll Moore, Director, Silver Fern Tape Recording Club, 9 Kamahi Place, Rotorua, New Zealand. This more than 12-year-old club has members of all ages in England, Africa, New Zealand, Sweden, Australia, Zimbabwe and the U.S. Dues are about $15 (U.S.) per year.

James K. Jobson, Sr.
Austell, Ga.

Expression of Sympathy

Dear Editor:

I was recently told the sad news about Dick Heyser. It came as a shock, even though I knew he had been ill. All at B & O who have had the privilege of meeting him have had a deep respect for Dick, both as a thinker and as a person.

All of us here would like to express our sympathy to those who were close to him. We feel that you were so close to him that we can express our thoughts to you, and that you will give our message to others whom we do not know, but who knew him well.

S. K. Pramanik
Bang & Olufsen
Struer, Denmark

Audio

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RICHARD C. HEYSER

At the Chapel service on March 19, 1987, for our friend and colleague Richard Charles Heyser, who had passed away on March 14, the Rev. Kenneth A. Wahrenbrock delivered the following eulogy, which is slightly abridged for publication here:

Entered in my diary for March 14 is the following: Dick Heyser has passed the torch.

Dick brought the math for audio out of the 17th century and into the modern age. He has presented the foundation: it is our task to keep adding the blocks to build the wall, to understand his ideas and share them with the world, to pick up the torch and carry it on!

The following was presented by Gerald R. Stanley to the Assembly at Crown International in Elkhart, Ind. on March 16:

A Transform

Isaac Newton said, "I do not know what I may appear to the world, but to myself, I seem to have been only like a boy playing on the seashore, and diverting myself in now and then finding a smoother pebble or a prettier shell than ordinary, whilst the great ocean of truth lay undiscovered before me."

One of God's great gifts to man is the boys who play on the seashore and are able to uncover rare gems of truth. Dick Heyser was one such who, with boyish enthusiasm, touched all of us in the audio industry.

Driven by the magic of "Ah ha!" Dick would share the latest gem with us. Immeasurably patient with our frequently puzzled responses, he would expose facet after facet of the jewel 'til we could catch a glimmer of the jewel's fire.

Such is the nature of truly creative genius. Truth is beauty, and we will miss you, Dick. Yes, I will miss you.

Dick Heyser was born in Chicago, May 1, 1931. He moved to Phoenix and received his BSEE at the University of Arizona, was chief engineer of a TV station in Phoenix, and came to CalTech and began working at Jet Propulsion Laboratory in 1955 while still a student. He earned his MSEE there. He was part of the team developing the TV cameras for the space probes and the imaging technique and equipment to improve the pictures received. He developed new instrumentation that assisted audio, oceanography, and medicine. He was a Fellow of the AES and its President-Elect. He was awarded their Silver Medal recently. He was a Fellow of the ASA. He was a member of the Sapphire Club and the IEEE. He was a Senior Editor of *Audio*. He had been an engineer at JPL for 31 years.

Early in this century, John Oxenham shared these words which describe much of what we know about Dick:

> Four things a man must learn to do
> If he would keep his record true.
> Think without confusion, clearly.
> Love his fellow man, sincerely.
> Act from honest motives, purely.
> Trust in God and heaven, securely

Dick's life, relationships with others, dedication to the search for truth, his sensitivity to others, his joy of life and discovery all reflect those words.

I would share some "snapshots" of Dick:

1. At an AES dinner meeting, discussion around the table was stimulated by Dick's ideas. A question from one who had less experience of the subject brought Dick's smooth shift to simpler vocabulary and more careful explanation to ensure there was understanding of the ideas. He shared with spirit and heart and skill.

2. When questioned about developing Time Delay Spectometry, he responded, "I had to measure some speakers in my lab. I had no anechoic chamber, so I designed TDS." Later on came the revelation of what it was, the math that supported it, and the amazing measurements it would make as more people began to understand the procedure and principles. He continued to expand its usefulness with new disks of software.

3. When sharing his ideas, as he always did with clarifying explanation, he suddenly stopped and said, "It always hurts a bit to share in 10 minutes what has taken me 10 years to develop and understand and prove."

4. With Dick at a blackboard or overhead projector, the ideas flew so quickly and developed in so many directions at once that his listeners' eyes and minds frequently glazed. Dick's attitude was that if you didn't ask questions, you were intelligent enough to completely understand what he was talking about, so he plunged on ahead and challenged you more.

5. There were times when he spoke to groups and conventions and showed his love for people. If they differed with him, that was all right; no defensiveness at all, just acceptance of persons. Yet there was a sense of hurt when others did not try to understand what he was proposing.

6. He had a great desire to teach and challenge. The presentation of the Catastrophe Theory stretched many minds and helped them understand the meaning of the new things they could see and then hear.

7. He loved to teach and sought to be alert to how his ideas were being received. At times he would warn the group with, "This is important!" Then he would demonstrate the foundations that undergirded the idea.

Another colleague, Emanuel Tward, wrote these words:

> The amazing thing about Dick Heyser was that he spanned the range

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of technology, from the most practical of electronics and acoustics to the most fundamental philosophy of how we make observations of physical phenomena. His Principle of Alternatives, his view of how nature is describable in an infinity of equally valid alternative frames of reference, led him to rethink contemporary analysis. The required mathematics that his principle dictated was the underpinning of his TDS theory and impacts contemporary physical thought in general. His great love of acoustics allowed him to use his theory to derive measurable quantities which verified his concepts. The validity of the concepts are being attested to at the most practical level by the growing number of people who are using commercial products based on TDS.

On a personal note, Dick Heyser was a Renaissance Man in my eyes. He was a boy genius until the day he died. He questioned everything, had to understand everything, and knew so much about everything. He delighted all those who surrounded him by his ingeniousness, his ingenuity, his kindness, and his modesty.

Illustrative of the man is this story he told me, two weeks before he died, of one of his earliest memories. He recalled being an infant in a pram which had a little window in the hood and looking out through the hood at a car passing on the street. The car had spoke wheels. He remembered wondering which direction the spokes were turning as the wheel rotated.

Richard Heyser questioned everything and answered many of the questions that we mere mortals didn't have the sense to ask in the first place.

There are multitudes of other images that developed as he worked with the JPL staff, assisting and consulting with almost every group or division, the Navy in ocean probes and the medical profession with diagnostic research with ultrasound TDS. Dick was always searching for truth and knowledge and sharing it willingly with all who would listen and learn.

Dick's faith was profoundly stated in these words: "There is an is!" He lived his spiritual depth and strengths in every relationship, looking always for the good in others, caring for others in stress or illness, serving as a source of love and concern to any who sought it or might need it.

His relationship with his parents and wife Amy also illustrates this. We sense the deep bonds of love they shared.

Let us all be aware that our heritage is so much richer and deeper because Dick lived and gave so freely of himself. Forgive us that we were not able to capture more of what he would have shared with us. We can now only honor his memory. Our words would honor him poorly if we do not renew our sense of dedication to those philosophic and spiritual values which he shared. Amen.

WE DELIVER.

302570. Mussorgsky: Pictures At An Exhibition; Ravel: La Valse—Mehta, cond. (CBS Masterworks)

337279. Placido Domingo—Save Your Nights For Me. Love songs. (CBS)

328740. Mozart: Piano Concerto No. 26 (Coronation); Rondos—Murray Perahia, English Chamber Orchestra. (Digital—CBS Masterworks)

336396-396390. Billy Joel's Greatest Hits, Vol. 1 & 2. (Columbia)

337659. U2—The Unforgettable Fire (Island)

324822. Ravel: Bolero; La Valse; Rhapsodie Espagnole—Maazel, cond. (Digital—CBS Masterworks)

349324. South Pacific. K. Te Kanawa, J. Carreras, etc. (Digital—CBS)

348458. Dvorak: Cello Concerto—Yo-Yo Ma; Maazel, London Philharm. (Digital—CBS Masterworks)

347955. Huey Lewis & The News—Fore! (Chrysalis)

347153. Cyndi Lauper—True Colors. (Portrait)

347039. Billy Idol—Whiplash Smile. (Chrysalis)

346643. Andreas Vollenweider—Down To The Moon. (CBS)

346478. Madonna—True Blue. (Sire)

349985. Johnny Mathis/Henry Mancini—The Hollywood Musicals (Columbia)

348979. Tina Turner—Break Every Rule (Capitol)

343319. Janet Jackson—Control (A&M)

326629. Bruce Springsteen—Born In The U.S.A. (Columbia)

319541. Elton John—Greatest Hits. (MCA)

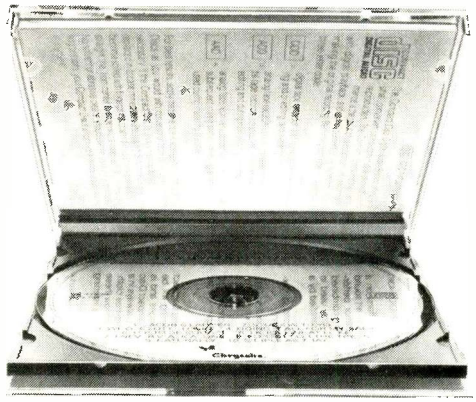
343715. Vivaldi—Four Seasons. Maazel, members Orch. National de France (Digital—CBS Masterworks)

340323. Sade—Promise. (Portrait)

342105. Bangles—Different Light. (Columbia)

335547. Berlioz: Symphonie Fantastique—Barenboim, Berlin Phil. (Digital—CBS Masterworks)

347492. Glenn Miller Orchestra—In The Digital Mood. (Digital—GRP)



348110. Buddy Holly—From The Original Master Tapes. (Digitally Remastered—MCA)

341305. Robert Palmer—Riptide (Island)

349308. Bronford Marsalis—Royal Garden Blues. (Columbia)

353516. George Howard—A Nice Place To Be. (MCA)

353458. Bruce Willis—The Return of Bruno. (Motown)

353250. George Strait—Ocean Front Property. (Digital—MCA)

353045. Miles Davis—Kind Of Blue. (Digitally Remastered—Columbia)

352245. David Sonborn—A Change Of Heart. (Warner Bros.)

351718. Georgia Satellites. (Elektra)

351692. Beastie Boys—Licensed To Ill. (Def Jam/Columbia)

351338. Eric Clapton—August. (Duck/Warner Bros.)

351122. Europe—The Final Countdown. (Epic)

350140. Pretenders—Get Close. (Sire)

348318. The Police—Every Breath You Take—The Singles. (A&M)

348094. Original Soundtrack—Stand By Me. (Atlantic)

346544. Kenny G—Duotones. (Arista)

346312. Billy Joel—The Bridge. (Digital—Columbia)

344721. Lionel Richie—Dancing On The Ceiling. (Motown)

331264. Bryan Adams—Reckless. (A&M)

314997-394999. Stevie Wonder's Original Musiquariam 1. (Tamla)

348987-398982. Linda Ronstadt—'Round Midnight (Asylum)

353771. Bolling/Rampal: Suite No. 2 for Flute & Jazz Piano Trio. (Digital—CBS)

353789. Sly & The Family Stone's Greatest Hits. (Epic)

246868. Jim Croce—Photographs And Memories—His Greatest Hits. (Saja)

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293597. Led Zeppelin—Houses Of The Holy. (Atlantic)

350736. Rolling Stones—Rewind. (Rolling Stones Records)

339044. Mozart: Symphony No. 40 & 41 (Jupiter)—Kubelik, Bavarian Symphony Orch (Digital—CBS Masterworks)

319996-399998. Motown's 25 #1 Hits From 25 Years. (Motown)

291278. The Doobie Brothers—Best of the Doobies. (Warner Bros.)

273409. Horowitz Plays Favorite Beethoven Sonatas: Appassionata, Pathetique, Moonlight. (CBS Masterworks)

334391. Whitney Houston. (Arista)

333286. Phil Collins—No Jocket Required. (Atlantic)

314443. Neil Diamond's 12 Greatest Hits, Vol. 2. (Columbia)

349373. Beethoven: Symphony No. 9 (Choral)—Bernstein, NY Phil (CBS Masterworks)

343582. Van Halen—5150. (Warner Bros.)

339226. Gershwin: Rhapsody In Blue; Second Rhapsody; etc.—M. Tilson Thomas, Los Angeles Phil. (Digital—CBS Masterworks)

349571. Boston—Third Stage (MCA)

342097. Barbra Streisand—The Broadway Album. (Columbia)

345827. Bob James and David Sanborn—Double Vision. (Warner Bros.)

343095. Philip Glass—Songs From Liquid Days. (CBS)

219477. Simon & Garfunkel's Greatest Hits. (Columbia)

316604. Tchaikovsky: 1812 Overture; Marche Slave; Beethoven: Wellington's Victory—Maazel, Vienna Philharm. (Digital—CBS Masterworks)

287003. Eagles—Their Greatest Hits 1971-1975. (Asylum)

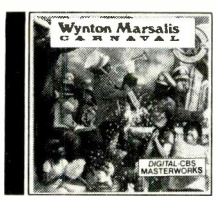
321570. Beethoven: Symphony No. 5; Schubert: Symphony No. 8. (Unfinished)—Maazel, Vienna Philharm. (Digital—CBS Masterworks)

336222. Dire Straits—Brothers In Arms. (Warner Bros.)

348649. The Pachelbel Canon And Other Digital Delights. The Toronto Chamber Orchestra. (Digital—Fanfare)

341073. Steely Dan—A Decade of Steely Dan. (MCA)

308049. Creedence Clearwater Revival Featuring John Fogerty/Chronicle. 20 greotest hits. (Fantasy)



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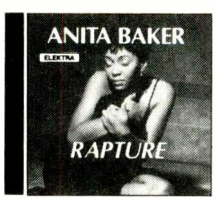

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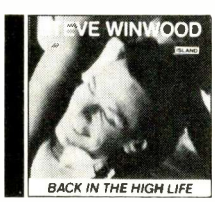

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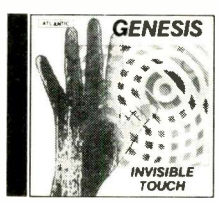

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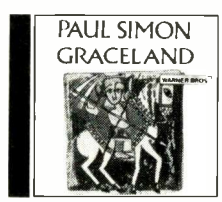

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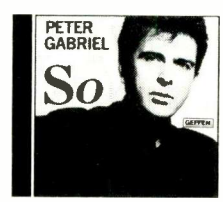

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B93/C3

TAPE GUIDE

HERMAN BURSTEIN

Cassette Life

Q. I am interested in buying prerecorded cassettes rather than their LP counterparts. Assuming they are both well cared for, which medium will provide more plays before sound begins to deteriorate?—Robert Peterson, Oakland, Cal.

A. Generally, the cassette medium will provide more plays than phono discs before deterioration becomes noticeable. A good, well-cared-for cassette should be able to go through at least 500 plays satisfactorily. I am assuming that "well cared for," in the case of cassettes, includes appropriate cleaning and demagnetization of heads and the use of a deck with a well-engineered transport mechanism.

VCRs for High Fidelity

Q. What is your opinion of Hi-Fi VCRs as audio *gear? Do they beat open-reel decks for sound quality, as some manufacturers claim?*—Doug Freese, Thornton, Colo.

A. My understanding is that Hi-Fi VCRs, both Beta and VHS, are capable of excellent audio recording in all basic respects—frequency response, noise, distortion, and accuracy and steadiness of motion. They tend to outperform open-reel decks.

As with anything you buy, be sure that you first listen to whatever unit you are considering. Judge with your own ears how the quality of Hi-Fi VCRs compares with open-reel decks. And compare features.

(*Editor's Note:* Hi-Fi VCRs do live up to their billing but are very sensitive to tape dropouts. To ensure good performance, follow your VCR maker's recommendations for head cleaning, and use fresh, high-quality tapes for your recordings. Do not use such VCR special features as stop-motion and visible search on tapes intended for Hi-Fi audio use, as these features increase tape wear and dropouts.—*I.B.*)

Automatic Adjustments

Q. I have been reading with great interest about cassette decks with automatic adjustment of bias and equalization before recording, and about decks having dynamic bias adjustment during recording (HX Pro). Which system do you think would give the best results in such respects as frequency response, signal-to-noise ratio, and distortion?—James A. Hawk, Oak Ridge, Tenn.

A. Decks with automatic recording adjustments seek to optimize bias and record equalization (treble boost). They also optimize recording level to match the sensitivity of the tape being used so that Dolby noise reduction will work properly. Dolby NR requires proper tracking—that is, equal input levels and tape output levels—in order to maintain flat treble response. Proper adjustment of bias and record equalization serves to ensure flat response and low distortion.

The chief advantage of a deck with HX Pro is that it guards against treble losses caused by the signal's contribution to the total bias. The treble content of the audio signal is used as part of the required bias: as treble content increases, the amount of bias current is decreased so that total bias remains constant. The reduction in oscillator bias means less bias erase and therefore less treble loss. It also means that the bias level always matches the signal's immediate requirements.

We don't have a case of either/or here. It is possible to have both automatic set-up adjustments and HX Pro, and thus the advantages of each. Let me add that automatic adjustment serves to widen one's choice of tapes, in addition to achieving good performance.

Interchanging Dolby B and C Noise Reduction

Q. My home cassette deck has Dolby C NR. My car deck only has Dolby B NR. What can I do to get optimum sound in my car without re-recording my Dolby C tapes to Dolby B?—Eran Schreiber, Great Neck, N.Y.

A. If you use Dolby B NR to play tapes recorded with Dolby C, the result will be a moderate emphasis of the midrange and treble. This may or may not be objectionable. It might conceivably even be desirable if you find that your car's system needs midrange and treble boost. If it *is* objectionable, and if your car audio system includes tone controls (what self-respecting system doesn't, today?), a slight downward turn of the treble and perhaps a slight upward turn of the bass should essentially rectify matters.

Evaluating C-120s

The November "Tape Guide" invited readers' reactions on the subject of C-120 performance, and several have taken the trouble to respond.

Most of these readers feel there is fairly little sonic difference between C-120 and shorter lengths of the same tape formulation. Thomas C. Shedd of Wilmette, Ill. feels that "the sound quality of C-120s is not quite up to that of comparable C-90s." However, John M. Kaar of Menlo Park, Cal. notes only that he has found C-120s to have somewhat less headroom than shorter tapes. Surprisingly, he has not found print-through more troublesome with the longer tapes.

Robert F. Drake of Ashland, Wisc. points out that the better tape formulations are hard to find in this length. The C-120 tapes listed in *Audio*'s 1986 Equipment Directory are all Type I formulations, with the exception of BASF's Metal IV. Mr. Drake indicates that TDK AD (a premium Type I) is available in Japan as a C-120.

As to reliability, two readers (Charles M. Romahn of Greenwood Lake, N.Y. and Edward J. Stephens of Muskegon, Mich.) have had no special problems, though Mr. Shedd says that in his experience this is only the case with the better tape brands. And Mr. Drake finds C-120s to be a bit more fragile.

Mr. Drake also feels that European decks do better with the thin C-120 tapes than those from elsewhere, perhaps because this tape length is more popular on the Continent. And according to Mr. Kaar, it's vital to keep the torque of one's cassette drives as close as possible to 50 grams/cm, and certainly between 40 and 60 grams/cm, or even C-60s may cause trouble.

Tape tangles, when they do occur, are not necessarily disastrous. Mr. Kaar adds that when the tape does "wrap around the capstan for no apparent reason," it can be "untangled, its wrinkles smoothed out, and [the tape] put back in the shell and even played in the same deck with no further trouble."

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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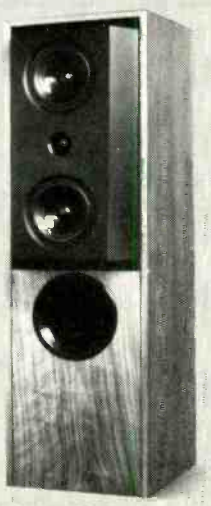

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KEF Electronics of America Inc., 14120-K Sullyfield Circle, Chantilly, VA 22021

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The low-frequency droop associated with dbx NR is not audible with most speakers, to most people, on most occasions.

Bias "Tuning"

Q. My deck has a "bias tune" knob. When is this to be used? What is the effect of cutting or boosting bias?—Victor Caranante, Dix Hills, N.Y.

A. Bias current is supplied to the record head, along with the audio signal, in order to minimize distortion and maximize the amount of signal recorded on the tape. For each kind of tape, and for each brand, there is an optimum amount of bias current that achieves suitable low distortion, high recorded level, and good treble response. An increase in bias above the optimum reduces treble response, while a decrease exaggerates it.

The purpose of the "bias tune" knob is to permit the user to make a fine adjustment of bias so as to achieve flattest possible high-frequency response, as judged by ear. If you have a good ear, and if your deck has three heads (permitting simultaneous recording and monitoring), you can adjust bias while recording and listening to musical program material that contains substantial high-frequency content. An even better way is to use FM interstation noise and adjust bias so that tape playback sounds as much as possible like the source.

Using FM interstation noise as a test signal is especially helpful if you have a two-head deck. You can't play a recording made on such a deck until after you've rewound it. Therefore, comparing the source with the recording is much simpler if the source is a relatively constant signal, such as interstation noise, than if it changes constantly, as music does.

With either type of deck, simply switch between the noise as heard directly from your tuner and as heard in tape playback, and try the effects of slight increases or decreases of bias while you record. With a three-head deck, you can hear the effects of each bias change almost immediately after making it. With a two-head deck, you must go through several trials—record, rewind, play—until you find the bias setting which yields flattest response, as indicated by the closest similarity between the source and the tape playback.

Use an indicated recording level of −20 dB for these tests. Recording at zero level would give misleading results, as high-frequency response would be reduced by tape saturation.

Droop with dbx NR

Q. In the March 1986 issue of Audio, a review of the Yamaha K-1020 cassette deck noted that when using dbx noise reduction, there was a low-frequency roll-off and that this was true not only for the Yamaha. I have an outboard dbx 224 noise-reduction unit connected to a pretty fair open-reel deck. Can I expect the same low-frequency roll-off? The reviewer said he missed the deep bass in some LPs; I can't remember any noticeable bass attenuation in my system.—Mike Marino, Hagerstown, Md.

A. So far as I know, the low-frequency droop is characteristic of dbx NR rather than the tape deck it's used with. However, the droop is not very serious and is inaudible on most occasions, with most speakers, and to most persons. The droop is only about 3 dB at 40 Hz and something like 5 dB at 30 Hz. This is easily touched up with an equalizer or with a bass control.

There is also a treble droop with dbx NR, but this gets serious only beyond 15 kHz. Many audio sources and many adults' hearing do not extend this far.

Taping Compact Discs

Q. Using high-quality ferricobalt cassettes, can the wide dynamic range of Compact Discs be successfully taped with Dolby C and dbx NR?—H. Lilienfeld, Umkomaas, Republic of South Africa

A. The noise floor and highest recordable signal level on CD are usually 90 dB or so, more than can usually be recorded on cassette, except perhaps with dbx NR. However, the dynamic range of the *music* on CD is usually no greater than 70 dB. Today's cassette decks, using good tapes, have signal-to-noise ratios of 70 dB or greater with Dolby C NR, and 80 dB or greater with dbx NR. Accordingly, it would appear that full-range Compact Discs can be successfully copied by decks with Dolby C and/or dbx NR—even by decks having only Dolby B NR, if the music's dynamic range is smaller (as it often is). The only limitations would be a higher noise floor and some compression of high-frequency peaks, due to tape saturation.

'We didn't design our speaker with only one bass response, because we didn't design your listening room.'

—Ric Cecconi, KEF SENIOR DEVELOPMENT ENGINEER

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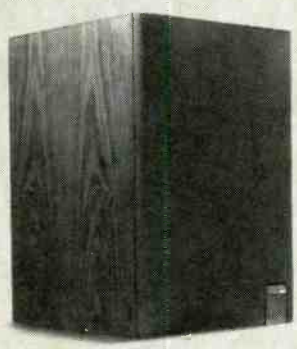

REFERENCE MODEL 102

KEF
The Speaker Engineers

KEF Electronics Ltd., Tovil, Maidstone, Kent ME15 6QP, England
KEF Electronics of America Inc., 14120-K Sullyfield Circle, Chantilly, VA 22021 703/631-8810
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AUDIOCLINIC

JOSEPH GIOVANELLI

Stylus Velocity

Q. What is meant by "stylus velocity in cm/S"?—June E. Thomas, Wantagh, N.Y.

A. When a phonograph record is played, the stylus is in constant side-to-side motion as it traces the groove walls. Its speed (which varies with the signal being traced) is expressed in centimeters per second. This number is most often used to define a cartridge's output level, which will vary with the stylus velocity. It is sometimes also used to define the cartridge's ability to track high-velocity modulations.

Amps for Musical Instruments

Q. Which high-end amplifiers/preamplifiers are suitable for use with electronic musical instruments for live performance? Should I use dual-monophonic equipment, or is stereophonic equipment more suitable? I do want stereo during these performances. I would also appreciate your advice concerning the selection of loudspeaker systems.—David Chetkin, Newport Beach, Cal.

A. Many amplifiers used in conjunction with musical instruments perform other functions besides amplification: Reverb, vibrato, fuzz, sustain, equalization, et al. Most also offer mixing capabilities. If what you need is just amplification, any amplifier will provide it. Depending upon the size of the rooms in which you perform and upon the acoustical efficiency of the loudspeakers you use, amplifier output power may have to be considerable.

If you have selected your amplifier but still require the various effects I've mentioned, you will want to use a "top" or "head," a control center analogous to a hi-fi preamp (or, sometimes, to an integrated amp) but containing the inputs and many of the control features that a musician is likely to need. Just be sure that it does include the particular features you require.

I can't see how it matters whether or not you use separate monophonic amplifiers or stereophonic amps. If the amplifiers are to supply high power but have poorly regulated power supplies, you should consider separate, monophonic equipment or perhaps stereo equipment operated in the bridged mode (and hence in mono).

I am sure you realize that there are some very fine mixing boards around which also provide amplification, along with (at the very least) equalization and reverb. I have not seen one which directly incorporates vibrato, fuzz, or sustain (although such a board may exist). I have seen at least one with built-in rhythm synthesizers too.

Even if you do not find quite all of the features you need in either a "top" or a mixing board, you may be able to find accessory boxes to supply the features that you're missing. If you need fuzz, you can find fuzz boxes to produce it. If you need sustain or vibrato, there are some nice boxes which produce these effects. If your inputs lack sufficient voltage gain for your instrument, you might try plugging in "power boosters" (actually, 1-transistor voltage amplifiers) between your instrument and your input.

Much of the sound character of electronic musical instruments is a matter of the coloration occurring in the loudspeaker systems used. Thus, loudspeaker selection, although critical, must be left to you.

Speaker Switches and Protective Relays

I recently read the letter from reader J. T. Satterwhite ("Audioclinic," June 1986), wherein he describes intermittent loss of audio output from his receiver when it is played at low volume levels. I'd like to suggest an overlooked point, the protection relay. Oxidation or corrosion of the relay contacts, accelerated by "hot-switching" the relay, can lead to distortion or to dropouts in either or both channels.

Oxidation can be cleaned from the contacts by careful disassembly of the relay, followed by the use of a good contact cleaner (such as Cramolin). Corrosion of these contacts requires replacement of the relay. If one chooses to attempt cleaning the relay contacts, it cannot be said too emphatically: Be careful! When removing the plastic shield, watch the coil. In applying the contact cleaner, do not bend the contact supports. When replacing the shield, do not break any wires. If you are uncomfortable doing any of this, don't do it—you can always just replace the relays. Replacements are not too expensive and can save lots of time and frustration!

Another set of contacts which is prone to failure by "hot-switching" is the speaker selector switch. Switching from "speakers off" to "A" to "B" with the volume turned up can produce the same contact wear which relay contacts are subjected to. My advice is: Prior to turn-on, adjust volume to zero. Turn the system on and wait for the relay to close. Then turn up the volume. Prior to turn-off, turn the volume down to zero, then kill power. When switching speakers, turn volume down, switch, then turn volume up.

These procedures should keep the equipment in its owner's home rather than in the local repair shop.—Mark D. Pagan, Laurel, Md.

Hum in TV Audio

Q. I hear a hum in my audio system when attempting to feed the output from my television set into it. Can you help?—Pat Yacques, Dallas, Tex.

A. I can think of a number of possible reasons why hum may be heard when feeding the output from a television receiver into your sound system.

If your TV set only has an earphone output and you are using that to feed signal into your system, there is a chance of hum, especially when the volume control on the TV set is turned to a relatively low setting. This will permit the inherent background noise and hum in the audio of the TV set to assume a greater amplitude, in proportion to the desired signal, than it will if the volume control is advanced.

Care must be taken to avoid overloading your main system or at least injecting so much signal as to make the volume of the main system difficult to adjust.

Assuming that your set has a "line output," I have had problems when such sets are connected to cable TV systems. I believe the problem is a result of ground loops. This occurs because the true ground source for the cable signals is physically distant from my main ground point, causing a serious difference in potential between the two grounds. If I am correct, what is

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

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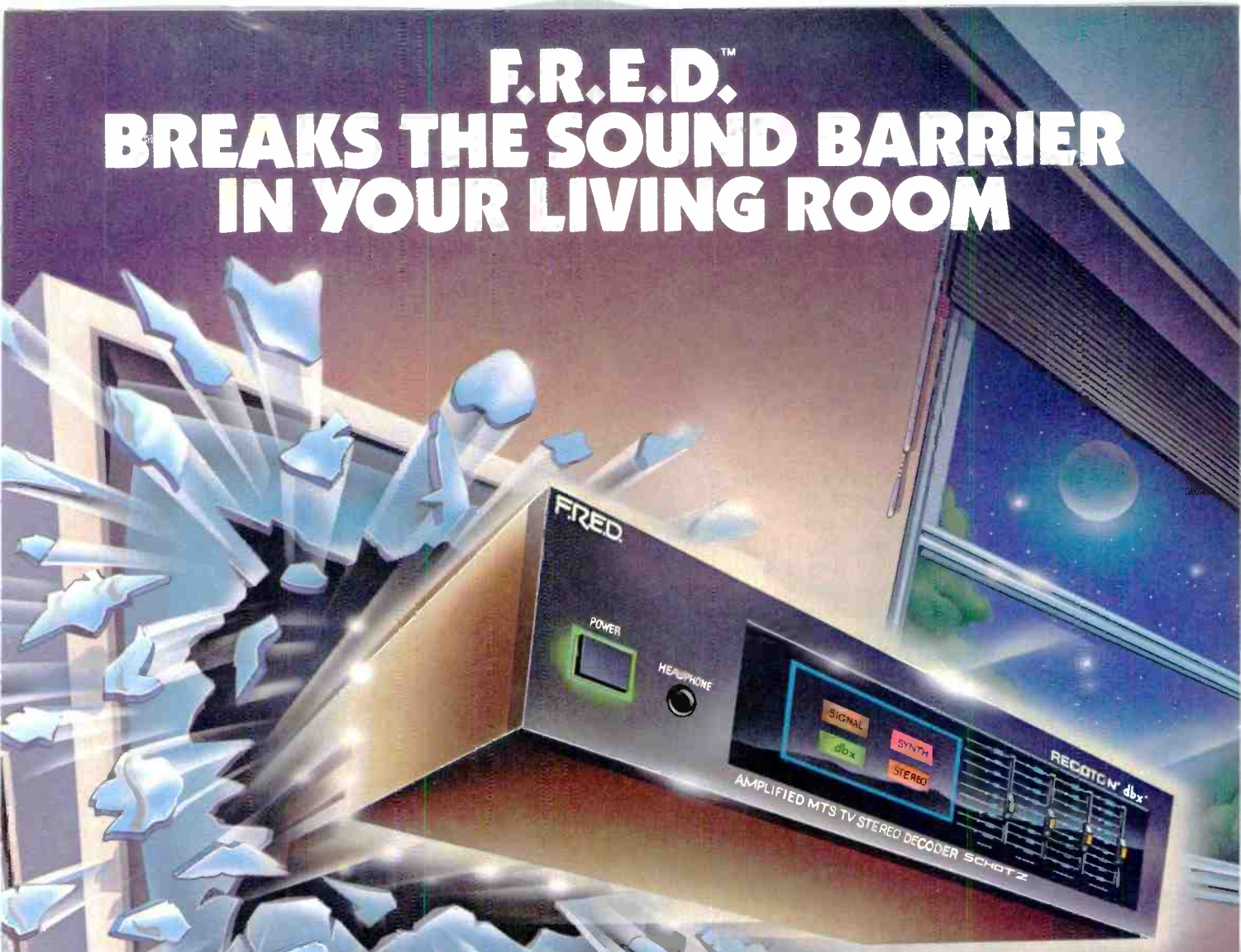

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When a power amplifier produces a buzz, fast switching of its rectifier is usually the culprit.

needed is an r.f. isolation transformer to isolate the cable ground from the rest of the audio system. I have not been able to locate such a transformer (75/300-ohm baluns are usually not isolated). Can any of you help?

Another possible source of hum may be that your TV set employs "intercarrier mixing" to derive its audio i.f. Your TV set needs very good limiting in such instances to avoid video buzz and hum from being heard in the audio output. It is much better if the set maker provides separate sound i.f. circuitry, starting from the output of the tuner, but this approach is more expensive. Intercarrier buzz can be distinguished from other noise problems because it changes with the video picture; it is usually most noticeable when the screen is white or full of white lettering against a colored background. If this is your problem, you may be able to improve matters by increasing the signal strength to the TV's tuner (perhaps by using an antenna booster amp) to saturate the limiter.

Ordinary ground loops are another consideration. These can occur via the signal cables, through the use of three-prong grounded plugs on both your TV set and sound system, or from other causes. Try disconnecting the signal cable's shield where it plugs into one channel of your amplifier (the ground should only be disconnected at one end of any cable). If that does not solve the problem, disconnecting the shield on the other channel may help (or may cause total loss of signal until you reconnect it).

Contact-Cleaner Testimonial

In response to the November 1986 "Audioclinic" item entitled "Dirty Contacts in a Dry Climate," I offer the following recommendation based on a similar experience.

After trying virtually every contact cleaner on the market, I have found the best result with a product which is called Cramolin, available from Caig Laboratories, 1175-O Industrial Ave. (P.O. Box J), Escondito, Cal. 92025; (619) 743-7143.

I am an engineer at a sound-recording studio in Southern California. As such, I am responsible for maintaining all audio equipment (mixing consoles, tape decks, etc.), and it used to be necessary for me to clean "dirty" potentiometers and switches every month or so. After switching to Cramolin, I have found that I now only need to clean these components once a year, and in some cases one application has been sufficient. According to the label, besides cleaning, Cramolin acts as a lubricant and preservative.—J. D. Stein, San Diego, Cal.

Buzz and Static

Q. What can I do to eliminate buzz and static, which I think comes from my amplifier?—Eric Nelson, Landisville, Pa.

A. If you hear this buzz and static only when listening to certain signal sources, your amplifier is probably not the cause. Rather, it is more likely to be in the signal source or in the cables between the source and the amplifier.

If you hear the noise only when listening to AM or FM, a better antenna might help. If you hear it only when listening to records, then you probably have an open ground connection somewhere; most likely, the ground lead that should run from the turntable or tonearm to a grounding point on the amplifier has become detached.

Both AM and (to a lesser extent) FM tuners are also prone to picking up interference from various sources, including TV sets, home computers, and household appliances. If this is your problem, physically separating the tuner and/or the antenna as far as possible from the noise source is the only solution, but it usually works well.

It is difficult, however, to cure the "buzz" produced by a TV set. Sometimes good power-line filters will help. At least they can keep these signals from getting onto the power lines, which would then act as a good antenna to radiate the undesired signals.

Where a power amplifier produces buzz, it is usually a matter of the fast switching of the rectifier. If individual diodes are used, bypass each one with a capacitor rated at about 0.02 μF, with a d.c. breakdown voltage well above that produced by the power supply. In the case of a bridge rectifier "package," about all you can do is to place a bypass capacitor across the input to the bridge and another across its output. You might also bypass each input lead to the chassis.

Signal Level from CD Players

Q. Should the output level from a Compact Disc player match the line input sensitivity of the preamplifier into which it is plugged? My player has a rated output of 2 V rms. The input sensitivity of the AUX jack of my preamplifier is 50 mV. I have seen ads for input attenuators to be used with sources having too high an output signal level; they are claimed to lower input overload distortion. Are they a luxury or a necessity? What are the symptoms of "overload distortion"? Wouldn't an attenuator introduce distortion?—Bernard Gilman, Brookline, Mass.

A. The need for matching a CD player's output level to the input sensitivity of the equipment into which it feeds depends on a couple of things. Some equipment is designed so that the input signals feed directly into the volume controls. Under these conditions, high-level signals are attenuated by virtue of the volume control's setting. No distortion results because no early stages are overloaded.

However, this leaves the possibility that turning the volume control up even slightly past its minimum setting will produce a high sound level from the loudspeakers. This leaves the listener with only a very small adjustment range between near silence and a deafening roar when listening to CDs. It also means the volume control will have to be readjusted substantially when switching between CDs and other sources—and if the volume is not turned down before CDs are played, there can be damage to the loudspeakers or even to one's hearing.

If there are gain stages between the input and the volume control, these stages can often be overdriven by signals of higher amplitude than they were designed for.

In either case, I recommend that you do use an attenuator. Because it is nothing more than a voltage divider, it will not add distortion.

It is difficult to describe symptoms of overload distortion. Perhaps the best description is that it sounds like what you hear when you put too much signal onto a tape. Naturally, the distortion will only occur on peak music amplitudes, which is one reason it might be difficult to detect by some ears and with some equipment.

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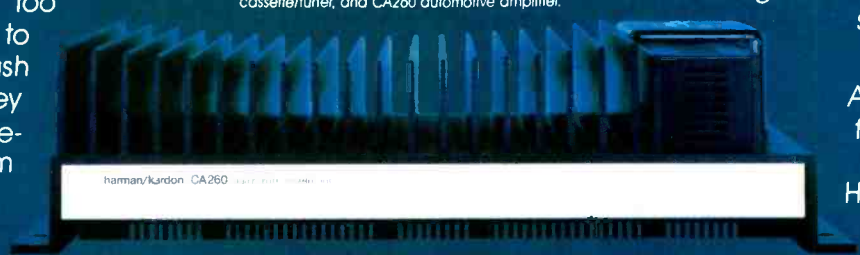

Shown: The new CH161 DIN-mount in-dash cassette/tuner, and CA260 automotive amplifier.

Our competitors must feel that High instantaneous Current Capability, Low Negative Feedback and discrete componentry constitute "too much performance" in automotive amplifiers. All of our mobile amps, from the 3.5 Watt/channel CA205 to the 60 Watt/channel CA260, are "over designed" to include these superior design criteria.

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SDA SRS 2
$895 ea.

Digital Disc Ready

Matthew Polk's SDA SRS and SRS 2 have both won the prestigious AudioVideo Grand Prix Speaker of the Year Award.

"The Genius of Matthew Polk Has Created Two Awesome Sounding Grand Prix Award Winning SDA SRSs"

"Spectacular...it is quite an experience"

Stereo Review Magazine

Now the genius of Matthew Polk brings you the awesome sonic performance of the SDA-SRS in a smaller, more moderately priced, but no less extraordinary loudspeaker, the SDA-SRS 2.

Matthew Polk's own dream speakers can now be yours!

Matthew Polk's ultimate dream loudspeaker, the SDA-SRS, won the prestigious Audio Video Grand Prix Speaker of the Year award last year. Stereo Review said "Spectacular...it is quite an experience" and also stated that the SRS was probably the most impressive new speaker at the 1985 Consumer Electronics Show. Thousands of man hours and hundreds of thousands of dollars were spent to produce this ultimate loudspeaker for discerning listeners who seek the absolute state-of-the-art in musical and sonic reproduction.

Matthew Polk has, during the last year, continued to push his creative genius to the limit in order to develop a smaller, more moderately priced Signature Edition SDA incorporating virtually all of the innovations and design features of the SRS without significantly compromising its awesome sonic performance. The extraordinary new SRS 2 is the spectacularly successful result. Music lovers who are privileged to own a pair of either model will share Matthew Polk's pride every time they sit down and enjoy the unparalleled experience of listening to their favorite music through these extraordinary loudspeakers, or when they demonstrate them to their admiring friends.

"Exceptional performance no matter how you look at it"

Stereo Review

Listening to any Polk True Stereo SDA* is a remarkable experience. Listening to either of the Signature Edition SDAs is an awesome revelation. Their extraordinarily lifelike three-dimensional imaging surrounds the listener in 360° panorama of sonic splendor. The awe inspiring bass performance and dynamic range will astound you. Their high definition clarity allows you to hear every detail of the original musical performance; while their exceptionally smooth, natural, low distortion reproduction encourages you to totally indulge and immerse yourself in your favorite recordings for hours on end.

Julian Hirsch of Stereo Review summed it up well in his rave review of the SDA-SRS: "The composite frequency response was exceptional ...The SDA system works...The effect can be quite spectacular...We heard the sound to our sides, a full 90° away from the speakers...As good as the SDA feature is, we were even more impressed by the overall quality of the Polk SDA-SRS....The sound is superbly balanced and totally effortless...Exceptional low bass. We have never measured a low bass distortion level as low as that of the SDA-SRS...It is quite an experience! Furthermore, it is not necessary to play the music loud to enjoy the tactile qualities of deep bass...Exceptional performance no matter how you look at it."

The awe-inspiring sonic performance of the SDA-SRS 2 is remarkably similar to that of the SRS. Words alone can not express the experience of listening to these ultimate loudspeaker systems. You simply must hear them for yourself!

"Literally a new dimension in sound"

Stereo Review

Both the SDA-SRS and the SDA-SRS 2 are high efficiency systems of awesome dynamic range and bass capabilities. They both incorporate Polk's patented SDA True Stereo technology which reproduces music with a precise, life-like three dimensional soundstage which is unequalled and gives you, as Julian Hirsch of Stereo Review said, "literally a new dimension in sound". Each beautifully styled and finished SRS 2 cabinet contains 4 Polk 6½" trilaminate polymer drivers, a planar 15" sub-bass radiator, 2 Polk 1" silver-coil polyamide dome tweeters and a complex, sophisticated isophase crossover system. It is rated to handle 750 watts. The SRS utilizes 8-6½" drivers, a 15" sub-bass radiator, 4 Polk tweeters and an even more complex crossover. It is rated to handle 1000 watts.

Both the SDA-SRS and SRS 2 incorporate: 1.) time compensated, phase-coherent multiple driver vertical line-source topology for greater clarity, increased coherency, lower distortion, higher power handling, increased dynamic range and more accurate imaging. 2.) a monocoque cabinet with elaborate bracing and MDF baffle for lower cabinet read-out and lower coloration. 3.) progressive variation of the high frequency high-pass circuitry for point-source operation and wide vertical dispersion. 4.) the use of small active drivers in a full complement sub-bass drive configuration coupled to a large 15" sub-bass radiator for extraordinarily tight, quick and three-dimensional mid and upper bass detail combined with low and sub-bass capabilities which are exceptional. The speakers are beautifully finished in oiled oak and walnut.

"Literally a new dimension in the sound"

Stereo Review Magazine

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"Our advice is not to buy speakers until you've heard the Polks"

Musician Magazine

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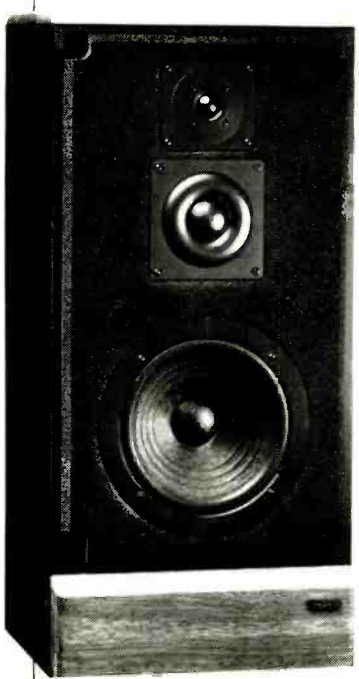
*U.S. Patent No. 4,489, 432 and 4,497, 064. Other patents pending.

Where to buy Polk Speakers? For your nearest dealer, see page 160.

Advent Loudspeaker

Advent's largest speaker, the three-way Maestro, includes a 10-inch woofer, a 1-inch dome tweeter, and a midrange driver of a new wide-dispersion, dual-profile design. At higher frequencies, the midrange driver's central dome becomes partially decoupled from the ring surrounding it. This improves dispersion by providing a smaller radiating area for shorter wavelengths. To reduce diffraction, the baffle is covered in foam and the grille frame is recessed. The cabinet measures 33¼ in. H × 16 in. W × 9¾ in. D. Price: $649.95 per pair.
For literature, circle No. 100



Audio Control Car-Stereo Bass Enhancer

Like Audio Control's Phase Coupled Activator for home systems, the Epicenter detects traces of rolled-off bass fundamentals and digitally reconstructs them for added bass impact in car-stereo systems. The Epicenter also includes a 36-dB/octave subsonic filter. The main unit is installed in the trunk or elsewhere, leaving only the small control unit to be placed in or under the dash. Price: $179.
For literature, circle No. 101

DB Systems Preamplifier

Optimized for line-level use, DB Systems' DB-1A-HL preamplifier has five high-level inputs instead of the one phono and four high-level inputs of the DB-1A. Options include a tight-tracking, low-noise volume control, gold-plated jacks, and a solid oak cabinet with a faceplate 10½ inches wide. Price: $375 with DB-2A power supply.
For literature, circle No. 102

Sony Home CD Changer

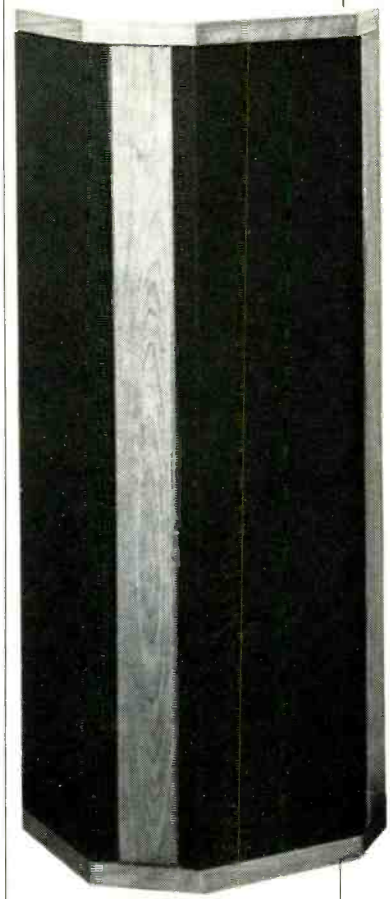
The CDP-C10 uses the same 10-disc magazines as Sony's DiscJockey CD changer for the car, thus eliminating the need to unload magazines when transferring discs from home to auto or vice versa. Features of the home unit include wireless remote control, multi-mode repeat, and digital filtering. A single-clock design reduces spurious noise. An error-detection system freezes the movement of the laser pickup when the signal is lost, for faster recovery from tracking errors due to damaged or defective discs. Price: $800; extra magazines, $29.95 each.
For literature, circle No. 103

Alphasonik Car-Stereo Amplifier

A Class-A design, the MA-2100 is rated at 100 watts per channel into 4 or 2 ohms; bridged for monophonic use, it can deliver 200 watts into a 4- or 8-ohm speaker. Both low-level and high-level inputs are provided, with continuously variable input sensitivity. Price: $395.
For literature, circle No. 104

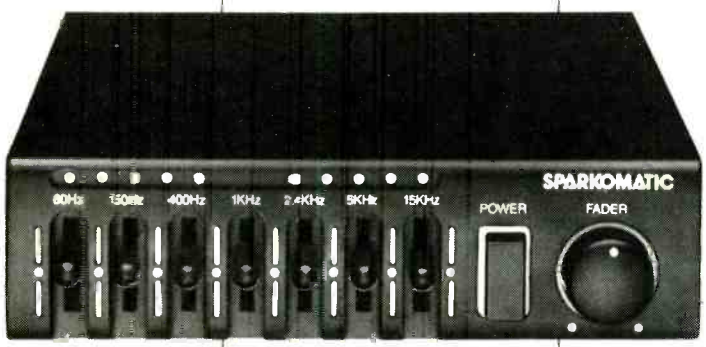
CBS Test Records

Five new LP test records, the CTC Professional Series, replace the well-known CBS STR Technical Series discs. The CTC-300 Phonograph Test Record can be used for measuring frequency response, crosstalk, resonance, polarity, compliance, and tracking ability of a phono cartridge. The CTC-330 Studio Test Record provides tests for sensitivity, frequency response, separation, phase, and turntable speed. Also available are the CTC-340 Acoustical Test Record (for measuring system performance, including speakers), the CTC-350 Turntable and Tone Arm Test Record, and the CTC-310 Distortion Test Record. Price: $30 each.
For literature, circle No. 106



Allison Loudspeaker

The Model IC 20 speaker system's imaging is adjustable by wireless remote control. The two 10-inch woofers are placed near the floor, to avoid room-boundary problems, and are wired in push-pull (one woofer faces into the cabinet while the other faces out) for lower distortion. The four 3½-inch midrange drivers and four 1-inch tweeters are placed in line arrays, to minimize floor and ceiling reflections. Recommended amplifier power range is 30 to 400 watts per channel; low-frequency performance is specified as 28.5 Hz for −3 dB, 23.5 Hz for −6 dB. Price: $4,900 per pair.
For literature, circle No. 107



Sparkomatic Car Equalizer/Booster

Unusual styling marks the SBE7, a seven-band graphic equalizer with built-in power booster delivering 25 watts per channel at 1% THD. Its features include night illumination, LED output-level indicators for each band, and a front/rear fader. Price: $44.95.
For literature, circle No. 105

BERT WHYTE

SWELL CELLS

Laurence Dickie, inventor of the Matrix enclosure.

Last month, in *Audio*'s 40th anniversary issue, I pointed out that in the early days of hi-fi, some of us built massive loudspeaker enclosures with sand-filled panels that weighed more than 600 pounds. Others constructed speaker baffles with bricks and mortar! All of these extreme measures were undertaken to suppress and attenuate the boomy resonances produced by large, undamped enclosure panels. Back in those days of monophonic sound reproduction, in spite of our relatively primitive equipment, we could easily perceive that enclosure resonances greatly degraded music signals. As the hi-fi business grew, complete speaker systems with furniture finishes were introduced. However, commercial constraints with respect to size, weight, and cost precluded any "brute force" anti-resonant construction. Thus, for many years now, commercially available speaker systems have suffered in varying degrees from the omnipresent coloration of music signals caused by enclosure resonances.

Are the deleterious effects of cabinet resonances really that much of a problem? After all, countless numbers of people listen to speaker systems that are rife with resonances, and apparently they are adequately pleased with what they hear. In fact, sad to say, many people equate the boomy resonances of their speaker systems with good bass response. Well, to each his own. (Some people prefer margarine to butter.) I suppose one could trot out handy clichés, such as "ignorance is bliss" or "what you don't know won't hurt you," but that would be unkind. Education is a more reasonable approach. To the trained ears of a person who listens to live music, the superimposition of resonant colorations on his audio component system is anathema. He is keenly aware that these are unnatural artifacts, phenomena that do not exist at a live concert.

To avoid enclosure resonances, many people use electrostatic or planar speakers, which do not employ enclosures. However, these dipole designs trade one set of problems for another, which can include imaging difficulties, an inability to achieve high playback levels, and restricted low-frequency response.

In the monophonic era, our main concern was the amplitude of the panel resonances which caused that unwanted boominess. With the arrival of stereophonic sound, the slow decay of panel resonances was seen to exacerbate the problem of enclosure resonance effects. This lengthened decay had always been present, of course. With stereo reproduction, however, the differing arrival times of the direct sound from the drivers and from the panel radiation caused a "smearing" and loss of image specificity, which degraded the three-dimensional qualities of the stereo sound.

In recent years, studies have revealed the magnitude of enclosure resonances. Consider that in many typical loudspeaker systems, the total surface area of the enclosure panels may be more than 30 times the area of the driver diaphragms. In some poorly damped enclosures, panel radiation is down only 6 dB in relation to the direct radiation from the drivers. In fact, it is possible at certain discrete frequencies for panel radiation to exceed the driver output! A further problem is that panel resonances commonly occur in the range from 70 Hz to 1 kHz, which unfortunately coincides with perhaps the very most active area of the music spectrum.

Using a laser interferometer and improved accelerometers, B & W, the loudspeaker manufacturer, was able to obtain some important new data on enclosure resonances. They found that panel radiation at low frequencies is influenced by panel stiffness. High frequencies are influenced by panel mass, and intermediate frequencies are influenced by panel damping. In the time domain, it was found that the desirable rapid decay of enclosure resonances demands high damping and/or low mass.

Further, conflicting requirements in the frequency and time domains with respect to the suppression of panel resonance could not be satisfied with the typical wood particleboard enclosure. Thus, recent investigations focused on new materials for the construction of speaker enclosures. Among these are various laminates, some using graphite or boron fibers (which are very expensive). Another is a so-called aerospace material known

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The inspiration for the Matrix's cellular design was a case of wine with a honeycomb insert which protected the bottles.

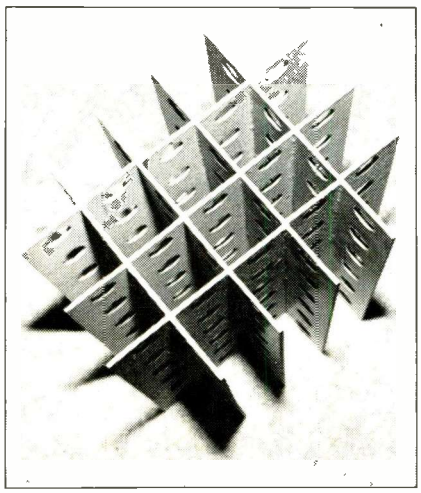
as Aerolam, which consists of two thin aluminum "skins" placed on either side of a core honeycomb-structure damping material. There have also been some Scandinavian speaker enclosures that return to the "brute force" philosophy of cast concrete! Tests by B & W clearly showed that the typical particleboard enclosure, internally damped with bitumen, contributed too much panel radiation. The Aerolam enclosure had significantly less panel radiation at lower frequencies, but unfortunately it also had a higher degree of coloration in the midrange. Even the concrete enclosures, which one might presume to be free of resonances, were found to have a pronounced ringing at 350 Hz caused by lack of internal damping in the concrete.

After these tests, the search for new anti-resonant construction materials didn't look very promising. Then Laurence Dickie, chief electronics engineer of B & W, came up with the Matrix anti-resonant loudspeaker enclosure. I described the internal honeycomb structure used in the B & W Matrix 1, Matrix 2, and Matrix 3 loudspeakers in the September 1986 issue.

As I pointed out in my original description of the Matrix, it is a structure made of a very rigid proprietary material with high damping qualities. The Matrix is composed of a series of interlocked, perforated pieces that form a cellular honeycomb. The cell ends have a very high degree of stiffness. The planes of the cell ends are fitted to corresponding grooves on the inner walls of the particleboard enclosure panels and then bonded in place. The many cells of the honeycomb are filled with an acoustic foam. This concentration of foam furnishes an almost anechoic condition in which the out-of-phase energy from the rear of the drivers is almost totally absorbed, having somewhat the same effect as increasing the enclosure's internal volume. With the Matrix bonded to the interior of the enclosure, there is continuous structural integrity, with the enclosure becoming monolithic in its solidity. Although the Matrix structure does not weigh very much, it is rigid enough to support considerable weight.

Since I have been an advocate of anti-resonant speaker construction for many years, I was interested in this new Matrix development, and I asked B & W to send me detailed technical information about it. They responded by very kindly inviting me to visit their Steyning Research Center in England.

The Steyning Research Center is a very busy place, with a staff of 25 engineers and scientists headed by research director Peter Fryer. While I was at Steyning, I had the pleasure of meeting Laurence Dickie. He told me his inspiration for the Matrix concept had come from idly staring at an open case of wine, with the bottles nestled in the cells of a protective cardboard honeycomb insert.



Made of a proprietary material with high damping qualities, these cells give the Matrix enclosures their anti-resonant rigidity.

In the laser lab at the Steyning Research Center, Dr. John Dibb (left) and Dr. Peter Fryer, the center's research director, demonstrate computerized modal analysis techniques.

The labs at Steyning are filled with advanced and esoteric equipment, much of it used in the development of the Matrix concept to measure speaker enclosures, drivers, and other components. Point accelerometers were particularly useful in measuring the amplitude of vibrations at various points on the enclosure-panel surfaces. The computer-processed accelerometer data was used for measuring the time effects of impulse excitations applied to the enclosure, among other tests. Point measurements from the enclosure surface were also subjected to computerized modal analysis. As in the past, B & W made extensive use of their Doppler laser interferometer. This is a spot-measuring device, where the surface to be analyzed is scanned sequentially, and then the data is stored and computer-processed to yield a composite picture. The system, unfortunately, cannot be used in real time.

B & W has also put into operation an entirely new type of laser measurement tool known as an Electronic Speckle Pattern Interferometer. The ESPI consists of an optical unit with a TV camera, an electronic processing unit, and a TV monitor, all of which is mounted on an air-suspension optical table. The ESPI employs a 10-mW helium-neon laser light to illuminate the test object. This produces a speckle pattern, quite similar to a grainy photograph, when the object is viewed through a lens. The ESPI's big advantage is that it operates in real time. The unit's continuous interferogram of the resonance patterns is updated 25 times per second. Sine-wave frequencies can be applied up and down the spectrum, and the change in speckle patterns can be viewed continuously and instantly on the TV monitor. The fruits of this new ESPI technique include the Matrix speaker drivers, in which the driver basket and mounting plate are made of a single casting of magnesium alloy. The rear of these driver castings is treated with a polyurethane elastomer damping compound.

B & W is also doing a great deal of sophisticated computer modelling. Data derived from measurements and

ANYTHING ELSE IS JUST UN-PROFESSIONAL

From Live Aid to Lincoln Center, top ten artists to top studio producers, JBL has been the #1 choice in professional loudspeakers for more than 40 years. Now the JBL "T" and "TL" series promise to make the star of stage, screen and studio, the star of car audio, too.

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"T" series loudspeakers feature high and mid-high frequency transducers made of pure titanium—the same titanium domes that are used in JBL's professional studio monitors. Titanium's high strength-to-weight ratio ensures clear, powerful highs without listener fatigue. And now, for the first time, you can get the benefits of titanium at a lower cost with the "TL" series' titanium laminated domes.

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Pictured above, left to right are The T95, T55, T65, and, the TL900, TL500, TL600.

JBL

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B & W's Matrix Mini, a tiny 11-pound system, is a classic example of 10-gallon performance out of a pint pot!

other sources, along with desired parameters, is fed into a computer whose special processing can predict the performance of a hypothetical speaker, so building an actual speaker is not necessary. I sat down at a computer terminal with the affable Dr. Fryer, and we fed into the computer some "wishful thinking" parameters that would result in an idealized Model 801 loudspeaker. We derived a version with some very desirable characteristics, but as I will relate, it was trumped by an even better design.

There were many other new ideas and concepts and possible future products all deriving from B & W's sophisticated research programs. There are far too many to detail here, but I would like to tell you about several of the most advanced B & W products which will debut at the Summer CES in Chicago. First is the B & W Matrix Mini System. This little speaker measures 9⅝ in. high by 6⅜ in. wide by 8 5/16 in. deep and has an internal volume of 6 liters. The cabinet, molded in one piece from glass-fiber filled polyester, employs Matrix construction. The bass midrange unit is a 126-mm Kevlar driver. The tweeter is a newly developed, 26-mm metal dome unit whose diaphragm weighs just 0.33 gram; B & W says it is down only 6 dB at 40 kHz. The tiny, 11-pound Mini has a rated frequency response of 65 Hz to 40 kHz and a sensitivity of 85 dB, and it can handle amplifiers of up to 200 watts. If you get carried away, there is B & W's Audio-Powered Overload Circuit (APOC). I heard this little giant, and it is a classic example of getting 10-gallon performance out of a pint pot! To gild the lily, there is a companion Matrix Mini Tower subwoofer. It stands 39 inches high, is 6⅜ inches wide, and has a depth of slightly over 8 inches. It has full Matrix interior construction and uses two 130-mm bass drivers. Operating as a fourth-order vented system with an internal volume of 14 liters, it has a rated −6 dB point of 33 Hz. Used together, the Matrix Mini and Matrix Tower are said to provide response from 33 Hz to 40 kHz at an SPL of 107 dB! Because of the extreme rigidity of this system and its lack of resonance, the sound is ultra-clean, and as for stereo imaging, the speakers simply disappear!

The most choice B & W item that will debut at the SCES is the Matrix 801. This totally updated unit now employs matrix construction with a new bass driver, and the fibrecrete (fiberglass- and steel-reinforced concrete) head sports the new metal dome tweeter. A new sixth-order Butterworth vented system provides—would you believe?—a −3 dB point of 19 Hz! Rated sensitivity is up to 87 dB at 1 meter for 1 watt input, and overall frequency response is rated as 20 Hz to 20 kHz, ±2 dB. With resonances controlled, the Matrix 801 loudspeaker should provide super stereo.

THE DELICATE BALANCE

POLARIS. The promise of delicate tube-like performance is part of the allure of MOSFET amplifiers. But the promise remained largely unfulfilled, until now, because of transconductance error. In Polaris, Sumo employs proprietary active bias output circuitry to correct the problem. Dedicated servo circuitry also reduces crossover notch distortion to levels found in the very best Class A amplifiers. And the elimination of protection circuitry ensures the purest possible reproduction of music.

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"It is so clearly superior to past amplifiers in the low- to mid-priced range—not to mention most amplifiers two to three times its price– that I can unhesitatingly recommend it for even the most demanding high end system."

Anthony Cordesman

stereophile

vol. 8, no. 4

ADCOM GFA-555 POWER AMPLIFIER

HIGH POWER, HIGH CURRENT

"...it rivals any transistor power amplifier in its power class that I have heard—including high-powered receivers or amps with trick power supplies—at any price."

The complete review:

A BEST-BUY BREAKTHROUGH OR THE START OF A NEW WAVE?

I am reluctant to call any given transistor power amp a "best buy" or breakthrough. From my talks with designers and other audiophiles, it is clear that the state of the art in power amplifiers is about to change. From where I stand, the Adcom GFA-555 is the first sample of this new wave. It is so clearly superior to past amplifiers in the low- to mid-priced range—not to mention most amplifiers two to three times its price—that I can unhesitatingly recommend it for even the most demanding high end system.

The GFA-555 does everything well, and most things exceptionally well. It provides superb, well-controlled bass with far better speaker load tolerance than most amps. Its midrange and treble are remarkably low in coloration. There is no hint of hardness, and none of the loss of inner detail common to transistor amplifiers.

"The Adcom's soundstage is sufficiently superior that even those who claim all power amplifiers sound alike might hear the difference."

With the exception of the Krells, I have never heard a more detailed, natural, and extended upper four octaves in a transistor amp. The Adcom may even be a legitimate rival to the Krell; it's brighter and more dynamic, and somewhat more open. And, like the Krell, it gives the impression, on really good material, that the amplifier simply isn't there, on really good material. Nor is the Adcom romantic or sweet, like New York Audio's new Moscodes. Rather, it offers natural upper octave detail that the latter miss. Other amplifiers have similar upper octave performance, but I unhesitatingly recommend the Adcom over the very stiff competition from Tandberg and Threshold.

The Adcoms' soundstage is sufficiently superior that even those who claim all power amplifiers sound alike might hear the difference. It comes very close to the better tube power amplifiers in providing detailed, stable, realistic imaging with natural depth. It is not an Audio Research D-250, but is extraordinarily holographic—I suspect almost embarrassingly so. This kind of soundstage has previously cost at least $2000.

I am also highly impressed with this amplifier's dynamics. Once again, it is not going to survive a one-on-one with the Audio Research D-250 or Conrad Johnson Premier Fives, but it rivals any transistor power amplifier in its power class that I have heard—including high-powered receivers or amps with trick power supplies—at any price. It provides these dynamics into virtually any load without bloat, restriction of sound, or change in timbre. For all the nonsense published by most manufacturers about driving complex loads, this amplifier actually delivers.

The Adcom does not lose sweetness and detail as its power goes up. I am normally leery of transistor amplifiers rated much above 100 watts; they too often blur detail and harmonic information, and this sonic price tag is far more costly than the added power is worth. This does not happen with the Adcom unless the distortion lights are blinking, and they only blink when the amp is delivering well over its rated 200 watts per channel (8 ohms) or 325 watts (4 ohms). By comparison, once-outstanding high power amplifiers like the Hafler DH-500 now sound annoyingly veiled.

With a minor dealer modification, you can even drive 1 ohm loads like the Scintilla. I can't measure whether the Adcom delivers its rated 800 watts per channel into 2 ohms, or 20 amps peak, but I *can* tell you that it does a superb job of driving this superb speaker. Anything in its price range (or even close) generally changes timbre and degenerates when driving the Scintilla at 1 ohm.

"For all the nonsense published by most manufacturers about driving complex loads, this amplifier actually delivers."

I'm going to have to say a few words about its technology before I give Adcom a swelled head. You'll be happy to note that the manufacturer claims for the GFA-555 a simple gain path, a 700 watt toroidal transformer, a well- regulated high current power supply, new ultra-stable bias circuitry, direct coupling, no current limiting, and no output inductor. More substantively, its harmonic shape mixes suitable yinyang while avoiding the curse of pyramidology. This, of course, means that it weighs 34 pounds, has simple rack-mount black styling, pilot lights, warning lights (to indicate distortion levels above 1%), and measures exactly 7 5/16" by 12 1/4" by 19".

More pragmatically, the technical specifications are significant in that they represent reasonable bandwidth (4-150,000 Hz), damping (150-200), gain (27 dB), and noise (-106 dB). Of these, only the noise specification is outstanding. No attempt is made to beat distortion records: .09% THD at rated power into 8 ohms, and .25% into 4. I have heard so many power amplifiers with infinitely (well, an order of magnitude) better specifications sound so much worse; this may be the amplifier whose sound could convince *Stereo Review, High Fidelity*, etc. that their present measurements are virtually worthless.

I suspect that the Adcom is going to force many designers in the $1000-1500 range to either make radical improvements in their products over the next six months, or look at the possibility of retiring from competition. This is a "must" amplifier to audition before you spring for anything close in price. If the Adcom is simply the first of a whole wave of good amplifiers, it will help revitalize the high end for the average audiophile, and force most manufacturers into more reasonable pricing. Now, Adcom, if you can only come up with a preamp as good! **AHC**

"I suspect that the Adcom is going to force many designers in the $1000-1500 range to either make radical improvements in their products...or look at the possibility of retiring from competition."

Manufacturer's note: Approximate retail prices listed in order of mention in review:

Adcom GFA-555	$ 680
Krell	2300-7500
N.Y. Audio Moscode	900-1600
Tandberg	1000-2000
Threshold	1490-3150
Audio Research D-250 (MK II)	6000
Conrad Johnson Premier 5 (pair)	6000
"high powered receivers"	?
"amps with trick power supplies"	?
Hafler DH-500	850

EDWARD TATNALL CANBY

TIME TRAVAILS

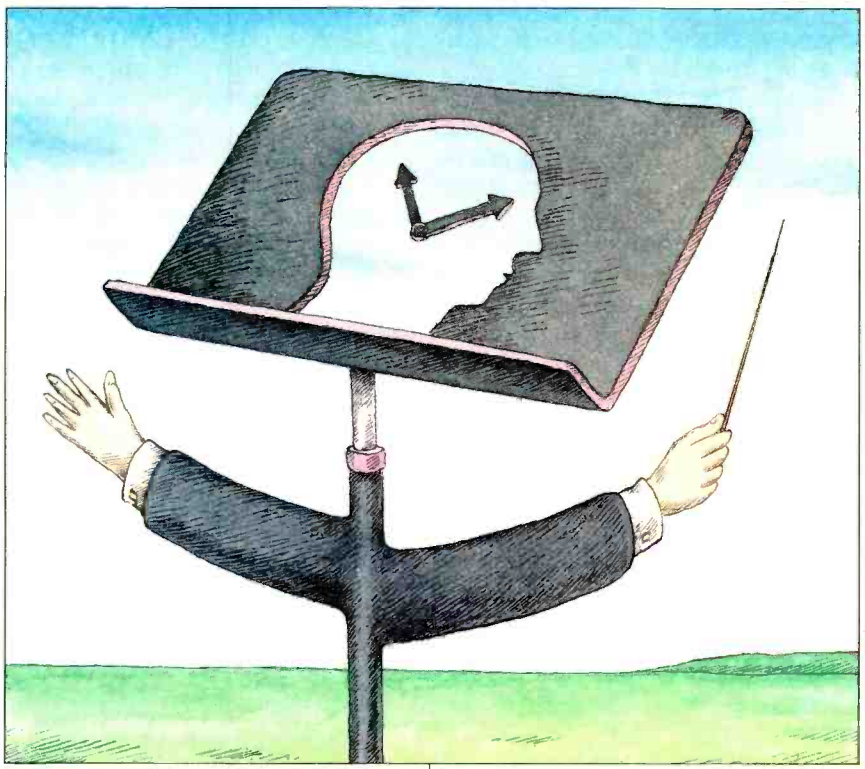

Illustration: R. J. Kaufman

How time plays tricks! It marches on, as it always has, with stately uniformity in the best tradition of precise engineering, but some days seem short and others dreadfully long. It is the same with years, when the human mind gets to thinking about them. I plain forgot *Audio*'s 40th anniversary, marked in last month's issue. No disrespect! Just a time trick.

I am always acutely aware of passing time, since I am a listening musician. For instance, take the pauses between movements of a symphony during a live concert: Unless you have a hammy and insensitive conductor on the podium, these pauses will be matched to the feeling of the music and the occasion. When that happens, there is the visible and almost audible up-breathing of a musical phrase just ended, and another about to begin, a thing of real beauty if done mostly in silence. I won't forget a recent New York concert of the Czech Philharmonic under its veteran conductor Vaclav Neumann. To watch that marvelously time-sensitive leader raise his expressive hands, slowly, for a new phrase of Dvořák, and witness the simultaneous sensing of that pause by dozens of musicians—the string players poising their bows, the winds taking breath, the percussion with hammers rising for the blow—is one of the ultimate experiences in the use of sheer time for making good music.

But those between-movement pauses heard at home, on a "live" tape, are fussy and much too long, full of distracting coughs, rustlings, and what-not. Wise producers take out a bit of the interval for better listening at home, where our sense of time is different. (God knows what timing sense we have for car stereo!)

These things are not unknown in the recording profession. But the rules of procedure are generally unwritten, and maybe better so. It is always a matter of sensibility, in the recording studio or the concert hall, a subtle sort of forecasting, to know how this take or that will affect the home ears. I suspect that a lot of good producers, persuaded by engineering exactitude, would even deny that they make such calculations at all. They do, and so do many conductors, those who do not ignore their partners in the control room.

Forty years of this magazine? After 40 years, what's one particular year? I wrote my piece for May 1987, looked straight at it, and never batted an eye. The date didn't register! It's been a long time—40 years this month, in fact, since my first column appeared.

And so to a time formula which I put forth in our 1972 25th-anniversary issue: The Canby Constant. To my considerable pleasure (never having heard a word about it since), I recently got a letter from a reader who recalled the Constant and said so. A bit of a time capsule, that. I'll get to it in a few lines.

I did not overlook *that* anniversary. *Audio* put on a huge celebratory bash, and it was a vast and fruitful effort, too, far beyond mere publicity. Just about every celebrity in the audio world was on hand for that occasion, including such people as Avery Fisher and Herman Hosmer Scott and plenty more of that generation. I was stunned when I was told I had been picked to give the "keynote" speech, since of all audio non-engineers, I am the most "non"! On mature (and frantic) reflection—days of it, ahead of time—I decided that the reason I'd been picked was basically simple. Timing.

As I say, I had that sense of how long, or how short, moment by moment. I had just then produced the last of 25 years of weekly radio programs on New York's WNYC (then municipal, now Public Radio), each one, as nearly as I could manage, extending for exactly 28 minutes and 30 seconds. Obligatory, since if I went overtime by 3 seconds, exactly 3 seconds of my speaking voice would be cut off, regardless of sense. It happened, even when the station started the tape late, which it sometimes did. Timing in every sense was my obsession, even to the timing of pauses to create paragraphs. Not to mention the precise timing of spliced stunts in music, one performance grafted onto another so precisely that you could not tell, nor hear the splice. (I know—today it can be done with even greater precision and a lot less risk, or no risk, via those hideously expensive digital editing systems. So, alas, I am as the horse and the buggy.)

Yes, timing. Very simply, the promoters at *Audio* could count on me to pace my speech, as on the radio, and to avoid mumbles, punches, and talk-

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More and more, the "live" recording is disjointed in time, but there is nothing really wrong with this, and musicians can adapt.

ings-to-one-side, ignoring the necessary mike. Also, they knew I would *time* my "program." That was the real payoff, and I suspect it didn't matter too much what I said, just so it vaguely had to do with hi-fi or something. To tell you the truth, I haven't the faintest idea what I did say. It was done entirely ad lib, if after much thought. I made it up as I went along, as I often did in radio programs, departing from a written script to say something that suddenly seemed better. Spontaneity? That's how it came out, anyhow.

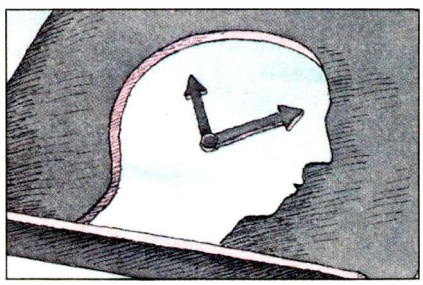
But the thing that knocked 'em for a loop in that 1972 speech was the timing. I got the point: I was allotted, as I remember, exactly 15 minutes out of the rather complicated program; there was plenty else, and the featured speaker *could not* be allowed to go on and on.

So, taking maximum advantage of my special experience and consequent expertise—timing—I arrived at the big do with a small, bulky object in my coat pocket. When I was introduced, before I so much as opened my mouth, I pulled this thing out and set it going. It was a kitchen timer, the pre-digital kind, all mechanical. You wound it to the time you wanted, and it ticked loudly and then went off with a loud *ding*. This was set on the podium, to one side, where all could see it and breathlessly follow the little black pointer as it traversed those 15 minutes, implacably, just like radio itself.

Yes, I did glance over at it three or four times, to be sure. But mostly I just talked. And as I came to my peroration (or whatever it was) and then ceased, the thing went *ding*. Right on the button, within maybe 2 seconds.

I doubt if anybody in that audience remembered, after that, the things I had said. But the Great Names in audioland came up one by one with congratulations on the performance. How did I do it? They really were astonished. And as a matter of fact, so was I. It didn't seem to me anything special, just a parlor trick. And a good sense of timing.

I tell you this simply because timing is so vital in every audio area—I mean *the sense for passing time*, the judgments on pauses, on speeds, on tensions and relaxings, on "edits" and the combining of takes, especially. Musicians tend to hate editing. It is a gut distrust that has a lot to do with their own sense of timing. Minus experience in audio, a tape editor may well indeed disrupt the flow (translate: Inspiration) of a musical offering. But if the good tape editor, in digital as in analog, himself has a fine-tuned sense of timing and can hear what happens when two different takes will be joined (and can readjust to different and better crossover points), then at least the musical feeling is taken over into the finished product.



Thus there is a high art to tape editing, just as profound and as subtle in its special area of usefulness as the basic art of musical performance itself. I see absolutely no reason to suppose, as musicians still do, that this art is intrinsically less than their own. Both musicians and tape editors (or producers, or what have you) are *interpreting the musical score*, each with his own highly trained expertise—and sense of timing.

Of course, what with early editorial deadlines, *Audio* has not yet actually arrived at its 40th as I write this. Time, these days, is immeasurably bent and spliced in more and more areas. Increasingly, the warping of time in this fashion is a part of our way of life, to the point where people scarcely notice it at all. Can it be any different in the art of musical performance? More and more, the "live" broadcast, or in another form the live recording, is disjointed, with segments of time rearranged or simply removed. *There is nothing intrinsically wrong with this.* Just a considerable chore, and a damper to inspiration for participating musicians. They can adapt and most do. Are they different from the actors in the movies, who have never worked in any other manner?

The musicians are lucky. I once watched a movie being made on the street outside my New York apartment (it woke me up around 6:30 in the morning). The scene lasted roughly 1 minute; the filming took almost 3 hours, and 2 hours more to set up and take down the elaborate gear. Over and over, the same red sedan screeched around a nearby corner and squealed to a violent stop; the same people jumped out and ran for cover in my apartment lobby. We had become a gangster hangout. I could see no difference in the takes, but back they went and did it again, and again. All for 1 minute of theater! I didn't even get the name of the movie. So much for continuity on film.

Oh yes, the Canby Constant. It's nothing much, and it has nothing to do with audio, except that it is another type of time warp—the inner, subjective sort. I discovered this Constant—or, rather, noticed it—a long time back, but it wasn't until *Audio*'s 25th anniversary, thinking hard on the passage of time, that I suddenly saw how to put it into elementary form. (If *I* can understand it, any audio person should get the idea in an instant, though most of my non-audio friends don't.) The Canby Constant states that the apparent subjective time span from the present back to one's earliest childhood memory never changes. In each mind, it is always fixed, a constant if there ever was one. Think about it, and you will agree. Take, say, the time you had the measles, at age 5. At 10, this trauma seemed far back to you, in babyhood. And so it was. At 20, it was the same. At 70, there is no change; you continue to remember those distant experiences just as you always have.

This, you see, has some interesting mathematical consequences and perhaps even accounts for my forgetfulness concerning our 40th anniversary. The years are like a long ladder back to childhood, *but it grows no longer*; the rungs just pile up and are pushed away, getting ever closer and closer in the spacing. Each year is shorter than the last. At my age they really fly. The rungs are frighteningly close.

Time warp again. I can see, as I did in 1972, why old Methuselah in the Bible died at 1,000. His years were reaching infinite closeness, the point of no passage; they could go no further! Time had to stop. And so must I.

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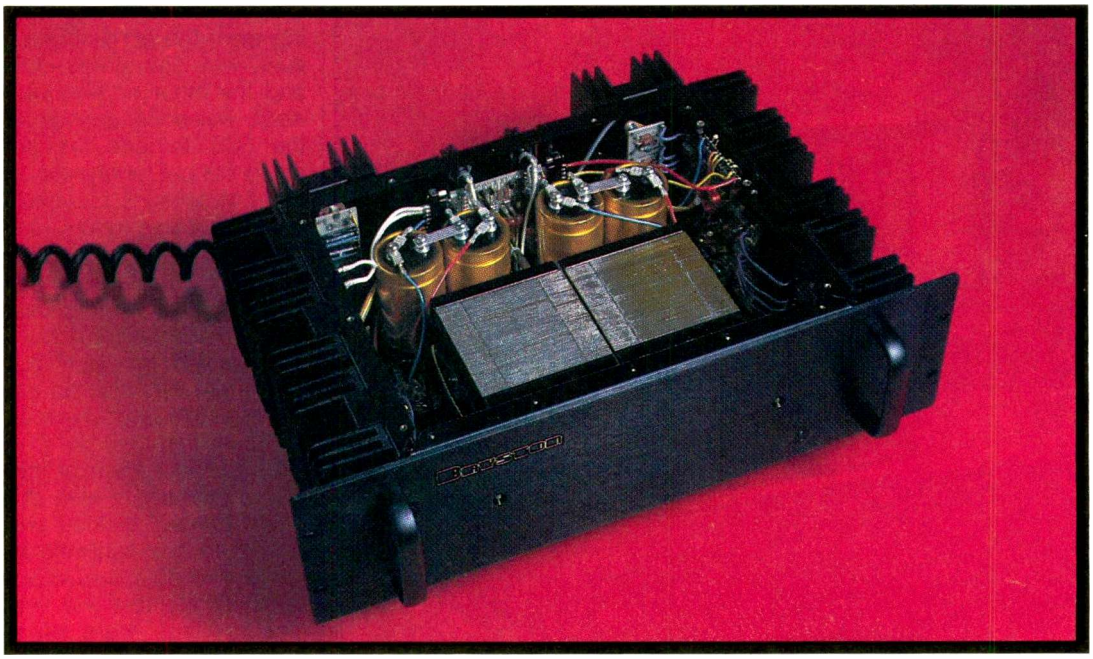

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1. Musical accuracy
2. Long term reliability
3. Product integrity

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IVAN BERGER

QUARTER NOTES

Early makers of solid-state equipment emphasized compactness, as in this mid-'60s publicity shot from Electro-Voice.

As of last month, *Audio* has been covering sound reproduction for 40 years. As of this month, I've been writing about it for 25. Since Leonard Feldman and Bert Whyte looked pretty thoroughly, in our anniversary issue, at what's happened in audio during the magazine's first 40 years, I thought I'd concentrate on what the field was like when I first officially entered it.

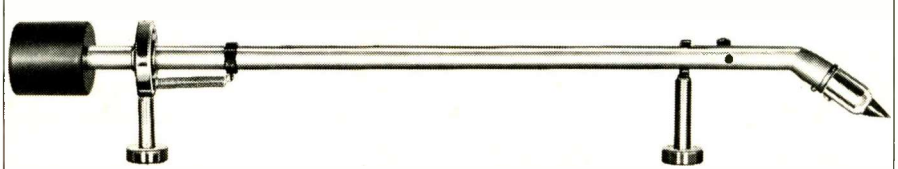
In 1962, a year out of college, I thought of myself as a newly minted hi-fi buff (we weren't saying "audiophile" yet). Actually, I'd been one longer than I knew, ever since I'd bought the family's first 45-rpm changer from my birthday money and then urged the switch to LP in my Cub Scout days. In 1962 I was already on my fourth sound system, built around Dynakit tube electronics (PAS-2 preamp, FM tuner, and two 60-watt Mark III amplifiers). It included a kit-built Weathers turntable, a Dynaco/B & O integrated arm and phono cartridge (capable of tracking with as little as 2 grams of force!), two 8-inch Wharfedale speakers in R/J enclosures, and a Magnecord PT-6 monophonic recorder. As my college was all male and near no women's colleges, having this good an outfit owed as much to sublimation as to clever dealing and economizing.

I thought it an exciting time, with audio in a state of ferment. (Later I discovered that it almost always is.) The biggest news was that the FCC had just approved a "multiplex" system for FM broadcasting. Already, according to a Sherwood ad, stereo FM was "an established reality," with 87 stations, in 29 states and Canada, either on the air in stereo or planning it. New York City had two stereo stations on that list, though New Yorkers could also pick up stereo from nearby suburbs. Some stereocasting was still being done the old-fashioned way, however, with one stereo channel on FM and the other on AM; by year's end, *Audio* was editorializing that it was time the FCC forbade the practice. You could still get tuners with separate AM and FM sections for simulcast stereo, but even these tuners (such as H. H. Scott's 333) had multiplex circuitry built in. If you had an older FM tuner, though, multiplex adaptors were pretty widely available from Eico, Eric, Fisher, Grommes, Knight, H. H. Scott, and others. There was also an internal adaptor, available from Dynaco.

Thanks in part to stereo FM but even more to the advent of the stereo LP, John Koss' bright idea of headphone listening was catching on fast. There was even one lightweight, on-the-ear phone available, the AKG Model K 50 ($22.50). My first two magazine articles, in fact, were on the several brands of phones available, and the little switch-boxes we used to hook them up to amplifiers (few audio components, if any, had headphone jacks yet). Edward Tatnall Canby, by then a long-time *Audio* contributor (as were Herman Burstein and Joseph Giovanelli), also devoted several columns to this new phenomenon.

I don't think I got the idea of writing about headphones from Mr. Canby (I read *Audio* only sporadically back in 1962, though I became a regular reader the next year), but he'd already been quite an influence on my career. As the new audio columnist for *Saturday Review*, I was filling a post that had originated with him. And I had gotten my first grounding in hi-fi from the *Saturday Review Home Book of Recorded Music and Sound Reproduction*, which Mr. Canby had cowritten with C. G. Burke and Irving Kolodin. I also often listened to his radio program and almost felt I knew him.

The B & O Stereodyne cartridge tracked at a mere 2 grams!



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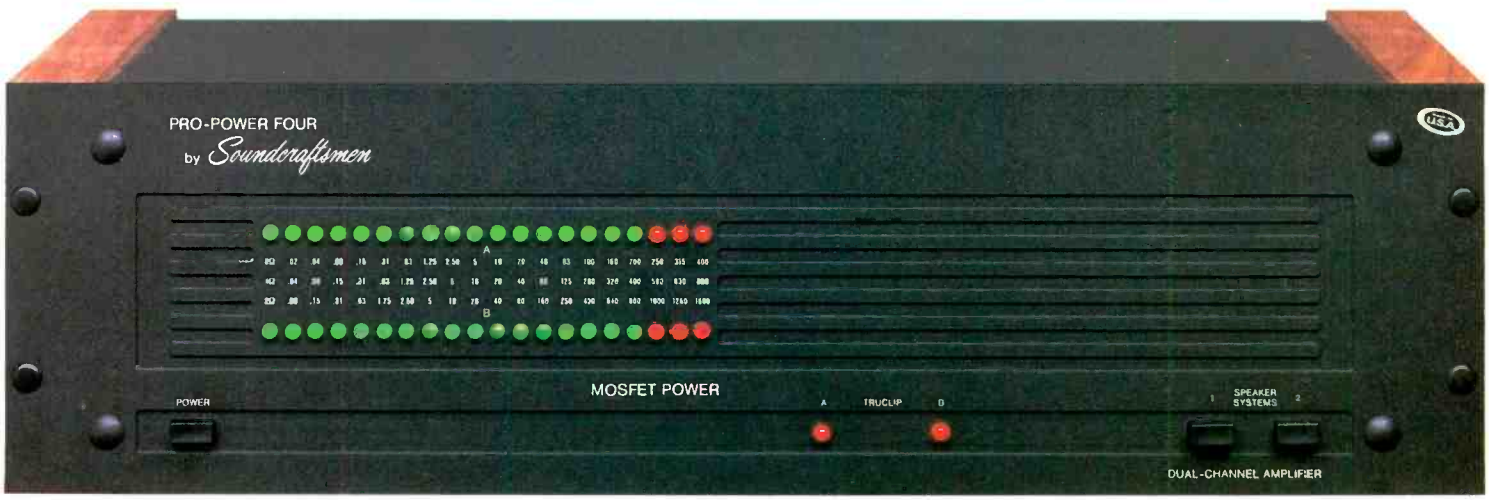

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I thought that 1962 was an exciting time, with audio in such a state of ferment. Later I found that it almost always is.

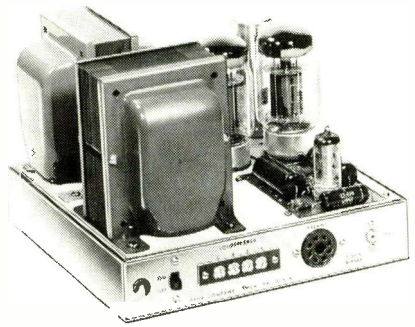
Today's audiophile would feel only vaguely out of place in a hi-fi salon of 1962, but an audiophile from that era would be stunned by what he saw today. On the phono side, we already had stereo records and moving-coil cartridges—but no controversy over whether they were generically better than other types. We also had belt-drive turntables with sub-platform suspensions: AR's was already on the market, and a Stromberg-Carlson had preceded it.

We also had four record speeds: 33⅓ rpm, which is still going strong; 45 rpm, now an endangered species; good old 78 rpm, which is still with us, and 16⅔ rpm, which was then the newest and is now the deadest speed. You could already buy several brands of S- or J-shaped arms with "universal" cartridge shells, then called "Ortofon" shells after the company whose arms had first used them.

Changers were still big sellers. Garrard had held first place for years, but I think Dual, with its clever 1006, had by 1962 already ousted Miracord from second place. There were ways to add a bit of automation to some manual arms too: Rek-O-Kut offered a motorized arm lift, and Empire had a magnetic end-of-record lift built into its arms.

The most advanced engineering, however, was in single-play tables. Fairchild, for instance, offered an optional electronic speed control for its sleek 412 turntable, designed by Raymond Loewy. This was a tube oscillator which changed platter speeds by varying the power frequency fed to the table's motor.

The Weathers I owned was simplicity itself, with only five parts. Instead of the usual approach, using a heavy platter for speed-smoothing momentum, the Weathers used a platter stamped from aluminum so light that an electric clock motor could drive it. What could be better regulated? Such a light platter could revolve on a single needle bearing, and the motor's torque was slight enough to be transmitted by a small wheel of soft gum rubber pressed against the platter's inner rim. Since gum rubber didn't take a set when left compressed, there was no need for a mechanism to move it to a rest position when the turntable was switched off.



The cheery glow of tubes was everywhere.

Resonances galore, I'm sure, but still a lot of clever engineering.

Mono records were still being reviewed, but most new releases were stereo. Broadway show albums were far more common in those days, because there were still plenty of new Broadway musicals. The CBS STR-100 test record had just come out and was the subject of an article in *Audio*.

There were predictions that the LP would give way to tape—open-reel tape, that is. People thought the big breakthrough was 4-track tape, which got twice as much music onto a reel and required no rewinding. (You just flipped it over and played the other side.) You could get complete record/play decks or more economical playback-only versions. Some of the latter had built-in playback preamps, but you could also buy a deck with only heads and get an amplifier with a tape-head input.

Stereo was new, so companies like Dyna made adaptors that could link two mono preamps.

The predictions were wrong, of course, because consumers found tape too expensive and no one wanted to bother threading it. So the LP seemed even more threatened a year or two later, when a stereo system using an easy-load plastic package of narrow tape, running at 1⅞ ips, hit the market. This wasn't today's cassette, however; it was part of a clever system from 3M which even included tape changers. But it never caught on. When Philips did introduce today's cassette a few years after that, it was a low-fi, mono medium designed for voice applications.

In electronics, receivers were only just beginning to become popular as transistors started nudging tubes aside; Altec had a hybrid tube/transistor receiver, and I believe there were others at about that time. We did have some solid-state amplifiers (still uncommon, unreliable, and, I'm told, *definitely* guilty of "transistor sound"). The two brands I recall were the TEC components from Transis-Tronics (which were so small that it was obvious they were transistorized) and the low-slung, graceful Omega gear. Electro-Voice had transistor gear soon thereafter. One premium name brand, Citation, announced solid-state equipment late in '62. There were no integrated circuits yet, and I think FETs, with their more tube-like characteristics, were yet to come. Digital tuner dials were also yet to come—they're one of the features which solid-state design made practical.

Some of the features we did have then are rare today. In addition to tape-head inputs, center-channel outputs were popular. I don't remember whether that was for mono feeds to other rooms or to fill the "hole in the middle" left by the speakers and recordings of the day.

There were no black components. Most were faced in some kind of brass

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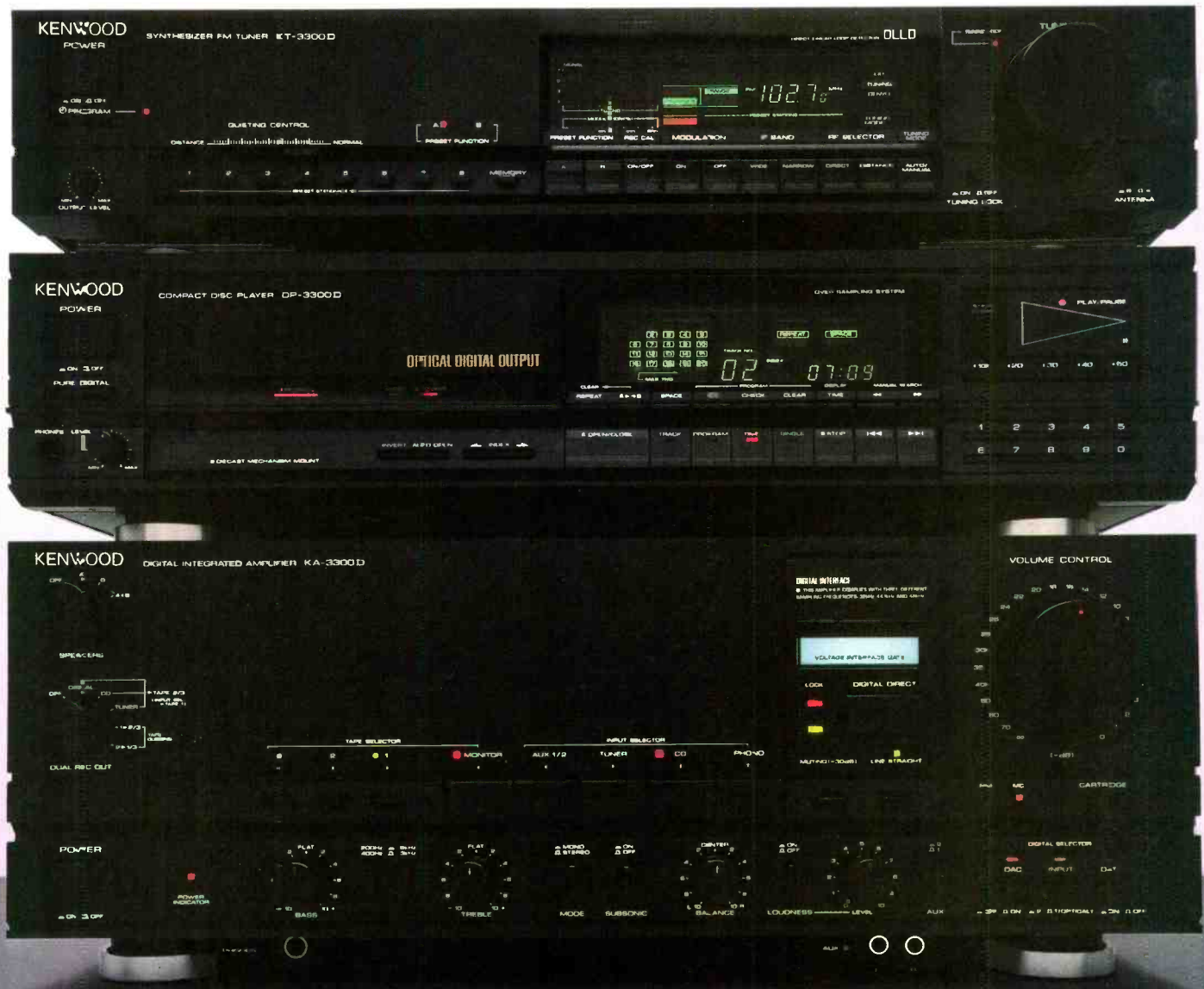

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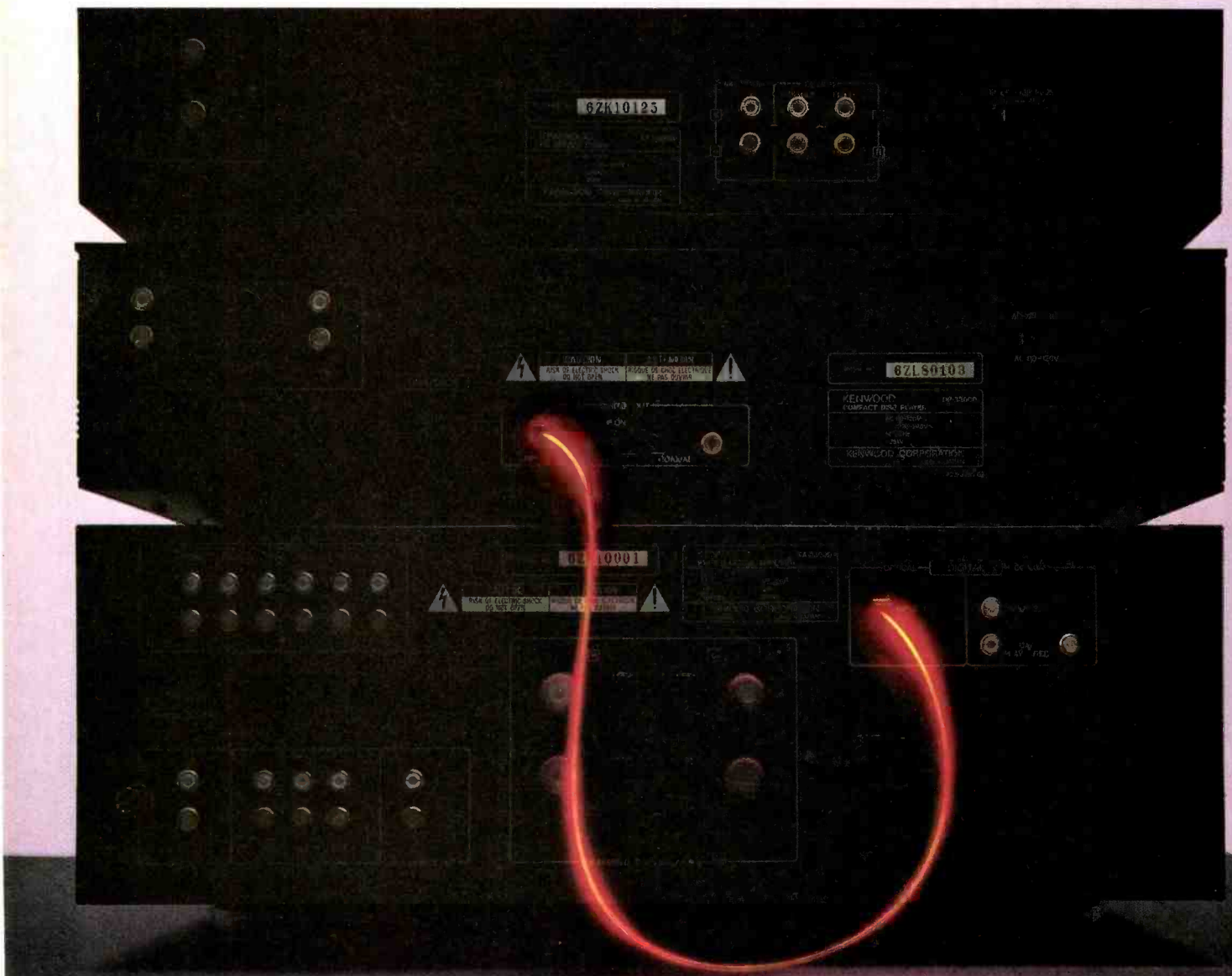


We removed the protective coating from the cable shown to clearly illustrate a fiber optic transmission.

Many audiophiles were technically minded enough to build equipment from kits and young enough to appreciate the savings.

or gold tone, though Harman/Kardon (which had formerly made copper-fronted components) was one of many companies offering a satin chrome or aluminum finish. There was even two-tone equipment, such as Dynaco's brass and brown or Sherwood's brass and white.

Component audio was the esoteric high end of the day, as the average music-lover still bought a table model or console system. A high proportion of buyers of components were technically minded enough to build equipment from kits, and usually young enough, like me, to deeply appreciate the attractive savings this entailed. Heathkit was still a major force (alas, they left the audio field last year), and the hot name was Dynakit. You could also buy kits from Knight (Allied Radio's house brand), Lafayette, Eico, PACO, and such major manufacturers as Fisher, H. H. Scott, and Harman/Kardon (both Citation and the lower priced Award series). Transvision, Heath, and others offered TV kits with cathode-follower audio outputs for integration with a sound system. Depending on the complexity of the component, savings could be substantial: Dyna's PAS-2 preamp was $60 in kit form and $100 wired, and Lafayette's KT-600A Criterion stereo preamp (a Stewart Hegeman design, I later learned) was $80 as a kit and $135 assembled.

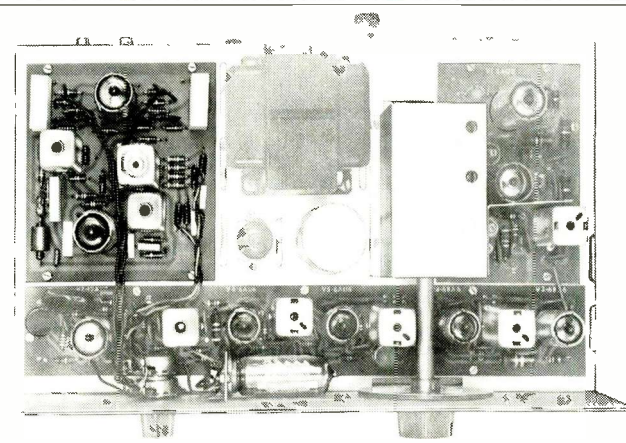
You could get all kinds of stuff in kit form back then. I think tape deck kits only emerged later (I built a couple in the early '70s), but the Fairchild and Weathers turntables were available as kits (my Weathers cost me about $50). Speaker kits were getting less popular since Acoustic Research's acoustic-suspension systems had popularized the idea of designing driver and enclosure together, but they were still available. So were plenty of bare drivers for those who wanted to build their own enclosures, and a dwindling few enclosures for those who wanted to choose drivers of their own.

There were already some electrostatic speakers, chiefly the JansZens. A favorite audiophile system of the time was a JansZen midrange/tweeter with an AR-1W woofer (an AR-1 with its midrange, tweeter and crossover left out). Leak had a speaker with a sandwich cone—plastic foam with an aluminum-foil covering, as I recall. There were also thin enclosures, such as the wood-diaphragmed "Bi-Phonic Coupler" from Advanced Acoustics, and conventional cone-driver systems from Goodmans and Jensen. The only advantage cited for these systems was convenience—the room-boundary effects that Allison and Boston Acoustics now make so much of were unknown back then. Fisher predicted that its thinnish XP-4 would be "the world's most imitated speaker" because it had no frame; the magnet was fastened to the cabinet rear, and the surround to the cabinet's front panel.

The world looked bright for the American hi-fi industry. Fisher had just opened a 50,000-square-foot plant in Pennsylvania, and at least one U.S. industrial giant, GE, still made cartridges, though it had scaled back from the full range of components it had offered in the '50s. (Stromberg-Carlson, part of giant General Dynamics, had dropped out of audio a few years back.) Most audio brands were American and most of the rest were British, but the first Japanese components were already here, from Pioneer, Sony (mainly just stereo tape decks and small radios), and Onkyo (a motional-feedback speaker driver).

We "hi-fi nuts" still faced skepticism, even about such fundamentals as "spending all that money just for a phonograph" and the idea of stereo itself. As *Audio* editorialized: "Isn't it time that doubts about the value of stereo were laid to rest? We still hear relatively well informed people making the relatively uninformed statement that only the very critical and experienced few can tell mono from stereo."

The board at the upper left adapted the Dynatuner to stereo FM.



The Weathers turntable was simplicity itself—and available as a kit for penurious young men like me.

IVAN BERGER

CHRYSLER REACHES INFINITY

Detroit's Big Three auto makers are now unanimous in their opinion of good sound as a factory option: Chrysler has joined the fold. Like its competitors, Chrysler has tapped the expertise and reputation of a major speaker company—Infinity—to produce a top-of-the-line car stereo system. The Chrysler-Infinity system has been available since last fall on the Chrysler New Yorker and LeBaron GTS and the Dodge Lancer; in '88, it will also be available on the LeBaron Coupe, the new New Yorker, the Dodge Daytona, and the Dodge Caravan and Plymouth Voyager mini-vans. On all '87 models but the Daytona, the system costs $624 over and above the AM/FM radio which is standard equipment on Chrysler cars. The Daytona's system, which includes a cassette holder, costs $630.

Like the other Detroit supersystems, Chrysler's has speakers in each corner of the car, with separate, individually equalized amplifiers for each, and uses a head unit adapted from the company's regular line. (The same "Ultimate" head unit, without the Infinity touches but with the same number of speakers, is $120 less than the top-of-the-line system.)

Infinity's contributions start with the speakers: Two 5½ × 7½-inch oval coaxial speakers in the rear deck, two 5¼-inch woofers in the front doors, and a pair of ¾-inch dome tweeters in the dash (Fig. 1). The woofer cones are polypropylene, and the tweeter domes are "Polycell" polypropylene foam. Total rated system response is 35 Hz to 20 kHz. The magnets (ceramic for the tweeters, barium ferrite ceramic for the woofers) are, says Infinity, big enough to provide decent efficiency and small enough for proper damping. Gaskets of Noryl plastic foam maintain proper sealing between the speakers and the body cavities which serve as their enclosures.

The speakers are biamplified, with system power totalling 88 watts: 14 watts (for less than 1% THD at 1 kHz) for each of the four woofers and 8 watts (1% THD at 3 kHz) for each of the four tweeters. The bass amplifiers are wrapped around the woofer magnets to save formerly wasted space, and the tweeter amplifiers are built into the head unit. Crossover frequencies range from 2.5 to 3 kHz, depending on the car model.

As the system diagram (Fig. 2) suggests, the tweeter amplifiers are the same ones that are used full-range in the Ultimate system. In fact, they operate as full-range amplifiers here, so they can feed both the tweeters (via passive high-pass filters) and the woofer amps (which have low-pass filters at their inputs). Theoretically, this would reduce the benefit of biamplification a bit, by making it possible for bass-heavy signals to overload this smaller amplifier, especially if the equalizer's bass bands are turned up. During my road tests, however, this did not become a problem, probably because no real power is drawn from this amplifier at bass frequencies. The woofer amps have differential inputs, permitting the use of balanced signal lines for reduced noise pickup.

The system also includes both fixed and dynamic equalization, separately configured for each speaker and car. The fixed parameters are based on speaker size and location, cavity resonance of the enclosure, the type of mounting, the baffle volume, the speaker grille design, and the vehicle interior (size, shape, and upholstery). The dynamic boost is essentially a loudness control whose degree of boost depends on the actual signal amplitude rather than volume-control position. This variable bass boost also helps overcome road noise, which can be as loud as 80 dB SPL at bass frequencies (100 to 300 Hz) in a car travelling 55 mph. Because the boost is reduced at higher amplitudes and the woofer amplifier incorporates a high-pass filter (18 dB per octave below 33 Hz), and because the woofer amplifier's power is not unreasonably high, the woofer can't be accidentally overdriven.

The head unit in the Chrysler-Infinity (and Ultimate) system was jointly designed by Chrysler and Mitsubishi and built by the latter. Like many Detroit systems, it has a fairly tall panel, which leaves plenty of room for the fairly large number of controls.

Closest to the driver are the main sound-quality controls. Volume is controlled by a large knob, still the most practical approach. Turning the volume all the way down clicks the power off. Pressing the volume knob when in radio mode will toggle between station frequency and clock display; in tape mode, pressing the same knob will reverse the tape direction. A ring around the knob turns the five-band equalizer below it on and off.

To the right of the volume knob is a control labelled "Amb" (ambience), which adds midrange boost and what appears to be mid-frequency phase-juggling to simulate reverb, but only to tape and FM programs. Nearby are buttons that select noise reduction (DNR in radio mode, Dolby B in tape mode) and tape equalization.

At the far right are a four-way speaker-balance joystick and a large, click-stopped tuning knob. Each click tunes the radio to the next channel (10 kHz per click in AM, 0.2 MHz per step for FM). A ring around the knob turns the AM stereo decoder (strictly for the Motorola C-Quam system) on and off. If a tape is loaded, pressing the tuning knob will eject it.

Flanking the tape slot are large buttons used for fast-forward and rewind

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On the whole, the system gets very high marks for sound and for ergonomics, and good marks for its tape performance.

in tape mode, and for bidirectional station scanning in radio mode. The scanner normally stops for 5 S at each station, but it will continue rapidly without stopping if the button is held down. If the "Set" button is pressed first, only the memorized stations will be scanned; if the AM/FM selector is pressed during a scan, the scan will continue on the band to which you have just switched.

Having a memory scan that can zip through both bands is especially useful on this unit, because its memory holds 20 stations—10 AM and 10 FM. There are only five memory pushbuttons, located below the cassette slot. Each holds two AM and two FM stations. To get a button's second station for a given band, you just press the button twice. The display shows whether you're using the primary or the secondary memory.

During my road tests in a LeBaron GTS, the head unit's controls were, for the most part, useful and easy to use without looking. Night illumination was good, except for the equalizer, and there was a nice variation in control feel and shape.

I would have liked to see music scan, automatic tape EQ switching (which the transport's design should accommodate), and Dolby C NR added to the tape deck, and a mono-stereo button added to the tuner. The latter is probably the more important, as the radio is either very sensitive to multipath or has its mono-stereo and blend thresholds set too high.

However, the many controls included were very good, indeed. I liked the two-push station-memory system, the volume knob, and the versatile tuning scan. The ambience control puts in too much midrange if you turn it way up, and not much spaciousness. But dialling in a little bit of ambience is very nice on program material for which it is appropriate, such as choral or organ music.

I could reach the equalizer easily while driving, and I found that very minor adjustments (a dB or two) made the system sound its best. I was glad I could shut it off, however, especially since the sliders' center positions were hard to judge in the dark.

With the equalizer off, the front speakers sounded pretty natural, but

Fig. 1—Speaker layout. The front woofers are mounted in the top front corners of the doors, and the front tweeters are atop the dash. Crossover frequencies are 2.5 to 3 kHz, depending on the car model.

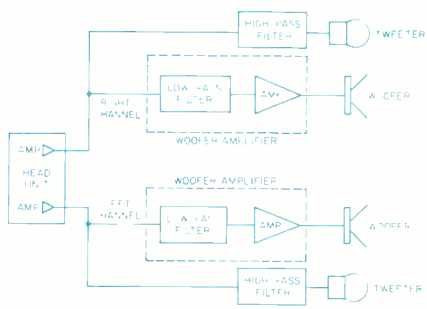


Fig. 2—Unconventionally biamplified, the Chrysler-Infinity system uses small, full-range amplifiers to drive the tweeters (via a passive filter) and the woofer amplifier.

the rear ones (at least in the car I tested) sounded a little bit hollow and tubby. The difference was slight, however; I don't know whether dispersion or equalization would account for it, but the sound seemed to change less when I faded between the front and rear speakers than on other systems I've tested. What you mainly miss when you listen only to the rear speakers is some midrange. The front speakers, by comparison, add a bit of extra midrange warmth, which is less noticeable when the car is moving. With both front and rear speakers working together, the sound seemed flat when the car was moving but a bit bass-heavy when standing still. High triangles sounded metallic rather than silvery. The bass goes down adequately low (35 Hz is lower than many home speakers can handle), but if there were an optional subwoofer, I'd order it.

Imaging was good. On the LeBaron GTS, the instrument pod forced the dash-top tweeter on the driver's side to be both higher and differently angled than the one on the passenger's side. This may have been the reason that some supposedly centered sounds (as heard from the driver's seat) were a bit to the left of their correct position.

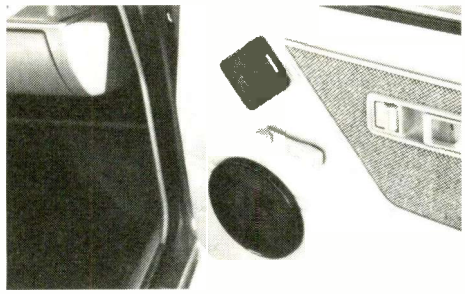
The tape section outperformed the tuner. On FM, sensitivity was fair (it's rated at 6 μV or 26.8 dBf), but multipath resistance was only so-so, and I heard the first picket-fencing I'd heard in months. The tape player yielded some just barely audible wow and flutter on very wobbly roads but was okay over Belgian block. (It's rated at 0.35% unweighted on smooth roads.) There was some overload, however, on very highly modulated tapes (such as metal tapes from digital originals) which played acceptably on other systems.

On the whole, the Chrysler-Infinity system gets very high marks for sound and human engineering and good marks for tape performance. It's a pity that its tuner performance doesn't live up to the rest.

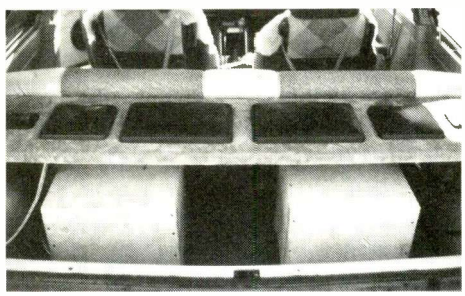
Spending the same amount of money on a custom system might or might not get you better performance. My guess is that you'd get a better tape deck and much better tuner, but the overall sound (without the benefit of the vehicle-specific equalization) might not be as good.

The **Boston** Acoustics

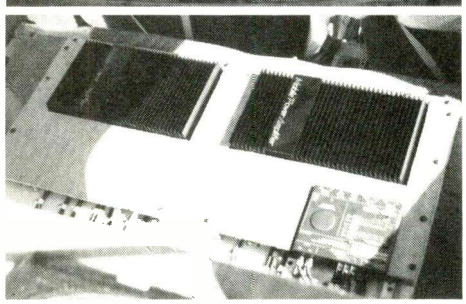
Installation of the Month Contest



Boston 761 two-way component system in doors. Each system includes a 6½" woofer, CFT tweeter and separate crossover. Tweeters are mounted in Varimount housings, and aimed toward listeners.



Boston 751 two-way component system in rear deck. System includes 5¼" woofer, flush-mounted CFT tweeter and separate crossover. Pair of Boston 790LF 6 × 9" subwoofers are mounted in center of deck. Two custom-built enclosures below deck each contain a 780LF subwoofer.



Nakamichi PA-350 and PA-300 II amplifiers, Audio Control 2XS electronic crossover mounted on panel below rear deck.

The June winner:
Allen Cripe, Seattle, Washington

Allen Cripe's sharp photographs show a well-executed system design and installation in his 1980 Dodge Colt. Note especially how the CFT tweeters in the doors, with their Varimount housings, are angled for superb imaging. Using Boston Acoustics speaker systems front and rear provides excellent coverage for all listening positions. Four subwoofers give bass reproduction down through the lowest audible octave.

The winner's dealer:
Magnolia HiFi and Video, Seattle, Washington.

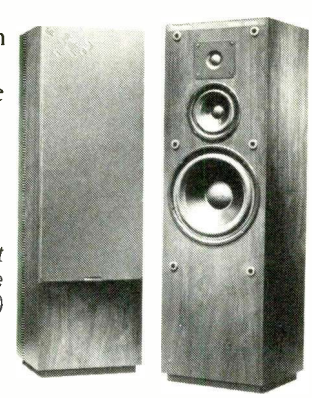
The winner's salesperson:
Bruce LeTourneau.

The winning system:
Boston Acoustics speakers: 761 two-way systems in doors. 751 two-way system in rear deck. 790LF 6 × 9" subwoofers in center of deck. Two 780LF subwoofers below deck in custom-built enclosures.
Sony: CDX-5 CD player.
Nakamichi: PA-350 35 w/ch 4-channel amplifier; PA-300II 75 w/ch 2-channel amplifier. DB-50 dual amp balancer.
ADS: P80 40 w/ch 2-channel amplifier.
Audio Control: 2XS electronic crossover.
Kimber and Monster Cable.

You have 4 more opportunities to win!

Just by submitting your photos and system description, you could also win the Grand Prize: a cruise for two to the Caribbean—even if you don't win a monthly speaker prize. Each month's winner will be announced in Audio Magazine through December, 1987.

For complete information about Boston Acoustics automotive speaker systems or this contest, call or write. Better yet, listen carefully to your present car system, then drive to your Boston Acoustics dealer and ask him to demonstrate how much better it can sound with Boston Acoustics speakers. After all, if we couldn't give you better sound for the road, we'd have stayed home.



The monthly prize: A pair of our newest tower-design home loudspeakers, the T830. ($480 suggested retail value.)

Contest Rules and Requirements

1. All speakers used must be Boston Acoustics (of course).
2. Give us your name, address, telephone number; year, make and model of your car; dealer name and address; names of salesperson and installer; brands and models of all components in your system; any other appropriate details.
3. Your photography is important. Photographs must be high quality black and white prints, minimum size 3" × 5". For the best results they should be well illuminated. All materials become the property of Boston Acoustics. No polaroids, negatives, color prints or slides accepted. Submit as many photos as you wish for best representation. Include one external view of your car.
4. Entries must be postmarked by the 5th of the month for issue two months later (ex: May 5th for month of July). Entries will be judged on appropriate use of components, quality and neatness of installation, clarity of photographs. Last entries due October 5, 1987. Send your completed form along with photographs to: Installation Contest, Boston Acoustics, Inc., 247 Lynnfield Street, Peabody, MA 01960. For a list of winners write to Boston Acoustics.
5. Grand prize winner will be chosen at random from all entries and announced in the December, 1987 *Audio Magazine*. All decisions will be made by Boston Acoustics and will be final.
6. The contest is open to all residents of the U.S.A. and Canada except employees of Boston Acoustics and CBS Inc. and their families. Void where prohibited by law.
7. Value of grand prize (cruise) is $6,000. Taxes are the responsibility of the winner. There will be no prize substitutions.

Boston Acoustics

247 Lynnfield Street Peabody, MA 01960 (617) 532-2111

A car stereo designed for people with ears. And something between them.

Odd as it may seem, most people judge how a car stereo sounds by judging how it looks.

Is it loaded with flashing lights? Littered with impressive buttons?

Then it must be a sterling example of modern technology.

This reaction, while somewhat understandable, never ceases to amaze the 326 car stereo engineers who work for Blaupunkt in Hildesheim, West Germany.

They prefer to take a more intelligent approach.

When designing car stereos, don't forget the car.

Blaupunkt might be the only car stereo company that thoroughly understands this simple fact:

A car is a horrible place in which to reproduce true high-fidelity sound.

It requires an incredible effort to overcome challenges like road noise and vibration. Shrill glass surfaces. Cushiony seats. Bad reception. Temperature variations. And the obvious principle that a driver has better things to do than to fiddle with a confusing array of buttons and knobs.

Keep this in mind, and it's easy to appreciate the difference between Blaupunkt and other leading brands.

If we don't engineer it, we don't sell it.

While other car stereo makers are content to purchase tape mechanisms, amplifiers, tuners, speaker components, and other vital equipment from outside sources, Blaupunkt engineers do almost everything from scratch.

To pack more technology into a smaller space, Blaupunkt engineers design their very own circuitry and hybrid chips.

To eliminate wow and flutter in cassette mechanisms, dynamically-balanced heavy brass flywheels are honed to within tolerances of .005 inch.

To make systems easier to operate, controls are arranged in logical fashion. So drivers can operate them by touch, without taking their eyes off the road.

It's a painstaking process. And it's repeated for every product we offer. Cassette receivers. CD players. Amplifiers. Equalizers. Speakers. Antennas. Even the connecting cables.

Few manufacturers go to all this trouble. With every feature. On every product.

Which makes it all the more remarkable that the design stage is only the first step in making a Blaupunkt.

Now comes the hard part.

Tuners are taken from mountain ranges to bustling urban areas to measure radio reception.

Antennas spend weeks in salt baths in order to measure rust resistance.

Literally hundreds of tests are conducted.

To ensure performance at 160° F above zero. To ensure performance at 5° F below zero. To ensure performance after 24 hours

The Blaupunkt Lexington SQR 46. Complex audio technology engineered to be simple.

Controls are designed to ensure ease of operation even while wearing racing gloves.

The mountains of Europe are just one of the obstacles Blaupunkt engineers have had to overcome to improve radio reception.

of punishing vibrations.

Last year alone, Blaupunkt engineers spent hundreds of thousands of hours testing.

And once a new model is approved for production, you might imagine that Blaupunkt engineers might relax a bit.

Wrong.

Every individual component is tested before assembly.

Then tested again during assembly.

Then the finished product is placed on a computer stand and tested before shipping.

But even that isn't enough.

Spot checks at random during assembly subject units to up to 400 additional tests.

Why do we do it?

If you're a rational person, you almost begin to wonder why on earth Blaupunkt goes to such incredible lengths.

Perhaps because customers have come to expect it.

Customers like you.

And customers like Lotus. Porsche. Audi. Rolls-Royce. Aston-Martin. Ferrari. Just to name a few.

But a more important reason is simply because that's the way they do things over in Hildesheim, West Germany.

Since 1932, when Blaupunkt introduced the first car radio to Europe, Blaupunkt has been obsessed with automotive sound.

It's hard to argue with the results.

Over the years, Blaupunkt has earned hundreds of patents in the field of automotive sound.

Example: ARI, a remarkable technology that brings you up-to-the-minute traffic reports in many major U.S. cities. And it's a standard feature in most new Blaupunkt receivers.

A thank you. And an invitation.

While we appreciate this opportunity to explain how well Blaupunkts are built, we are regretfully unable to demonstrate how good they sound.

For that, we invite you to visit the independent car stereo specialist near you who sells, services, and installs our products.

Check your Yellow Pages under "Automobile Radios & Stereo Systems."

Or call 1-800-237-7999, and we'll be happy to direct you.

Because frankly, while you may be surprised by how much goes into a Blaupunkt, you'll be even more amazed by what comes out.

Standard in VW and BMW (Europe), and worldwide in Ferrari, Porsche, and Audi.

Blaupunkt technicians in specially equipped vans cover the globe to test products.

BLAUPUNKT

BOSCH Group

Why do Blaupunkt products perform so superbly? They're designed to work together. We engineer everything ourselves. Most manufacturers don't.

Enter No. 9 on Reader Service Card

KEN POHLMANN

THE KINDEST CUT

Illustration: Michael A. Donato

Manufacturing CDs is very easy. All you need is one or more disc mastering systems to produce CD masters, injection molding machines to form the disc substrate, metalizing systems to apply the reflective coating, spin coaters for the top acrylic layer, printing machines for labelling, quality control to spot problems, and packaging machines to put discs in jewel boxes. You also need a few hundred skilled workers and a couple thousand square feet of clean rooms in which to put them and the machines. A "clean room" involves more than a good vacuuming. CD manufacturing clean rooms are about 1,000 times cleaner than hospital operating rooms, which in turn are about 100,000 times cleaner than my desk.

After a year of planning, six months of construction, six months of debugging, and $10 million to $20 million worth of investment, it is very easy to make a Compact Disc. What's the big deal? You are only mass-producing objects with a spiral of precisely arranged pits—2 or 3 billion of them, each the size of a bacterium.

Irony aside, CD manufacturing is tricky and expensive. That's why a CD pressing plant may charge more than $1,000 to master a disc and $3 for each disc manufactured (including the jewel box). Given this high initial cost, it is not surprising that a disc costs more than $15 by the time it reaches you. That bottom-line price is why CD lovers everywhere should stay tuned in to CD manufacturing technology. As new technology is developed, efficiency should rise and costs should fall—which should result in better disc availability and lower prices.

The latest piece of CD manufacturing news comes, curiously, from a company renowned for its work with LPs: Teldec Schallplatten GmbH, a record company with headquarters in Hamburg and laboratories in West Berlin. Although my colleagues Bert Whyte, B. V. Pisha and George Alexandrovich, and Leonard Feldman have previously described Teldec's Direct Metal Mastering process (December 1986 and April 1987 issues), I think the DMM technology is so innovative that it deserves yet another look. But first let's review analog LP mastering, from which DMM-CD is derived.

Conventional analog LP mastering starts with a master disc made of aluminum, coated on one side with a lacquer material made of cellulose nitrate, plasticizers such as castor oil, and dyes. A heated cutting stylus, its motions modulated by the input audio signal, chisels the spiral groove on the lacquer. A silver layer is applied to the master lacquer, and then the disc is electroplated with nickel. This new metal master is electroplated again to form a metal "mother." A final electroplating process results in stampers which press the vinyl disc.

Teldec is famous for its DMM technology for LPs, a process in which the groove is cut directly into copper using a diamond cutting stylus. Since copper is much harder than the lacquer paint on conventional LP masters, the DMM groove has sharper definition and is not subject to the effects of time and temperature. DMM also eliminates the need for silvering, a problematic process, as well as the first electroplating step.

Masters cut with DMM yield LPs in which groove echo is virtually eliminated, groove noise is reduced, high-frequency detail is enhanced, S/N is increased by up to 10 dB, and playing time may be increased by up to 15%. It may be no coincidence that about one-third of the first 100 LPs on a recent *Billboard* "Top Pop Albums" chart are DMM discs. These include the live Springsteen album, Paul Simon's *Graceland*, and Steve Winwood's *Back in the High Life*.

Now Teldec has announced a DMM-CD process for producing Compact Disc masters. They claim lower investment and production costs compared to conventional CD mastering systems employing photoresist methods. Unlike DMM-LP mastering, DMM-CD will not yield a higher fidelity CD, but Teldec claims that their process results in fewer bit errors on the master.

A conventional photoresist CD-mastering lathe uses a laser beam to expose a photosensitive layer on a glass plate. When the layer is developed, the pit structure appears. Metalization techniques (similar to those used for LPs) yield the metal molds which are used to replicate discs via injection molding of polycarbonate plastic.

The circular spot the laser projects on the photoresist layer, and the photoresist development itself, result in a pit with rounded contours. Likewise, the finished CD has rounded pits with

VANTAGE

PERFORMANCE COUNTS.

THE THRILL OF REAL CIGARETTE TASTE IN A LOW TAR.

9 mg. "tar", 0.7 mg. nicotine av. per cigarette by FTC method.

SURGEON GENERAL'S WARNING: Quitting Smoking Now Greatly Reduces Serious Risks to Your Health.

CD players' lasers must respond the same way to embossed pits as they do to photo-etched pits, and Teldec says they will.

a depth approximately one-quarter the wavelength of the pickup's laser beam. This laser beam is reflected with high intensity when it strikes the mirror-like disc surface between pits. When the beam strikes a pit, the round trip in and out lengthens the beam's path by one-half wavelength, causing phase cancellation and reducing reflected-light intensity. Thus, binary data is read from the disc.

It is crucial that CDs replicated from a Teldec master be playable on regular CD players. In other words, the pickup's laser beam must respond the same way to pits formed by embossing as it does to pits created by photoresist methods. If you take a close look, the embossed pits produced by the Teldec process look a lot like analog record grooves. The cross-section is a "V" with walls at a 45° angle. Teldec determined the correct stylus angle and optimized the speed with which the cutting stylus moves so that the resulting pits would modulate the pickup's laser beam with the same intensity and almost the same phase characteristics as the pits from conventionally mastered CDs. Teldec states that a player pickup built according to the CD standard cannot distinguish between the two types of pits.

There is another difference between these pits. The pits on a disc replicated from a conventional master have a smooth profile because the polycarbonate cannot conform exactly to the mold geometry. When a pit is embossed, however, a ridge is created along the sides of the pit. A stamper with these ridges is said to encourage polycarbonate flow during injection molding, producing relatively sharp pit edges on the finished disc. Teldec hopes that this will result in cleaner finished pits and fewer data errors.

According to Teldec, a primary advantage of DMM-CD mastering is its indifference to dirt. The conventional mastering process requires a clean-room environment because the slightest speck of dust would disrupt the laser beam on its path to the master disc. With DMM, the stylus is in mechanical contact with the master disc and indeed exerts tremendous pressure when it embosses a pit. Surface contamination (within reasonable limits) is pushed aside when the stylus

ON RE-DEFINING DYNAMIC RECORDING.

By combining Dolby HX Pro headroom expansion and DYNEQ dynamic equalization, the new NAD 6300 Monitor Series cassette deck achieves an astounding 80dB signal-to-noise ratio. But that's only part of the story.

Like all the components in our new Monitor Series, the model 6300 is an ultra high performance cassette deck that will challenge the best in the market. In fact it's the only recorder in the world which will make a cassette copy of any compact disc with virtually no dynamic loss. Like all NAD products, it's a no-nonsense component designed to deliver the highest possible *real world* performance for a very reasonable price. It's a combination of leading-edge technology and of trusted ideas we've used for years. It's dozens of subtle features blended with several truly significant breakthroughs. A very few examples. . . .

- The 6300 is the only cassette deck that combines the Dolby* HX Pro and the DYNEQ** system, thus delivering unprecedented high frequency headroom.
- Stunning 80dB signal-to-noise ratio approaches the standards set by digital recording.
- An exclusive NAD circuit which, when activated, allows you to make tapes specially processed for optimum performance in a car or portable stereo system.
- NAD's elegant "Play Trim" circuit allows you to correct high frequency losses that are common with pre-recorded tapes or cassettes recorded on another machine.

- A recording system that uses three heads for wide frequency response and dual discrete Dolby C circuits for accurate, off-the-tape monitoring.
- Ergonomics of the remote control offer logical placement of the most used functions and a unique upright design for ease of operation.
- The tape transport uses dual capstans of differing diameters so that they rotate at slightly different speeds, practically eliminating resonance induced wow.

In short, what makes the NAD 6300 a world class cassette deck . . . is a long story. To learn more about it, write for our Monitor Series brochure. Better yet visit your authorized NAD dealer—and hear the results of a thousand design decisions, correctly made.

*Registered trademark of Dolby Laboratories. **Patented and registered trademark of Tandberg Audio.

The Monitor Series From NAD

For more information send this coupon to NAD (USA) INC. | 575 UNIVERSITY AVENUE | P.O. Box 98 | NORWOOD, MASSACHUSETTS 02062

NAD 5300 Compact Disc Player
NAD 6300 Cassette Deck
NAD 4300 Stereo Tuner
NAD 3300 Integrated Amplifier

Name
Address
City State Zip

Enter No. 29 on Reader Service Card

An advantage of DMM-CD is its indifference to dirt. Contamination is pushed aside as the stylus punches its data pits.

punches its pit. Teldec engineers tell me that their prototype CD mastering system is operating in their lab next to an open window overlooking urban Berlin—not particularly clean!

In comparison to photoresist CD mastering, DMM seems relatively straightforward. And the most straightforward solution to an engineering problem is usually the best solution, because it is the most cost-effective. Convinced of the cost-effectiveness of DMM-CD, Teldec hopes that some mastering studios will invest in the new system in the same way that some LP mastering studios have their own analog cutting lathes. This would be a big step forward for CD manufacturing, a process hitherto confined to high-tech factories. However, the price tag for DMM-CD, estimated at $500,000 to $750,000, will deter most studios from taking the plunge. Even though such overhead costs as clean-room construction and maintenance are reduced, CD mastering will remain a tricky and relatively expensive operation. Given the engineering demands of CD mastering, it is hard to believe that any system will fundamentally change this.

In addition, I think there is a philosophical difference between CD and LP mastering. LP mastering is widely regarded as a final part of the mixing process, a stage when last-minute technical and even artistic decisions may be made. CD mastering, on the other hand, is strictly a data transcription process; all decisions have already been made. Since no production decisions are involved in CD mastering, it is, arguably, best left to the mastering technician at the CD factory.

Where will the Teldec system fit in? It offers an alternative for manufacturing facilities ready to expand their mastering capacity to meet demand. The Teldec system certainly appears to be more cost-effective than the Sony and Philips mastering systems. It may also be competitive with several highly efficient photoresist mastering systems recently developed by U.S. companies such as the Optical Disc Corp.

Of course, there's no telling how the magical properties attributed to DMM-LP mastering will help the industry's perception of DMM-CD when it becomes available this summer. That may be the single biggest factor contributing to its success or failure.

If nothing else, DMM-CD is an ingenious and cost-effective system that contributes to the increasingly vigorous industry of new CD manufacturing equipment. In short, second-generation CD manufacturing technology is on the way. In the same way that second- and third-generation player technology helped decrease player cost while improving performance, this new manufacturing technology should help do the same for discs.

For those of us with dirty rooms, there may be hope after all. A

THE NEW CONCORD CX70.

IT OUTPERFORMS OTHER CAR STEREOS EVEN BEFORE YOU TURN IT ON.

As the long acknowledged leader in high fidelity performance for the ear, it seems only fitting that Concord should also be the best at satisfying the need of the discriminating eye and hand as well.

Presenting the new Concord CX 70. One of seven CX series units, designed to deliver not just an unsurpassed audio experience, but a superb visual and tactile one. Designed with an unparalleled array of high performance audio features, high tech design, and high performance handling.

HIGH PERFORMANCE VIA HIGH TECHNOLOGY.

Consider the CX series tuners. Their microprocessor controlled circuits seek out and lock onto FM and AM signals that lesser systems miss altogether. Working in conjunction with Concord's FNR™ FM noise reduction circuitry these advanced tuners provide astounding reception.

Consider next the Concord tape section. Many audiophiles feel it to be the best automobile unit in existence. Stereo Review called the performance of a Concord unit "uncommon even among home cassette decks." This is not hyperbole at work, but high performance. Credit for such performance in the CX series units goes to our Dual Azimuth Matched Phase™ Tape Head. In addition, our servo controlled tape motors ensure rock steady tape handling and uncommon ruggedness and reliability.

OUTPERFORMANCE FEATURES

Dual Azimuth Matched Phase™ Tape Heads
Electronic Servo Controlled Tape Drive Motor
Full Logic, Soft Touch Tape Deck Controls
Advanced Tape Noise Reduction Systems
Microprocessor Controlled Digital Tuner
FNR™ Noise Reduction for FM
High Powered Built In 4 Way Amplifiers
Low Distortion Preamp Level Facer
Bass and Treble EQ/Tone Controls
Preamp Level Biamplification Crossover
Fletcher-Munson Loudness Contour Circuit

ADDING POWER INSTEAD OF REPLACING POWER.

Focus your attention now on our legendary amplifiers. How does a 2/4 way amp with 50 watts total maximum power sound? Very, very good. No tape deck amplifier gives you more power.

With Concord's low distortion preamp level fader and preamp outputs adding even more power is easy. You can configure and control a system that delivers punch with precision. And because the amps in the CX 70 can be "bridged" into 2 channels, every watt they produce can still be used when you add a power amp. So you're really adding power, not just replacing it.

Concord's new CX series. Designed to perform like no other car stereo in the world. Every element, from the tri-color display on the front to the precision components deep inside it, was designed with a single goal – high performance.

Put it all together with an ultra contemporary flat face design and a security removable chassis, it's easy to see that the Concord CX series outperforms other car stereos even before you turn them on.

CONCORD®
Anything else is a compromise.

Concord Systems, Inc., 25 Hale Street, Newburyport, MA 01950
(617) 462-1000 (800)-225-7932
Marketed in Canada by:
PACO Electronics Ltd.
20 Steelcase Road W., Unit 10
Markham, Ontario L3R 1B2
(416) 475-0740

A Harman International Company

KAPPA : THE DEFINI

Kappa is a concept and a group of products. Five unique drivers and four loudspeakers that incorporate them. Kappa speakers differ radically from conventional speakers in appearance, underlying design philosophy, and certainly in performance.

Conventional engineering wisdom has it that a single element loudspeaker is theoretically ideal. Theoretically, yes; practically, no. Our extensive research has convinced us that an array of purposely bandwidth-limited drivers, when properly crossed over, yields superior results.

The *Kappa* woofer cone is a rigid, yet inert, composite structure that's injection molded from graphite fiber and polypropylene. It is extremely low in distortion, even at maximum excursion, and exhibits a remarkable absence of midrange coloration. It provides the most accurate non-servo bass reproduction available.

For the frequency range of 85 Hz to 700 Hz we developed a unique transducer which we call Polygraph™. This 5" dome-shaped driver is made of very thin polypropylene supported by an extremely light, stiff lattice of graphite. Its transient response in the midbass and lower midrange — the area of most musical fundamentals — rivals that of the most expensive planar drivers. Its power handling and dynamic range surpass them.

A low mass, highly damped 3" dome constructed of soft polypropylene handles the midrange. Its edge wound voice coil contributes to high electrical efficiency. This driver not only mates beautifully with the Polygraph, but can go very low in our 3-way systems and provides a sense of utter coherence through the critical midrange.

Two new EMIT™ drivers complete the ensemble. The first, a considerably improved version of our famous EMIT,™ features reduced diaphragm mass and ultra-high gauss neodymium magnets for high frequency response beyond 44kHz. The second, our new SEMIT™ supertweeter is employed only in the flagship 9k loudspeaker and has a smaller aperture for maximized dispersion in the top octave.

All four *Kappa* series loudspeakers utilize computer optimized crossover networks that are hard-wired with audiophile 12 gauge cable and the finest passive components. All cabinets minimize diffraction with curved edges, special grills and absorptive treatments on the front baffles. And our top rated 8*k* and 9*k* speakers radiate sound front and back in the higher frequency ranges for optimal imaging and depth presentation.

At Infinity we've never let reliance on traditional materials confine us to traditional designs. With the help of modern technology and some rather revolutionary manufacturing processes of our own devising, we've succeeded in overcoming the cost / performance limitations of established designs.

Whether your tastes lie with Mahler, Coltrane or Streisand, we know you'll find that *Kappa* provides the definitive performance.

Infinity®

We get you back to what it's all about. Music.

Infinity Systems, Inc. 9409 Owensmouth Avenue, Chatsworth, CA 91311 (818) 709-9400
H. Roy Gray Ltd., 14 Laidlaw Blvd., Markham, Ontario, Canada L3P1W7 (416) 294-4833

A Harman International Company.

TIVE PERFORMANCE

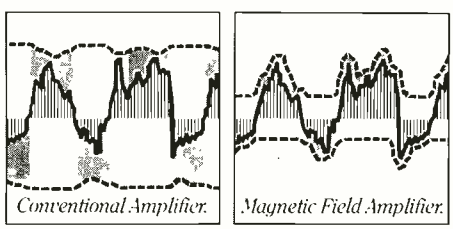
RECOG

Why the Carver M-500t Magnetic Field Power Amplifier has helped begin an industry trend and how it has stayed ahead of its inspired imitators.

Twice in the last decade, Bob Carver has taught the high fidelity industry how to make amplifiers that give you better performance and value. Both times his bold lead has attracted followers. Still, as evidenced by the current release of the M-500t, Carver sets standards yet unequaled in the audio community.

With its astonishingly high voltage/high output current and exclusive operation features, it is a prime example of why Carver remains the designer to emulate:

- Continuous FTC sine-wave output conservatively rated at 250 watts per channel.
- Produces 600 to 1000 watts per channel of dynamic power for music (depending on impedance).
- Bridging mode delivers 700 watts continuous sine-wave output at 8 ohms.
- High current Magnetic Field power supply provides peak currents up to ± 100 amps for precise control of voice-coil motion.
- Designed to handle unintended 1 ohm speaker loads without shutting down.
- Equipped with infinite resolution VU meters.



Solid line: audio output signal.
Broken line: power supply voltage.
Shaded area: wasted power.
Vertical lines: power to speakers.

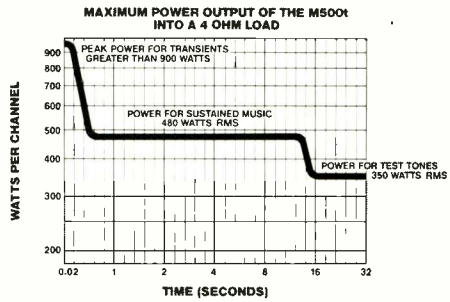
POWER EXPRESSED BY THE DEMANDS OF MUSIC.

The Carver M-500t Power Amplifier responds to musical transients with better than 600 watts per channel of instantaneous peak power through 8 ohm speakers. Well over 900 watts per channel into 4 ohm speakers.

And yet its Federal Trade Commission Continuous Average Power Rating is 250 watts per channel into 8 ohms.

The gulf between the two power ratings represents Bob Carver's insistence that amplifier design should fit the problem at hand. That problem is reproducing music with stunning impact, not simply satisfying a sine-wave test which doesn't even include speakers or sound sources. Hence the seeming gulf between the two ratings.

Bob reasoned that since music is composed of three basic types of power waveforms, those types of waveforms are what an amplifier should be designed to satisfy.



The Carver M-500t delivers massive power at three important output levels.

First there are instantaneous peak transients – the sudden smash of cymbals, drums, or the individual leading edge attack of each musical note. While these waveforms last less than 1/100 of a second, they form the keen edge of musical reality which must be present if you are to realize high fidelity. Though momentary, they also demand a tremendous amount of amplifier power.

Directly following instantaneous transients are combinant musical crests of demand that come from multiple instruments and their harmonics. These long term power demands may last up to several seconds but usually come and go in less than a second. And yet they can tax anything but an exceptionally powerful amplifier.

The third type of power demand is represented by the average power contained in the music, and is approximately one third to one half of the FTC continuous power rating.

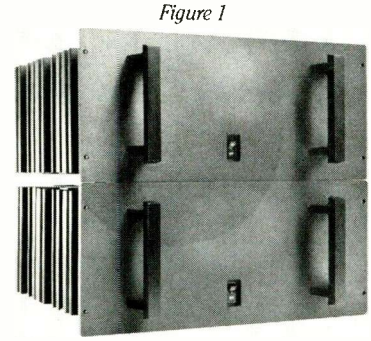
At extremely high output current levels, the Carver M-500t not only delivers over 700 watts of instantaneous peak power for instantaneous transients, but can deliver over 600 watts RMS of long term power for demands lasting up to several seconds. **The M-500t provides more power, more current and more voltage than any comparably priced amplifier ever offered.**

THE MAGNETIC FIELD AMPLIFIER VS. CONVENTION.

Audiophiles, critics and ultimately other manufacturers have each accepted the wisdom of Bob Carver's fresh approach to delivering power in musical terms. Yet only Carver has so elegantly translated theory into practice.

Rather than increase cost, size and heat output with huge storage circuits, Magnetic Field Amplification delivers instantaneous high peak and longterm power from a small but powerful Magnetic Field Coil. The result is an amplifier capable of *simultaneous* high current and high voltage that can do sonic justice to the dynamics of Compact Discs and audiophile records in a compact, cool-running design. An amplifier costing considerably less than the ultra-esoteric models which figured significantly into the genesis of its circuitry. For a reprint of the full story of its development as well as a catalog of Carver high fidelity audio components please call or write to us.

Figure 1



This $7,000 pair of esoteric amplifiers figure significantly into the heritage of the M-500 "t" version circuitry.

Figure 1 above shows a $7,000 pair of ultra-esoteric mono amplifiers. No expense was spared on their admittedly magnificent but still conventional design and construction.

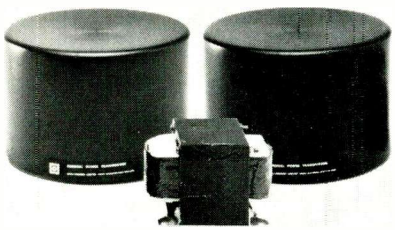
Figure 2 shows the massive toroid output transformers contained in these presitgious audiophile designs. At 10% regulation, their output current is ± 50 amperes.

All conventional amplifiers are condemned to using this type of design.

NITION.

Figure 2 also shows the patented Magnetic Field Coil employed in the Carver M-500t. Its output current is ± 100 amps at 10% regulation!!!!

Figure 2



Over 40 pounds of toroid coils put out half the current of a single six pound, four ounce Magnetic Field Coil.

DISTINGUISHING FEATURES OF THE CARVER M-500t.

Power is mandatory for dynamic impact and musical realism. And yet power requires control and finesse. While the Carver M-500t isn't the only amplifier to deliver adequate output, it is one of the few that tempers force with protection circuits beneficial to both the amplifier and your loudspeaker system.

◆ *These include DC offset, short circuit power interrupt as well as two special computer-controlled speaker monitor circuits which protect against excessive high frequency tweeter input and an overall thermal overload.*

◆ *The Carver M-500t continuously displays power output through dual, lighted infinite resolution VU-ballistic meters. Meters which can react to musical transients as brief as 1 millisecond.*

◆ *The M-500t is quiet. Inside and out. Its circuitry has the best signal-to-noise ratio of any production amplifier. Better than −120dB. And, in spite of its massive output capability, the M-500t does not require a noisy fan to dissipate heat. Thanks to the cool running Magnetic Field Amplifier circuitry.*

◆ *No other amplifier in the M-500t's price or power ranges is capable of handling problematic speaker loads as low as 1 ohm. Whether required by certain brands of speakers, or inadvertently derived by pairing too many low impedance speakers at one set of output terminals, all conventional amplifiers simply shut down or blow their fuses when faced with this condition.*

◆ *In stereo use, both channels of the M-500t can actually borrow from each other during unequal output demands. In addition, Carver amplifiers have pioneered phase inversion circuitry which takes advantage of the in-phase (mono) characteristics of bass to essentially double available power supply current at low frequencies.*

◆ *Finally, the Carver M-500t can be used in a bridged mode as a 700 watt RMS per channel mono amplifier without any switching or modification.*

MUSIC IS THE FINAL PROOF.

Were you to buy a power amplifier solely on features and performance specifications, painstaking comparison would inevitably lead you to the Carver M-500t.

But we are sure that your final judgment will be based on musicality. It is here that the M-500t again distinguishes itself.

Bob Carver has carefully designed the M-500t to have a completely neutral signal path that is utterly transparent in sonic character. The result is more than just musical accuracy. It means a total lack of listener fatigue caused by subtle colorations sometimes exhibited by conventional amplifier designs, regardless of their power rating.

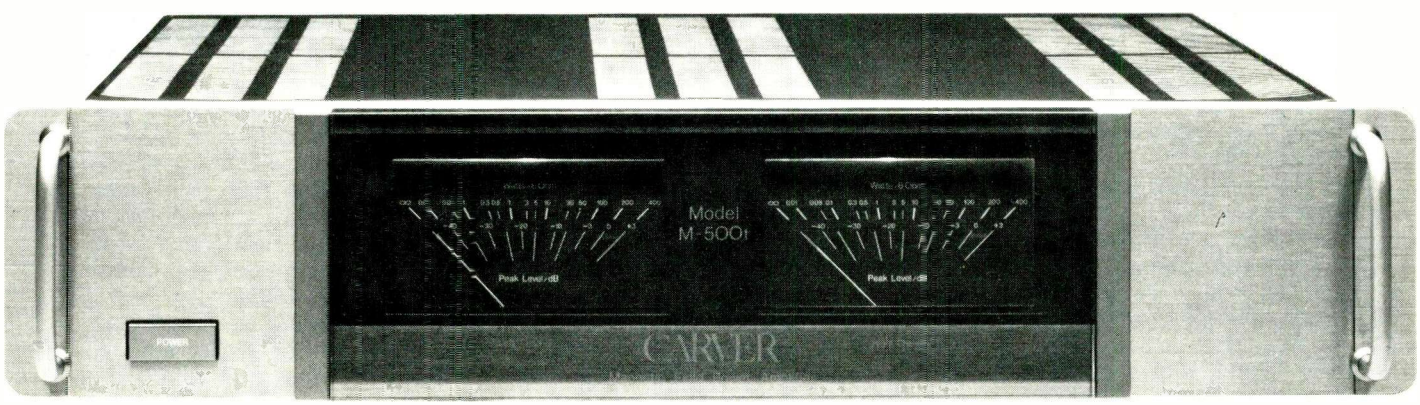
It means a veil is lifted between you and your musical source as the most detailed nuances are revealed with realism, believability and delivered with stunning impact.

VISIT YOUR CARVER DEALER FOR A SURPRISING AUDITION.

We invite you to audition the Carver M-500t soon. Against any and all competition. Including those who are only now embracing the principles which Bob Carver has refined over the last several years.

We doubt that you will be surprised when the M-500t lives up to the claims made in this advertisement. What will surprise you is just how *affordable* this much power, musicality and accuracy can be.

SPECIFICATIONS: *Power*, **251 watts per channel into 8 ohms 20Hz to 20kHz, both channels driven with no more than 0.15% THD.** *Instantaneous Peak Power*, 1000 watts into 2 ohms, 950 watts into 4 ohms, 600 watts into 8 ohms. *Longterm RMS Power for Music*, 500 into 2 ohms, 450 into 4 ohms, 300 into 8 ohms, 1000 watts bridged mono into 4 ohms, 900 watts bridged mono into 8 ohms. *Bridged Mono RMS Continuous Power*, 700 watts continuous into 8 ohms. *Noise* – 120dB IHF Weighted. *Frequency Response*, ±0-3dB 1Hz- 100kHz. *Slew* Factor, 200. *Weight*, 25 lb. Finish, light brushed anthracite, baked enamel, black anodized.



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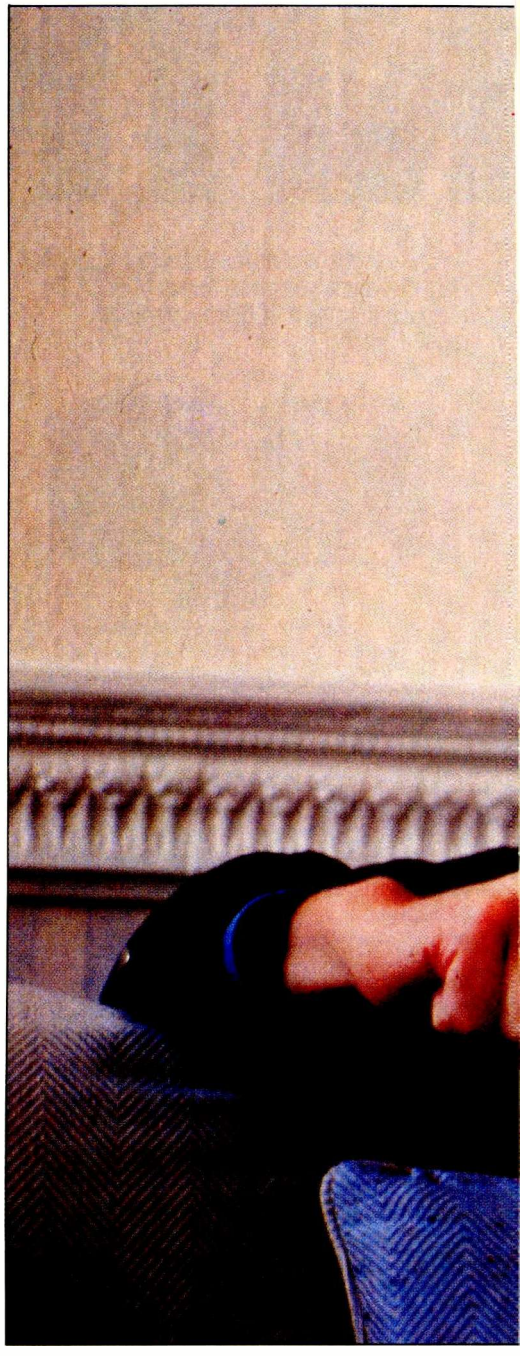
GEORGE MARTIN

The Beatles' producer tells the true story about why the first Beatles' CDs weren't issued in twin-track mono.

SUSAN BOREY



George Martin prefers not to look back. As a rule, he'd rather dwell on what's taking place today and what he might make happen next week. About six months ago, however, The Beatles' first producer was thrust into the past when EMI Music Ltd. solicited him to give a quick stamp of approval to the first four Beatles records to be released on Compact Disc (see our review elsewhere in this issue). Finding the test tapes of *Please Please Me*, *With The Beatles*, *A Hard Day's Night*, and *Beatles for Sale* to be, in his words, "dreadful," Martin agreed to go back into the Abbey Road Studios in an effort to do the music justice.

In the process, Martin has had to sail a narrow course between the twin perils of doing too little and doing too much, showing the recordings in the best possible light while sticking to the truth of the originals. Achieving the latter has meant living with the shortcomings of the recording technology of the early '60s: Martin's first major decision was to convince EMI to release the four discs in mono, as they were originally recorded. This choice has caused a stir, but Martin remains adamant that it was the right thing to do.

Today, Martin remains involved with the CD release project, which will see eight more discs brought out by the end of this year. He is also working on a 24-part television series based on his book, *Making Music*. In the middle of a workday that had started at 7 a.m., he recalled his early studio experiences with The Beatles and reflected on the problems that technology has solved for the music industry—and those it has created. *S.B.*

Did any of The Beatles have a hand in putting their music out on CD?

No, not at all.

Do you know how any of them feel about it?

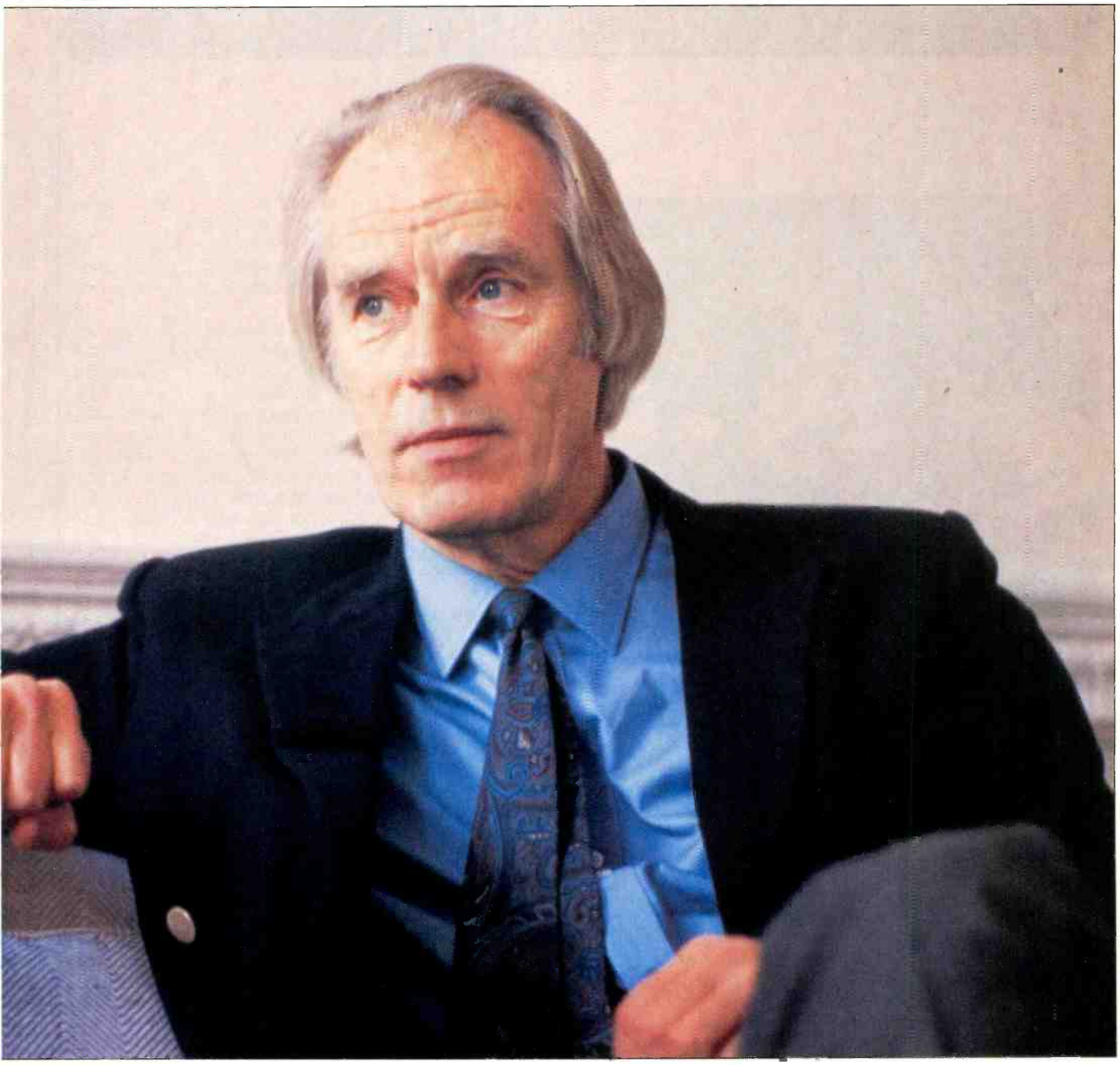
Well, I haven't seen George because he is in Los Angeles. I had dinner with Paul last Friday; he has just gotten back from holiday. I asked him what he thought about the CDs. He hadn't heard them, but he said he's delighted they're putting them out this way.

How satisfied are you with the results so far?

I'm delighted. I'm very pleased with what I've heard so far. I think I shall be more delighted as we go through. Those early ones are very interesting, and historical, but I think that the real value of CD is going to be when you hear *Revolver*, *Pepper*, and beyond.

How did you become involved with putting The Beatles on CD?

In December [1986], the managing director of EMI rang me up and said they were going to put The Beatles out on CD, and would I like to hear them? I said yes, and they came along and played me the tapes that they intended to put out. I thought they were dreadful, and I told them so. I said, "Okay, you have come to me and asked for my opinion, and I've given it to you, but I can't be quiet about it. If you say you're going to go ahead with this, I'm going to tell people I think they're terrible." So I put the managing director on the spot, and he said, "Well, what do you suggest we do?" I said, "Well, get some jolly good new ones," because he was planning to put out these first albums, *Please Please Me* and *With The Beatles*, which were turned out on twin-track, in that ghastly fake stereo which was perpetrated without my authority years ago. You had all the voices on one side and all the backing on the other, and all the dirt in between them. They were never intended to be issued like that. They were mono records done on a twin-track machine,



Photograph: Pete Vernon

and I told them so. I said, "If you want to do The Beatles a favor, issue them as they were made to be, in mono." They said, "You can't have a CD in mono," and I said, "That's the way to go." I spoke to Bhaskar Menon, who's the head of Capitol, and he agreed with me completely. And that's how they were put out.

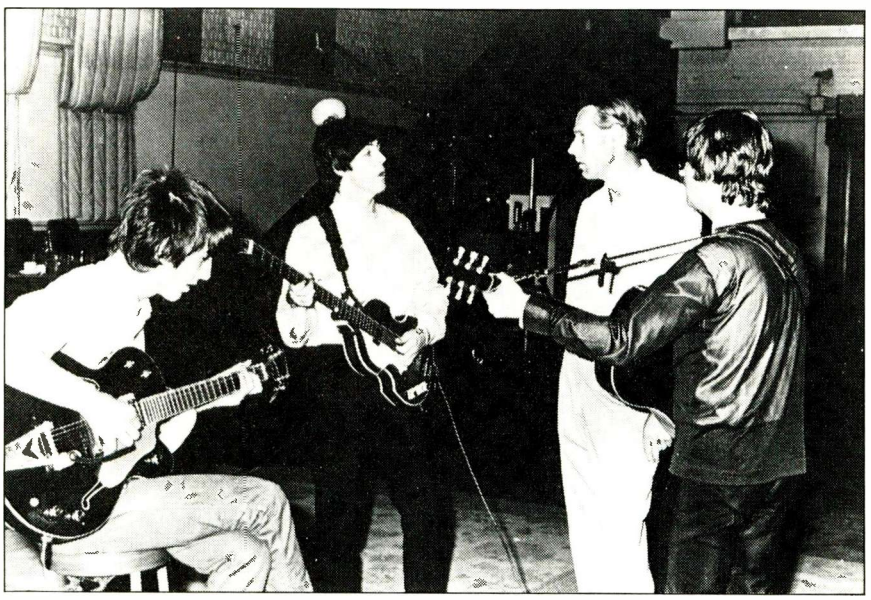
Having done that, EMI then asked me if I would take a look at the quality of the albums from then on. I've been listening to them and actually remixing—not to change them, but just to clean up the sound.

How can you clean up the sound, by re-equalization . . .?

Yes, and by actually turning down the tracks when there is dirt on them. In those early days, when we just put out mono, we didn't pay a tremendous amount of attention to stereo. I was learning how to handle stereo in those days too. Some of those early stereo mixes I did were rubbish, but I didn't think anybody was listening. In 1963, the percentage of stereo players in this country was about 4%. Everybody listened to popular music on mono back in those days.

Has there been a big difference between what you've had to do with, say, With The Beatles *and with* Rubber Soul?

Those first LPs were never intended to be issued in that ghastly fake stereo, with voices on one side and the backing on the other.



Well, I didn't do anything with the first four. I did do something with *Rubber Soul* and with *Help*, which was in rather awful stereo. I had to do something to tidy up the low end of the bass and the leaking of sound from one track to another. In the early days we didn't use headphones for dubbing. We used a loudspeaker, so the separation went right out the window. For example, when we listened to "Yesterday" again—as you know, that was done with just Paul playing guitar and singing at the same time. The performance was of him playing and singing two times, and then I went away and wrote the string quartet. So the 4-track consists of Paul's voice, Paul's guitar on another track, strings on another track. On the fourth track, I attempted to gild the lily, if you like, to get Paul to sing a better performance than he did when he sang with the guitar. In fact, I did use a little bit of that fourth track, but only in one tiny sequence, the last four notes of the first chorus. It was a sequence that I thought I had deliberately double-tracked. But it wasn't double-tracked! When I went back and listened to the tapes, I said, "No, you didn't double-track. What you did was use a little bit of the alternative voice track." And on the alternative voice track, I found that the leakage from the speaker playing the original track at the same time he is singing the new one gives the effect of double-tracking. I took out the main vocal and brought in the alternative, but the main vocal is still in the background.

Do you think that the new Beatles CDs are valuable in part because they bring the listener closer to the recording process, to hear how the recordings were produced?

I think the interesting thing is that you are hearing them now as I heard them in the studio years and years ago, without anything getting in the way, without the fog of bad reproduction which we've always had. Now you hear the full range, you hear everything, all the mistakes included.

I have heard you say that making a record is like painting a picture. Can you draw CDs into this analogy?

Yes, I can. Because of the nature of the earlier recordings, I think they were like a black and white picture. I think mono gives you that effect. As we got better, as I got better at producing The Beatles, the albums took on more life. I think that *Pepper* became much more colorful. We used the stereo picture with *Pepper*. If you shut your eyes, you can see things, or at least *I* can. On CD, the effect is even more dramatic. You don't get a flat picture, you get depth as well, almost a 3-D effect.

Does the clarity of the CD present any dangers for the producer? Is the producer more exposed?

Probably, but I don't think that's a danger. I think that as far as you're doing the work, you ought to be out there. You shouldn't be frightened.

Do you feel pressured to keep up with technology by making use of everything that's available to you as a producer?

The pressure's always been there to keep up. It hasn't worried me, particularly, for I haven't found it very difficult to keep up. But I think that, in fact, technology has overtaken my desires. In my studio in Montserrat, I've got two Mitsubishi 32-track digital recorders which are linked together, giving a total of 64 digital tracks. I've got a board that can cope with that, and all the toys that can go along with it for laying down guide tracks, drumbeats, syncing back in again, SMPTE codes, all the paraphernalia of modern technology. Which makes it easier to make records than it's ever been before, but it doesn't make better music. Better music's got to come from the heart, it's got to come from creativity. I don't think it's necessary to have the extremes of technology. It's like sitting in a comfortable chair, you know, instead of sitting in a hard-back. It doesn't make you any fitter, probably less.

Obviously, the process of making records has drastically changed since the time of the earliest Beatles recordings. Do you ever miss those times?

Do I yearn for those 4-track days? The only thing I yearn for is recordings that are more spontaneous. Today everything is so clinically controlled, and everything is so meticulously accurate. Rhythms are impeccable, ensembles are absolutely precise, intonation is perfect, not because you hear it so, but because you see it on a meter. This worries me because I think the heart is going, and I'd like to get back to humanity and mistakes.

Is there something bad about the modern process of recording, whereby members of a band don't have to be in the studio at the same time to make an album?

I think there's too much of what I call layer-caking, you know, people not playing together, and technology enables us to do this. It encourages us to do this, which I think is a shame. I use technology. I have a computer here which I use a lot. I send messages, type letters, keep files, and so on. And I've got a computer at home which I

think is invaluable to keep myself tidy, but *I* use *it*, it doesn't use me. I think that a lot of technology tends to tell people what to do. One of the things that I've gotten to know about is performance—people playing together, making music. The interplay of people is so important. We're forgetting to do that, and I think it's a shame.

What do you think about Compact Discs in general?

I think their dynamic range is wonderful. The loud bits you can hear without hurting and the quiet bits you can hear without background noise. Recording is merely a mirror of what's going on. The CD enables us to see it more clearly. We're looking through a completely transparent pane of glass now. Before, it was pretty cloudy.

A very interesting thing: I have a friend who's got a son of 12 who is very hard of hearing. He had meningitis when he was younger. He's always had a great deal of trouble listening to music, particularly rock or pop. He could never listen to a Walkman satisfactorily. But through a CD player—and he's got a portable now—he can listen to it on headphones. He gets a great deal of enjoyment out of it and he hears much more on CD than was possible with analog tape. It's something that surprises me because I wouldn't have thought that the frequency range was that much different, particularly for his limited hearing. But it seems to work better. It isn't just a question of range. It's a question of the kind of transients that a thing is given. The sound reproduction is much more natural. I think it's delightful.

If you were recording The Beatles today, would you record them digitally?

Oh, sure. I would certainly record them digitally. I'd use all the technology that's here. But I don't think that one can look back at things and say how different they'd be. It's rather like asking, "What would Beethoven have done if he had had an 8-track machine?" Everybody uses the tools of their time. Bach used a very good organ, which was a synthesizer, you know. They only used an organ because an orchestra wasn't there.

Do you think there's some kind of coldness that can be attributed to digital recording?

A lot of people have said this, and certainly the earlier digital recordings were. I'm not sufficiently technical to describe it. You know, digital recording has an actual ceiling, whereas analog recording doesn't. Analog recording has a frequency range which just tapers off as it gets higher, and it goes up to 100 kHz, way beyond human hearing. With digital, there is absolutely nothing above 22 kHz, no frequencies at all. There are a lot of people who claim they can hear that. I think they're mistaken. Some say they can't actually *hear* 22 kHz, but believe they can hear what it does to the lower frequencies. In other words, they are listening to the frequencies at, say, 15 or 16 kHz, the top end, which are colored by the absence of what would come afterwards.

What is it that makes a recording warm rather than cold?

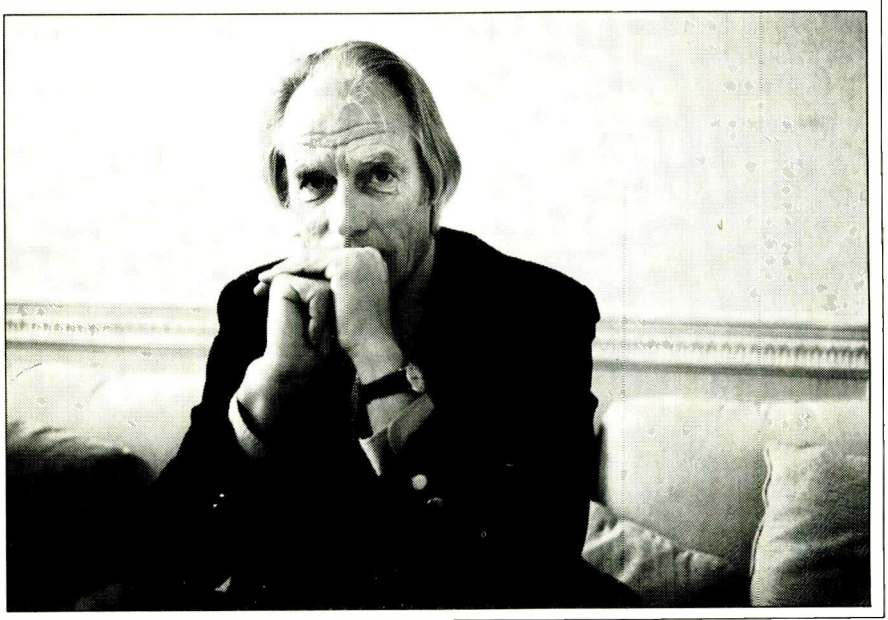
I don't know. To say it's a particular frequency would be wrong. There's no way to put it in words. It's a bit like John saying that he wanted a song to sound as though it's colored orange. It's up to you to define those things.

Do you foresee anything like the Beatles phenomenon happening again?

I do hope so. I really do hope so. I don't see it at the moment. There has been no evidence to say that, you know, Wham, or George Michael, is the new Beatles. It just doesn't add up. It's lightweight stuff.

It's awfully sad that the majority of people who are accepted as being musical giants are old men. By "old" I mean we're talking about Eric Clapton, Elton John . . . even Mark Knopfler is getting up there. But they're still giants, and they're great. Amongst the kids, the 18- to 20-year-olds, there *must* be some great talent. I wish we could find it and encourage it. There's no evidence of it happening, however. The majority of stuff coming from young people hasn't yet benefited from the background that they have. I wonder if any of them have listened to a Cole Porter song?

Yes, today I'd record The Beatles digitally. But one can't look back. It's like asking what Beethoven would have done with an 8-track.



Photograph: Pete Vernon

Audio
INTERVIEW

Lion's Pride: 30 YEARS AT BLUE NOTE

TED FOX

The bluest note of all sounded for Alfred Lion last February 2 when he died, at the age of 78, of congestive heart failure in San Diego. During three decades as the main man behind Blue Note, the greatest jazz label of all time, Alfred Lion produced some 900 records. Many producers will say they never made a record they didn't like, but perhaps none can say that with such verity as Lion.

Inspired by John Hammond's historic "From Spirituals to Swing" concert in 1938, Lion made his first recordings with two of the stars of the concert, Albert Ammons and Meade Lux Lewis. He established the reputation of his fledgling company with Sidney Bechet's classic "Summertime" and the Port of Harlem Jazzmen session. His friend and partner, Francis Wolff, barely made it out of Nazi Germany in 1939 to join him. Aided by their friend and musical adviser, saxophonist Ike Quebec, they began to document the exciting new be-bop scene in the mid-'40s. Blue Note was the first to record be-bop innovator Thelonious Monk, and at the time many thought they were crazy to do so. Lion also made records with Bud Powell and the young Miles Davis. He recognized the genius of Art Blakey and made many great Jazz Messengers records. In 1953 he hooked up with a young man, Rudy Van Gelder, who was to become the pre-eminent jazz engineer, but who at that time was recording sessions in his parents' Hackensack, N.J. living room.

In the '50s and '60s, Lion and Blue Note started or nurtured the recording careers of Horace Silver, Herbie Nichols, Lou Donaldson, Clifford Brown, Jimmy Smith, and Kenny Burrell, then Jackie McLean, Wayne Shorter, Herbie Hancock, Freddie Hubbard, Donald Byrd, and Andrew Hill, among many others. He also explored the avant-garde with Ornette Coleman, Eric Dolphy, and Cecil Taylor.

Health problems forced Lion to sell out to Liberty in 1966. Francis Wolff stayed on for a time, but Blue Note was no longer the same great company after Lion left. From the mid-'70s until the early '80s, reissue activity was only sporadic. But Lion and all jazz fans were cheered in 1985 as Capitol/EMI backed former CBS Records chief Bruce Lundvall and producer Michael Cuscuna in an ambitious revitalization of Blue Note.

In an interview that took place shortly before his death, Alfred Lion talked about the past, present, and future of his superb record company. He was a kind and gentle man in a rough business, and we can be thankful for the unsurpassable legacy of fine music he left us. *T.F.*

Meade Lux Lewis and Albert Ammons

Photograph: Frank Driggs Collection

I know you were first turned on to jazz in Berlin in the '20s, but wasn't it really John Hammond's "From Spirituals to Swing" concert in 1938 that led you to do your first recording?

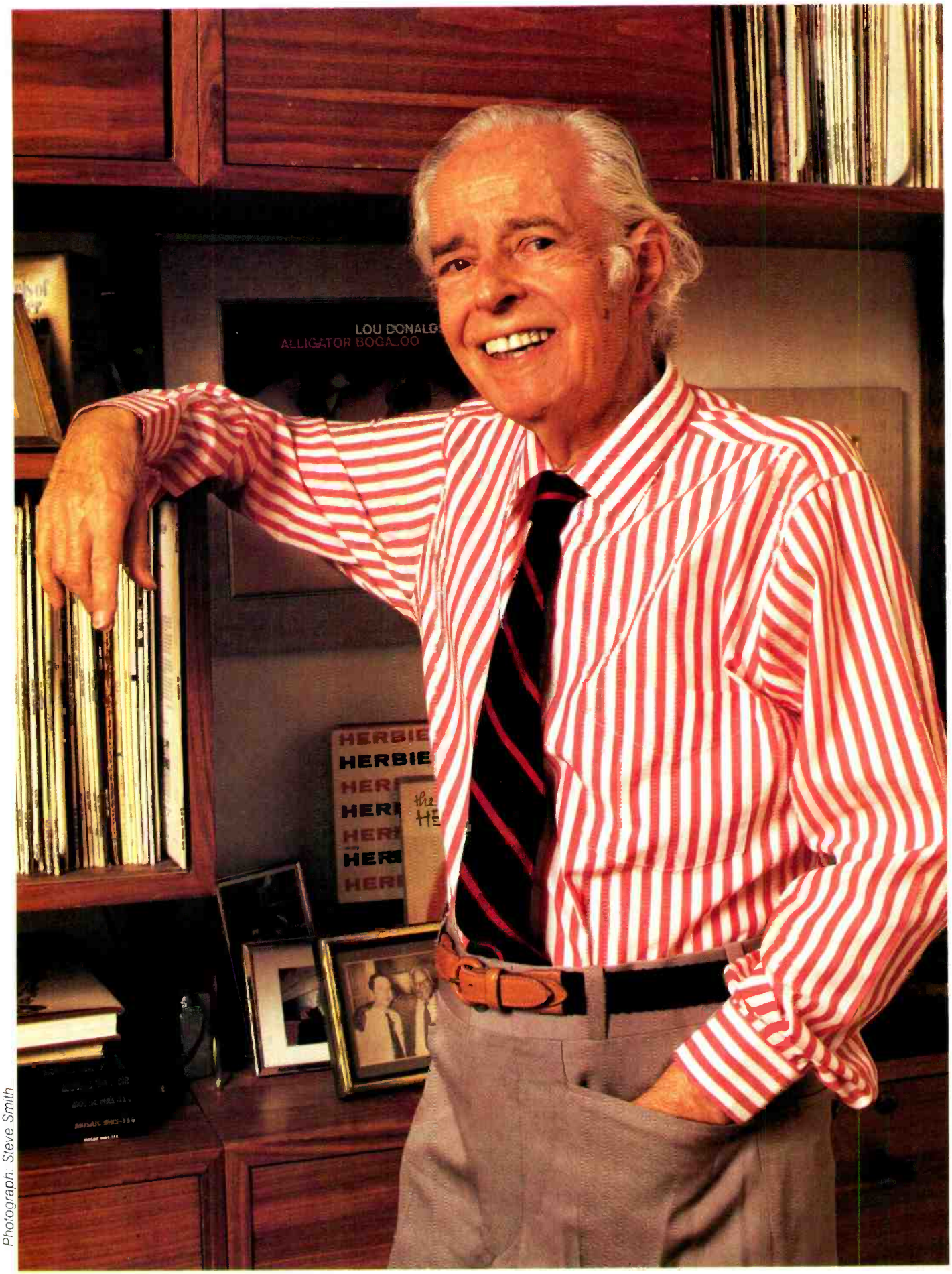
John Hammond is really responsible for my getting started, without him even knowing it. I want to give him a lot of credit. He's a fabulous man. I met John Hammond in a post office, and we started to talk. He told me that he was going to give a big concert at Carnegie Hall, and gave me two tickets. I was very much surprised. I was going to go with my girlfriend but she couldn't get out of the house, so I went by myself and gave the other ticket to a fellow outside. I listened to the concert and was flabbergasted. John was so far advanced at the time—Albert Ammons, Meade Lux Lewis, and everybody else. I was absolutely gassed. I made up my mind—having been with jazz for years and years, and always having my own ideas of how I would do it—to record Albert Ammons and Meade Lux Lewis.

You'd never recorded before, had you?

No. I just made the decision after I got out of the concert.

Were there already good records of Ammons and Lewis?

There were records, but they were 10-



Photograph: Steve Smith

Top: The Port of Harlem Jazzmen with Frankie Newton up front, in 1939. Above left, Alfred Lion in 1944; right, Sidney Bechet circa 1939.

Photograph: Don Peterson/Frank Driggs Collection

Photograph: Frank Driggs Collection

inch records, 78s. They were so short. People could do maybe two or three choruses and the record was over. I always figured, "My gosh, those guys need more room to stretch out! To come to a climax."

Where did you do the recording?

You know, I can't remember. It was a little studio somewhere on the West Side of Manhattan. One of those little studios where a man was running it by himself. It had a nice big Steinway, though.

How did you approach Ammons and Lewis?

I went to the Cafe Society, where they were playing, and told them I'd like to make some records with them. They were kind of astonished. They asked, "Are you going to pay us?" I said of course. I told them, "You've got time with me, because I really want you to stretch out on those records."

Your intention was just to make private recordings, no?

Yeah. I had no ideas of going into the business yet. I just wanted to make those records.

But you had no studio experience at the time.

Absolutely none. It wasn't a hard session, though. We came in and they tried out the piano, which was nicely in tune. They decided who would play first and who second, and when they would play together. I already had the selections in my mind: "The Boogie Woogie Stomp" and "Honky Tonk Train Blues" by Meade. Then we just made the records. It was late afternoon, and the sun was kind of mellow. I remember how it came through the windows. Ammons asked, "You got a little taste for me?" I said, "Sure, for you I got bourbon and for Meade I got Scotch." Ammons was a rugged personality. He drank bourbon, no water, nothing. Then they started to play. There was one suggestion I made very early. I told them, "When you play 'The Boogie Woogie Stomp' at Cafe Society, you come up to a nice climax and then change to a waltz. That doesn't go together with the hot stuff. Albert, let's leave the waltz out and keep on building to the end." He said, "I dig you, I dig you!"

Everything went quietly and nicely. I loved what I was hearing. When it was finished, I paid them right there. Then I was supposed to pay the guy with the studio, and I said, "I may not have enough money." He says, "That's all right. I'll hold the plates for you." I wasn't very flush then. So I kept on with my job for the next two weeks, then I bought my plates back. I listened to the safety plate back home and realized that it should really be heard by the public. So I decided to make some pressings and go into the record business. But I had no idea about how it was done. And what was the competition? Victor. Columbia. Decca. That was all. The three big companies.

What about Commodore?

Yes, Milt Gabler was recording. But at that time it was strictly for their own store. But I had no store. Anyway, I knew I needed a label. I had a good friend, Martin Craig, who was an artist and sculptor. He lived in Greenwich Village in a real bohemian loft. I asked him to make me a nice label, something modern. And Martin designed the Blue Note label. I started pressing 25 or 30 of each of those things the guys made—six 12-inch records. Now we had to figure out how to get the records out. I went to Milt at his store

on 52nd Street, and he was nice and everything. But I'll tell you the truth, he didn't really want anybody to be competition. You know what I mean? He took them because we all were friends, but with the records, it was business. They didn't want Blue Notes, they had the Commodore label. Somehow my records weren't displayed very prominently [laughter]. But my first customer was a music store in Philadelphia, H. Royer Smith. It was a classical old store with everything. The buyer said, "Send me three or four of each."

Did you do mail order also?

Yeah. We tried to make up a little pamphlet. I didn't know about stores and distributors. There were no distributors except the big three companies. There was nothing in '39—no books where you could check out things, nothing. You had to go by your wits. Slowly I sold maybe 100 copies of each. Then I started to send out review copies to all kinds of papers. I remember I sent some out to *The New York Times* and to *The Daily Worker*, the communist paper. There was a fellow on *The Times* by the name of Harold Taubman, a famous classical critic, and he wrote up some of the records, and so did *The Daily Worker*. People read it and it got around. Interest started and slowly, slowly it got a little bit better. I sold a little from my very moderate apartment, a cold-water flat on the East Side. That's where Blue Note started. Slowly.

Some of the first really important Blue Note sessions were the Port of Harlem Jazzmen sessions. How did they come about?

I met Sidney Bechet and made some records with him, like "Summertime." He was on the Port of Harlem session with Frankie Newton, J. C. Higginbotham, Teddy Bunn, Albert Ammons, Sidney Catlett, and Johnny Williams. That was my first band session, in 1939. My feeling for jazz is strongly based on the blues. I loved Ma Rainey and Bessie Smith when I was a kid. I grew up with a blues tradition. I think it's very basic and important in jazz. It's there all the time; I don't care if they play "out" or "in," you hear the blues. You can hear it on the Blue Notes especially. I was very much in favor of getting music that had this kind of feeling. That was behind my thinking with the Port of Harlem session. If you listen to it, what it really is is a blues. They're not playing popular songs. It wasn't a traditional New Orleans blues, it was a '39-type New York City blues.

To stimulate this feeling, you scheduled the session for late at night or very early in the morning, right?

I always liked to record late at night. I never liked to record during the day because I feel better at night, and I know the musicians are more with it at night. They play at night. You get a guy up at 11:00 in the morning and rush him to the recording studio at 12:00 or 1:00, he isn't quite together yet. His time is night, and not too early in the night, either. These Port of Harlem sessions took place after they closed Cafe Society, about 2:00 or 2:30 in the morning. When we got to the studio, the engineer wasn't there and we were waiting around, and it was a hot night. We started to drink a little bit, and everybody took his shirt off, and we opened the windows. Then the guys started to noodle around and play. Before we knew it, we heard some noises outside and the cops came up. We told them we were doing a recording session. They look around and all the guys have their shirts off, and Big Sid Catlett is sitting at a typewriter. They were wondering what's going on with all these colored guys. They told us to close the windows. We're finally almost ready to start, and in comes a big party, banging on the door. It was a party from Cafe Society. All kinds of people. Swanky. They were out balling, and heard about the session. And who was with them? Billie Holiday. They all came storming in. I got more upset all the time. We hadn't cut anything. I told them, "Hey, I want to make some records here," and they all left, and we finally got it going. Billie was kind of surprised that I asked her to leave, too.

I guess that was the session that put Blue Note on the map.

Yes. That was the first band session. It came so beautifully. You can hear it today. I felt it, and I got what I was driving at. There was a man by the name of Max Margolis, and he named some of those records for me. The title "Port of Harlem" was his idea. It was a nice handle.

Let's talk about Bechet. How did your relationship with him begin?

Thelonious Monk

We were living in Berlin. My mother was in the theater set, the movie set. She was like a jet-setter in a way, and she was very good looking. One day she told me she met a very strange man. A gorgeous-looking man with a turban and two big white dogs with him. She said, "We stopped and talked, and he told me he was a musician, and invited me to come see him play." She took me to where Bechet was playing. This was very early; it must have been 1922. I was a kid. It was called the International House or something. On different floors were different types of music. There was an American bar with pictures of cowboys and such. And there was Sidney with his soprano sax, dressed up like a cowboy.

Years passed, and I went to New York. One day I heard something about Sidney. Somebody tipped me off that he was living uptown around 125th Street. I met him and he was very nice. I mentioned my mother but he didn't remember, he'd known so many women in his life. He wasn't doing too much. He'd had a tailor shop. I said, "Let's get something to eat." So we went to an Italian grocery store for some sandwiches, and then there was a little room behind a display with a

couple of tables, so we sat down to eat the sandwiches. We looked around and one of the walls had toilet paper stacked up to the ceiling. He said, "Now we're really in the slop house." I asked him why he didn't make records. He said he'd wanted to make "Summertime" for RCA Victor and they told him no. They said, "That's not something for someone of your color." Sidney was a little bit pissed off. I said, "Make it for me, make it for Blue Note."

Was that record recognized right away as the classic that it is?

Yeah. That set off Blue Note in a way, too, because it was so outstanding for that time. It was soprano sax and had different intonation; everything was classic. He made the soprano sax popular like Jimmy Smith made organ popular. On that cut, Frankie Newton was out at the toilet. Sidney said, "It's okay. I'll make it all by myself." Later on, I read that someone had said he must have done that deliberately, he didn't want Newton on that song. No. That was not the case. Sidney was not that kind of person.

Tell me how your friend Francis Wolff came over to join forces with you.

Frank came over in 1939. We had lived on the same street in Berlin. A very nice, swanky section. We met on the street and got acquainted. He was always nicely dressed, but not Germanic; he dressed like the Americans or the English. He was also a jazz fan. That was very early. You know, you have friends in your life, but maybe only one *friend*, really. Frank was that person for me. We were together day and night for almost 30 years. We were friends for 50 years. I left Europe fast when I noticed things were not going the right way. Frank was there until he got caught in this Hitler thing. The Gestapo came to his apartment. I was working feverishly to get Frank out. His brother and sister got out to England. I got him out on the last boat. The Gestapo came to the boat shed as it was leaving and examined everybody again. He thought it was all over, but somehow he was passed and he got to New York.

He had no recording experience either, did he?

No, he was just a record collector, like me. I had the company started and had done a few records. We got together right away as partners. He stayed in my place. I was working for an import firm and Frank had no job. He met a woman photographer with a little studio. She shot bar mitzvahs and weddings, and occasionally she sent Frank out to take some pictures. Between the two of us, we made a living.

How did you two work together and divide responsibilities?

It came very naturally. I'm the kind of person who likes to run out and do things. I was the horse and he was the cart. All those things that I didn't want to be bothered with, Frank picked up—the business end of it. He did a lot of the detail things like the books, and taxes, and royalty statements. I saw the musicians and tried to get the sessions together. But he wasn't just sitting with the books. Frank was a jazz man. We always discussed things together. And he knew all the musicians, and the musicians all liked him because he was a very soft, nice person. You know how when two people are together all the time, they start to look alike? People used to ask me about my brother Francis.

Didn't he work for Milt Gabler for a while when you got drafted during the war?

Yes. Gabler wanted to distribute the records and sell them to the Army. When I got out of the Army, Frank and I got together again and started Blue Note again on a larger, but still small, scale.

You always seemed to encourage especially free sessions. Do you think that helped lead to the be-bop revolution of the '40s?

The music we recorded in the begin-

Jackie McLean at New York's Cafe Bohemia in 1956.

Photograph: Frank Driggs Collection

ning was a little different already from the usual. It already had a certain flavor that stuck out from the other things that were more set. This was in the Swing Era. That's when I met Ike Quebec. He was playing for Cab Calloway. It was a popular band with some fabulous musicians. Ike took Ben Webster's place after he left. I heard Ike play some solos and I said, "My gosh, the man plays so beautifully, but he gets two choruses all through the evening and he's finished." I said to myself, "Let him stretch out, let him play." I brought him in to Blue Note and we became very good friends. We had girlfriends together and went out to make the scene together. Anyway when be-bop came along, Ike was just as confused about it, in a way, as lots of other guys. When be-bop came along, a lot of famous players stopped and said, "I can't play like that, I can't think like that." Ike had open ears and everything, though he was a member of the old school. But the both of us went to different sessions. We went often to 52nd Street to see Dizzy, Milt Jackson, Max Roach, and others, and they were improvising and playing the new way. It was so free, almost like Dixieland in spontaneity. Of course they weren't playing Dixieland, but it was a free music. Ike realized it was a new way of thinking.

So although you did not immediately understand be-bop, your instincts made you receptive to it?

Yes. Receptive, of course. But I didn't dig it all the way. I'm sorry, I didn't, and I'm not the only one who didn't. Then I started to hear. I was always interested in drummers. I love drummers. So when I heard Max Roach, I said, "Yeah, it's different." But I didn't know what it all was because I'm not a musician, and I could never read a note. All those years I had Blue Note, I went by my ears and by my feeling. So I didn't know what they were doing with different timing and so forth, I just heard the difference. But it started to click for me. I could hear it better.

Ike came to me and said, "There are some good pianists around. Why don't you listen to them?" One was Thelonious Monk, and the other was Bud Powell. So Ike and I went to see Monk, and when I heard him I keeled over. I said, "That guy's so different. Everything is different—the compositions, the beat." I loved him, and that's how we started with Monk and bop. Then Bud came up the same way. He was fantastic, and I went for that.

You recorded Monk in the '40s, before anybody had.

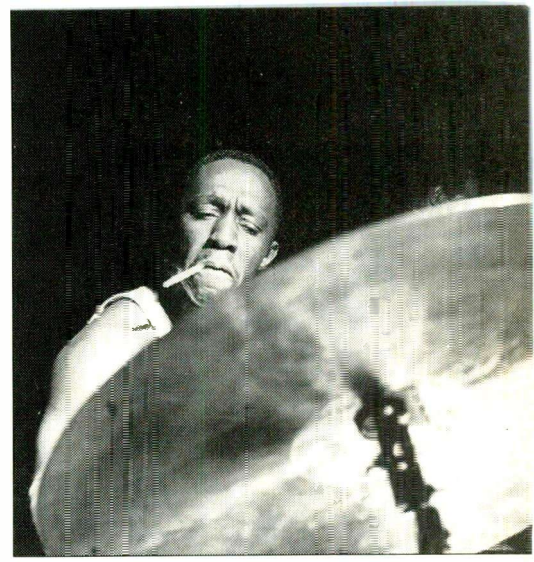
Nobody else had! It was such a struggle because people thought we were nuts. Nobody wanted to buy the records—except for a few, like Ira Gitler. There were other big critics who didn't want to hear about Monk. We couldn't give Monk away. But we made some records. And we made some records again! And I liked them so much we made some more! "The hell with it," I thought, "I've got to get this all down on records." I went uptown to Harlem with the records. All those people who are supposed to be simple, no culture, they said, "Hey, this guy's good." Then he made "'Round About Midnight" and oh boy! They put that on the jukebox. What a personality he was. He played the same way in the '40s as he did later on. He never became a big technician on the piano, but he had his own thing. He had 27 compositions, and I wanted to get them all down. We recorded everything he had. He didn't compose very much more after those.

How did he come up with some of the names for his songs?

Monk was a weird person, and he had some weird names too. Unusual. Some I cooked up, like "Straight, No Chaser," "Thelonious," and "Misterioso." Ike Quebec named "Suburban Eyes." We went to a bar after he listened to his test pressings at my house. Now, when Monk came to your house, he'd never leave; you'd have him there all night. Put up the bed. He listened to one take six or seven times in a row. Finally he said, "You got a taste for me?" I said, "Not in the house." So I suggested going to the bar next door. The bartender asked if he wanted his drink straight and Monk said, "Straight, no chaser."

Let's switch gears and talk about the Blue Note studio sound. How did you come to work with the great engineer, Rudy Van Gelder?

I was introduced to Rudy Van Gelder by a very fine musician named Gil Mellé, who was a baritone horn player. He told me about this man who had a very small studio, but he was a jazz fan



Photograph: Francis Wolff

Art Blakey

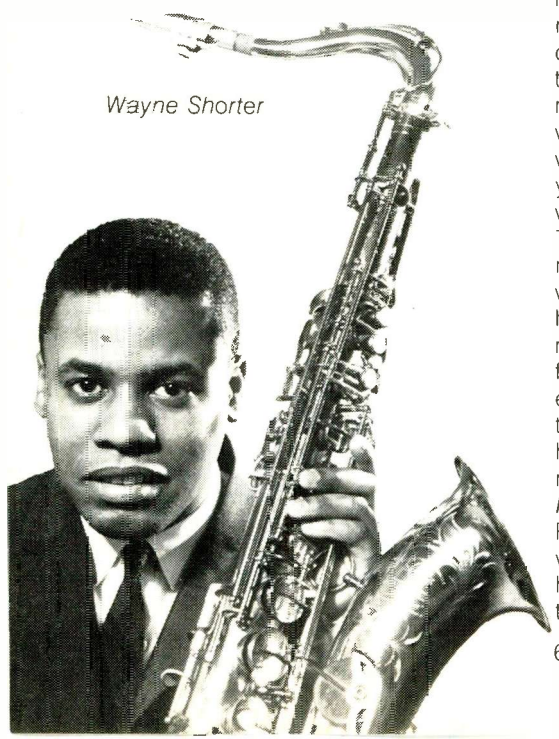
Photograph: Francis Wolff

Stanley Turrentine

Herbie Hancock

Sonny Rollins with Alfred Lion in 1957.

Jimmy Smith



Wayne Shorter

Photograph, Francis Wolff

and had good ears. Rudy's father and mother had a little house in Hackensack [New Jersey], and he had his studio in the front room. He was maybe 25. I started to record there. Rudy was always good, and I had a chance to tell him what I liked to hear in the recording, which was a different sense, somehow. For instance, when I listened to some of those commercial records that the big companies did, the drummer was always put in the back somewhere and you could hardly hear him. I could never hear the sock cymbal. So Rudy suggested we put a microphone down there. He was always working, hoping to meet what I wanted. He was very sympathetic and we worked together constantly. People say that the records that were made at Van Gelder's have "the Blue Note sound."

He has said that the Rudy Van Gelder sound is really the Alfred Lion sound.

He's very modest. It wasn't just the Alfred Lion sound. It was the combination of the two of us.

Tell me what the studio was like and how you worked there.

It was small. His equipment was limited, naturally. I don't know all the technical things. He had a nice, modest console. But he got good sound out of it. Look at those things we did. They've stood up. He had a separate booth where he sat behind the glass, and the musicians played out in the living room. We moved all the furniture out, of course. I never changed engineers after that. You know, I only had two engineers in the history of Blue Note. One was at the WOR studios on Broadway, where I recorded for two or three years. There was one engineer there I waited for all the time, Doc Hawkins. Then came Rudy after him. After we recorded in the living room for a little while, he built the big studio. He built it himself, and it took about a year. Oh my gosh, did he spend time! But it's a fabulous studio. He had fabulous equipment that was way out—better than what anyone else had. He always had the best equipment in the business. I don't know how he did it.

How would he work the sessions?

Rudy set up the mikes. He knew what we wanted, with all the experience we had together. He always improved on it too. I didn't interfere with what he was doing. He has a good feeling for jazz, and when the guys played out there, he knew what to do with them. Sometimes he'd make the guy sound better than he actually did in person. He gave them a little extra, which you can do in the studio. The musicians learned from him too. There's a mike technique—you know how a singer holds the mike different ways? The musicians learned that after a while. Rudy helped guys along who didn't know so much about that. He's a very knowledgeable and soulful person. He's not like some—they call them "needle noses"—who just look at that needle on the meter.

You used him so often, why didn't he become part of Blue Note?

Oh, he didn't want that. He had his own business. He didn't want any part of Blue Note in that way. He never wanted to go into the record business. And Rudy made records for all kinds of people: Prestige, Riverside. But somehow that Blue Note sound differed from Weinstock's [at Prestige]. You notice? We had something going between us.

What was the difference between yours and the Prestige stuff?

Maybe Rudy felt that those people were not as interested in what he was doing. They just came in there and said, "Make me a record session." The way they recorded was completely different from the way I did. They'd make a session in three hours, six tunes, let's go, boom boom. Then the next one, and the next one. Three hours. "We used two rolls of tape? That's fine." They never played them back, it takes time. Who's going to waste 10 minutes listening back? They didn't want to hear about sitting there for four or six hours, and having a pause and eating a sandwich, and then starting again. I didn't care about overtime. I didn't care about how much money it cost me. I wanted to get the thing right. So I never rushed them into the studio and rushed them out. When we went into overtime—which was double for everybody and triple for the leader—forget all this, let's make the records, right? The musicians didn't do it just for the money. They wanted to do it right too. They listened to the playbacks, and they'd say if something wasn't quite right and go back and do it again. If I wanted to use Herbie Hancock or Monk or whoever, and they weren't

Photographs, Frank Driggs Collection

available, I'd wait for them. I wouldn't just use someone else. Other people didn't do that.

That leads to another question. You developed a sort of company of players at Blue Note. Did you intentionally try to create a group of people who would be associated with Blue Note?

No, I didn't have that thought at all. It came very naturally. I used the men on the dates that sounded good to me. If a record used somebody and it came out really well, I'd say, "Let's make him a leader next time." I'd ask him if he had any good material. That's how all those guys developed. Herbie Hancock. Wayne Shorter. Lee Morgan. They say I was developing a repertory company, but I didn't dream it up.

Were they signed to you?

Some were. I couldn't sign them all up because I didn't have enough money for that. When you have stars like Lee Morgan and Stanley Turrentine, you have to concentrate on them. I could only have so many people under contract because each one had to be catered to and developed. I wasn't RCA Victor. But I was all right. I had enough people, and they were all good ones.

Were records important as a source of income for jazz musicians, or did they make most of their money on club dates?

The records were a nice sideline. Sure, if they played a week in a place they'd get so much, but by the time they got out, most of the money was already spent. Record dates paid much better than a gig. There were union minimums—so much for the sidemen and double for the leader. But we didn't go by that. At times, the leader got four times minimum, and some of the sidemen got more. Still, it wasn't anything like it could cost today. But in those days an LP was $3.75.

What was a good sale for a Blue Note record in the '50s?

If it initially sold 5,000, and then took off up to 50,000 or 60,000, that was good. Average was maybe 25,000 or 30,000. But it didn't make any difference to me. I didn't say, "Oh, this guy sold only so much, and that guy sold better, so let's drop this guy because he doesn't sell enough." The whole income picture for the company made it good for those who didn't sell so well. All I knew was whether they were good. I didn't care if they sold more or less. I'd stay with them if they were good. Hank Mobley, Jackie McLean, Horace Silver, Lou Donaldson—25, 30 years with Blue Note. They stayed with us.

Did you always keep the records in the catalog?

I never cut one out. I kept them going because people always came back to them again. Maybe the big companies can't do that anymore.

Well, you had a core audience of people who would always buy the Blue Notes.

That's interesting. Bruce Lundvall [head of the rejuvenated Blue Note] said that when he was a young guy he used to run to New York to buy Blue Notes whenever they came out. At the "One Night with Blue Note" concert [held in 1985 at Town Hall in New York], a woman came up to me. She looked like a housewife from Connecticut. She said, "Mr. Lion, I want to shake your hand. I bought all your records. I couldn't get them where I was living and I used to come to New York especially to get them."

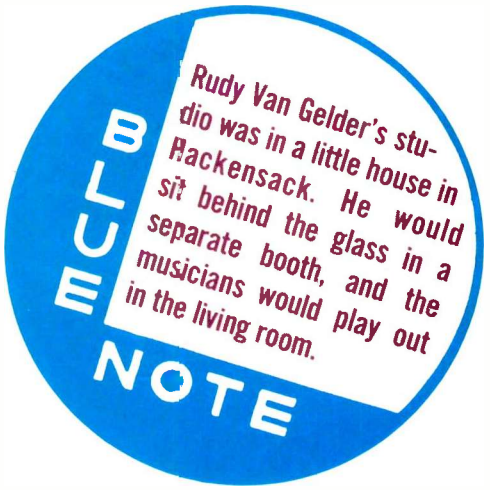
There was a feel to them. The covers were gorgeous. The pressings were great.

Everything was always quality with Blue Note. I saw to it myself. I got into it so heavily that I had to look at the label copy, the print, how the photos came out, the cover—it had to be right from A to Z. Frank was the same way. There are no mistakes in the liner notes. We read them over three times.

You made 900 records, but you never took a producer's credit. Why not?

I'll tell you. Whenever you have a Blue Note in your hand, I don't care what it is, and you don't see my name on it, that's one that I made [laughter]. Not the ones I had in the can that were only recently issued, though. Michael Cuscuna, the producer and A & R man, put my name on those. I just didn't feel that I should put my name on them. I did my part, but the most important part was the musicians. They're the ones who came and gave their best. Yeah, I was the producer, so what? I always put Frank's name on them for the photos, and Reid Miles, who was the cover design artist, and Rudy Van Gelder, the recording engineer.

Reid Miles developed the Bauhaus look of the album covers, didn't he?



Freddie Hubbard

Photograph: Frank Driggs Collection

Alfred Lion and Francis Wolff in 1964.

Ornette Coleman

Right. I liked that modern look. You can even see it on the very early Blue Notes. Always modern. Reid made most of the Blue Note covers. He was also working at CBS. In fact, Bruce Lundvall was president at CBS at the time and knew Reid. But Reid told them at CBS that he would continue making covers for us because we gave him the freedom that he couldn't get there. But he was not a jazz fan. That's funny. He likes classical music and popular singers. But it didn't matter. We'd sit down and I'd tell him, "This is what the music stands for. This is rock house. This is a little softer. This is lyrical." He'd come back with a cover.

Let's talk about some of the artists you've worked with over the years. How about Miles Davis?

He was a teenager when I first met him, and I was very young. I always admired the way he looked. He was always dressed sharp. He's a sharp cat. He was a swinger. And of course I loved his playing. We were friendly right away. In the beginning we made two records with J. J. Johnson, Art Blakey, and Jackie McLean. By the way, Miles was the one who brought Jackie to the date. The first date Jackie ever made was the Miles date for me. Jackie was just a nice young kid, but Miles knew he had something. Jackie also wrote a tune for the date, "Donna." Miles was still young, and still finding his way then, but he always knew what he was doing. There was no wishy-washy stuff with Miles. He was not hard to work with. Later on, people say, he was very temperamental, but not with me. I remember, on that first date, we were talking afterwards and Miles said, "You know, that Art Blakey, he really kicked everybody's ass."

Let's talk about Art Blakey.

I brought Art Blakey to that date. I first heard Art with Billy Eckstine's band. There was a disc jockey by the name of Freddie Robbins who was a good friend of mine. He had an idea that he wanted to put some jazz on the air, but he didn't know anything about jazz. So he said to Frank and me, "Why don't you write a show for me with your old collector's items?" That's how he started as a jazz disc jockey. Later on, he picked up on things very fast and he had Monk on there and Dizzy Gillespie. He did such a bad job with Monk, he asked him such a foolish question that Monk got disgusted and told him off, on the air. Freddie was so disturbed he told me to never bring this guy to the show again! Monk figured, "What kind of turkey is this?" Anyway, Freddie took me up to some club in Harlem with his wife to hear Eckstine's band. It was an afternoon thing. He had some very good soloists, and I heard his drummer. But it was dark, and I couldn't see him behind the band. Art was playing this jungle stuff. I asked Billy who he was, and Billy said, "That's Art Blakey." I said, "I'll remember that name." He hadn't made any records or anything yet. He had an enormous drive. It was African! Fire! Daring!

You first brought Art in as a sideman . . .

. . . on the Horace Silver trio date. Horace had four or five numbers. On the last number, I asked Horace, "How about a solo for Art Blakey and Sabu on the congas?" We put it on that record. "Message from Kenya" it was called. I think it was 1954. The Jazz Messengers came together then, with Horace and Art.

Horace Silver is great.

Can you imagine an artist staying with one company for 30 years? All his work is on Blue Note. The saddest thing for me was when the lights went out for Blue Note, after we sold it. The company we sold it to didn't know what to do with this stuff. It all ended up in a warehouse.

How did you first get involved with Horace?

He came into the office with a test pressing. We had a very unimpressive little office with boxes all over the floor. Two rooms on Lexington Avenue. He couldn't have been impressed with the setup. He played his record and it sounded good. Here was another original, funky guy. We set up a date that was supposed to be Lou Donaldson's. For some reason we couldn't make the date with Lou, so we made Horace's trio session. I always appreciated deeply what he did, and I gave him all the freedom he wanted. But we always discussed things together. We listened to all the takes and decided which to put out. Horace became very well known. "Song for My Father" was a big hit. When he played it for me, right away I knew that song should be num-

Photograph: Ruth Lion

Photograph: Bill Smith/Frank Driggs Collection

ber one on the LP. There were two takes. I liked the first, but he said he played more piano on the second. I said the first fit the tune better. That's the way we worked together. We listened to each other.

That kind of funky sound was really a precursor of soul music.

Yes, that became soul music. Black artists had something the others did not. I don't want to say that whites are not as good, but I didn't go to the West Coast [style of jazz] music. I stayed with them.

In fact, I think you were one of the first to use the term "soul" in an album title.

Yes, we did. We didn't mince words with our titles. When we brought out Monk, it was *Genius of Modern Music*. I didn't give a damn what anybody thought, *I* thought he was the genius of modern music. *The Incredible Jimmy Smith*, *The Amazing Bud Powell*, *The Eminent J. J. Johnson*, and so on.

Let's talk about Herbie Nichols. He was so wonderful, but he died in obscurity. What happened?

It's true. I don't remember how I met him, but he played me what he had in some studio. He asked me which tunes I liked, and I told him I liked them all. It was like Monk. They were colorful; you could draw pictures.

Why did he never record with a full band?

It never got to that. He made one LP for me, and it didn't sell at all. On the second record, he did just about all of the rest of the tunes he had. And he was sick, so he passed away before anything really happened. It was only a trio. On one record he used Art and on the other Max Roach. Actually, I think Herbie liked Roach better; Roach was better suited to him. Herbie could have been one of the great ones.

There was another one like that who was my last protégé—Andrew Hill. Very original. I think he was right up there with Monk, Bud Powell, Herbie Hancock, anybody. He made some very good records for me, but then the lights went out when we sold Blue Note. Andrew Hill didn't come in until the '60s, and I wasn't able to get all his recordings out, like I should have. But now I'm doing everything I possibly can to bring him back with the new Blue Note. I told Bruce Lundvall that's my last project.

Staying with the keyboards, let's talk about Jimmy Smith.

He was a completely different thing, but unbelievable. He gassed me from the minute he sat at that organ. The first thing he played me was a number called "The Champ." It was a fast blues written by Dizzy Gillespie, but he played one chorus after another, and the tempo and the feel—my gosh, who ever heard an organ like that! Soul. I remember I got him a job at some little club in the Village. I remember there was an audition, and Miles was there too. Afterwards, Miles said to me, "Alfred, he's going to make you a lot of money!" Jimmy did make some money. They played his records on jukeboxes. I tell you, though, I didn't think in those terms. I didn't care about the money, I just liked him. I must be a real turkey [laughter].

But when you had a big hit like Jimmy or Lee Morgan's The Sidewinder, ***didn't that almost force a change of direction in the company?***

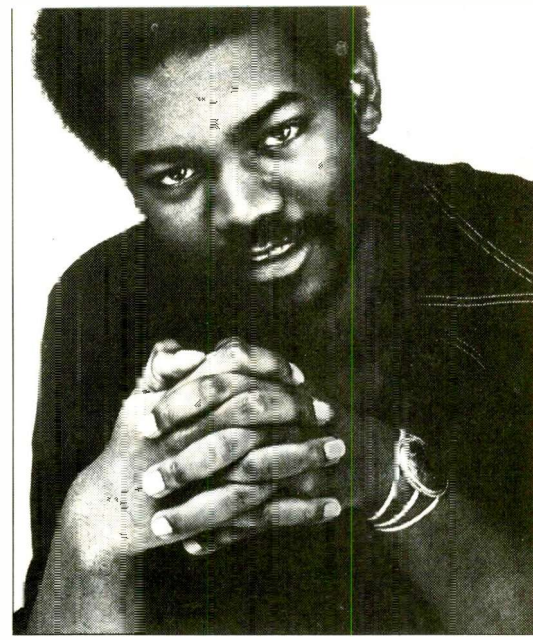
It didn't really change our direction. But the distributors were leaning heavily on me. "Hey, Alfred, get me something like that again." I thought, "Ah, those guys are businessmen." What I would do is maybe try to put something a little more funky into some different sessions and put the funky takes at the beginning of the LPs. But they just came out good, like *Sidewinder* and other things. I put a little thought into that. I thought, "If they like it they'll buy it. Maybe it's not the most advanced jazz, but it's good, funky music." I thought it would open the door for some artists and bring the buyer in a little faster, to dig some more musically advanced takes on the LPs that followed.

Later, you got into some pretty far-out stuff. I guess it started with Jackie McLean.

Jackie McLean. Then Cecil Taylor. Andrew Hill. Eric Dolphy. I was never stuck in one groove. I loved it when Michael Jackson came out, and I'm crazy about Prince. They both knocked me out.

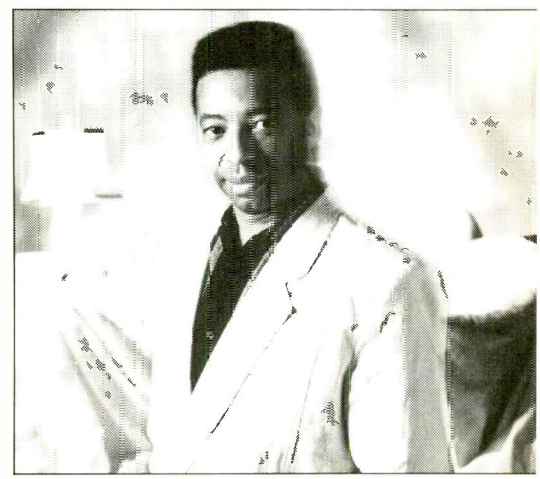
I see you have two pictures of Michael Jackson on your wall.

I like the way Michael Jackson looks. In one picture he is all blazing, full of life, and in the other he looks like a royal Prince Charming.



Photograph: Frank Driggs Collection

Earl Klugh



Tony Williams

Photograph: Francis Wolff

Bobby Hutcherson

Let's talk about Jackie McLean's Destination Out.

He had played a little more "in" before and was always good. Then one day he came in with this, with [trombonist] Grachan Moncur. The sound was Jackie, you couldn't miss him, but he had changed his sound. We just shifted over to it. He had some other older things that hadn't been released yet. But he said, "You know, Alfred, this is a little more up to date. Why don't you bring this out first?"

Did you then go out to recruit people playing the new music, like Sam Rivers?

Well, yes. My taste also got modernized. But I still also liked James P. Johnson and Art Hodes. There was room for everything. It's like Picasso. Is his Blue Period something you don't want to look at any more?

Blue Note launched a lot of great musicians in the '60s, like Herbie Hancock, Wayne Shorter, Freddie Hubbard.

Yes, also Joe Henderson, Tony Williams, Lee Morgan, Bobby Hutcherson, Grant Green. That was all the kind of thing where they started as sidemen on some of our sessions and then eventually became leaders. It was just a natural evolution.

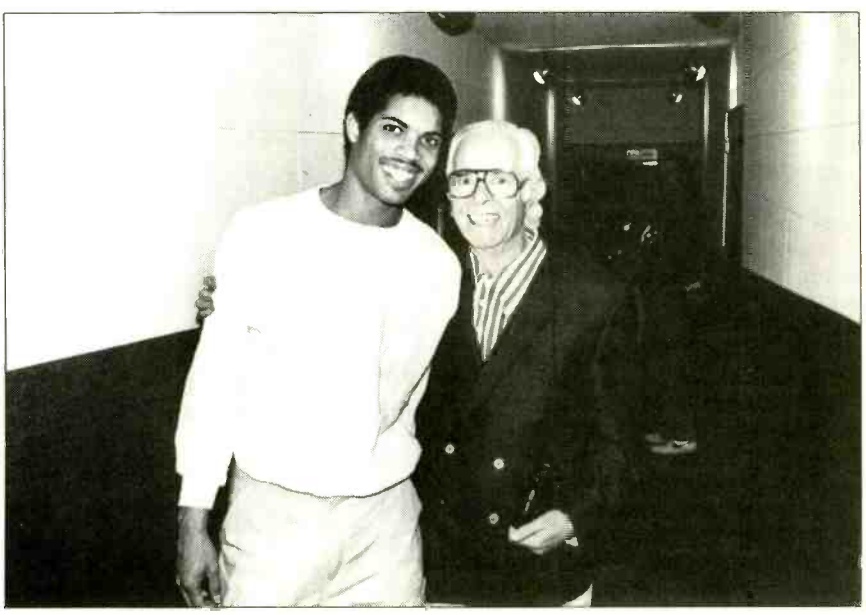
All of those people became the vanguard of the fusion movement after they left Blue Note. How do you feel about what they're doing now? What about Hancock's Rock-It?

To me it's a very inventive little thing. It has a lot of humor and rhythm. It's very catchy. There's nothing wrong with it, and it made a lot of money. I can see it. I don't believe in that selling-out business. An artist doesn't have to constantly be sweating and starving for his art. If he hits on something a little light and catchy that makes a little money, that doesn't mean he sold out. The tune probably came to him very naturally. It's him. To make a little dough is very important. Herbie will always be a musician of invention and dimension. He never gets boxed up and becomes stale. He is full of life and surprises.

Why did you decide to sell the company, in 1966?

My wife saw me getting worse physically. At one point, I had a little heart attack, but I didn't pay too much attention. But she was worried. She said, "You've been doing it 30 years, why don't you sell the company?" I didn't want to do it. Another thing was that Liberty Records came to me and wanted to buy Blue Note. I didn't have to go out and look for a buyer. So I thought it was the right time. So I did it, and I think my wife was perfectly right. I never really regretted it because when we

Gathered onstage at the "One Night with Blue Note" concert held at New York's Town Hall in 1985 (left to right): Bruce Lundvall, Alfred Lion, Reid Miles, Rudy Van Gelder, and Michael Cuscuna.



Stanley Jordan with Alfred Lion in 1985.

moved to Mexico I had another heart attack, and I had another one in San Diego which was quite bad. I had my time. I did it for 30 years, and I did everything I could and I loved it. Francis stayed on for another two years after I left. Then he dropped out because he had cancer.

How did you feel about the Blue Note material issued after you and he left?

To tell you the honest truth, it wasn't really Blue Note anymore. They tried to go into big-band setups and big productions. They put huge bands behind Jimmy Smith. It's hard to do that successfully to jazz.

After that they became more fusion-oriented with Ronnie Laws and Earl Klugh.

It didn't sound like Blue Note anymore They didn't get very far. Then Bruce Lundvall, the new president of Blue Note, and Michael Cuscuna saw that Blue Note was really worth bringing back to life, and they got big backing from EMI of England and Capitol in Los Angeles. They decided to really go to town with reissues. All right, they bring out reissues because it doesn't cost them as much as producing new things. But I don't think that's a problem. They want to reissue those records because they're really worth bringing out. They're bringing them out with the original covers and liner notes, and they're beautiful. I'm really happy. They're better pressed and the sound's better. The new processing sounds fresher and cleaner.

How do you feel about the new artists they've signed, like Stanley Jordan?

I was the happiest person when they signed up Stanley Jordan. I have never heard a guy on guitar like him. I was fascinated. I heard him for the first time in a private recital at Capitol in Los Angeles. I couldn't believe my ears. A genius. I was happy that his first LP was such a hit. The first new Blue Note artist, and a hit! Blue Note was always a lucky label for so many. Artists used to say, "When you get to Blue Note, they make it happen; they work with you and for you."

Some people have criticized Blue Note, though. They say that now that Blue Note is back with a splash, they should be signing up young, inventive people with new sounds that are still unrecorded, or underrecorded.

They did that with Stanley Jordan. He was an unknown playing on the streets. Then they have the Out of the Blue group. That's six young guys who play well and have a good feeling for jazz. They're very good, and they still get better and better.

But aren't there Miles Davises and John Coltranes out there who are still unrecorded?

Definitely. Those people are out there.

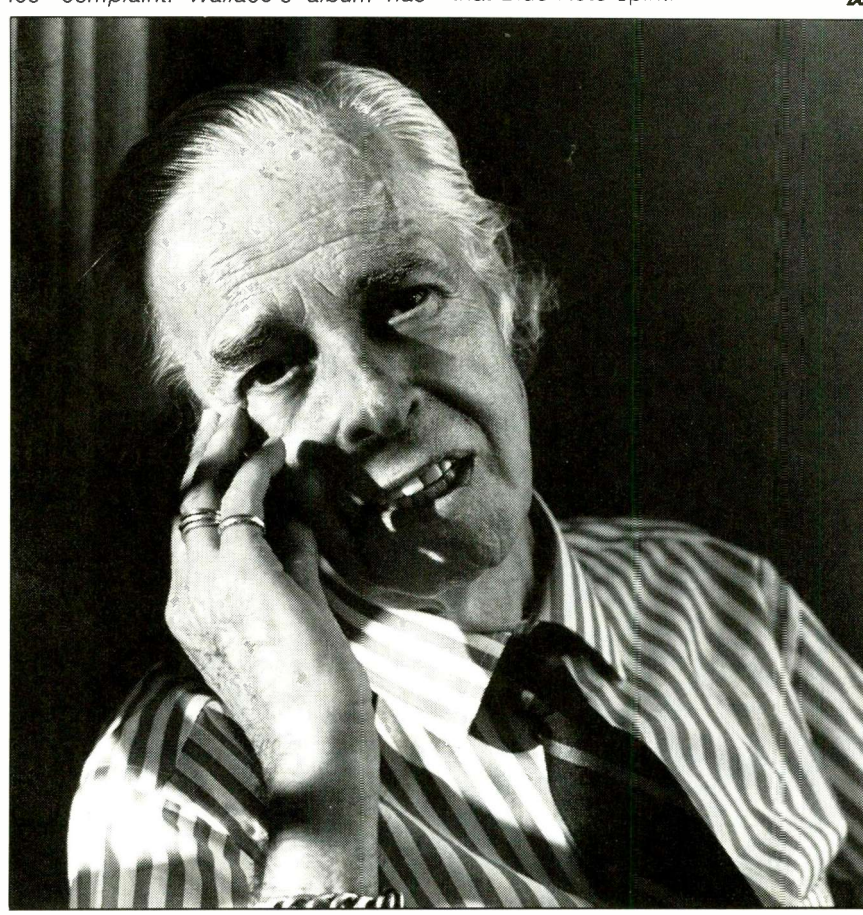
Is Blue Note still the kind of company that will go out and find them?

I know they are trying to do that. I think they're looking for people who have talent that they can bring out and make stars and leaders. They know they're not going to bring the walls down all at once, but they are trying it, and they will try more. I think Lundvall is a very honest person. As long as it's possible, he'll try and keep up the quality and artistry of Blue Note. A good example is this new guy Benny Wallace.

But that's a good example of the critics' complaint. Wallace's album has Dr. John and Stevie Ray Vaughan on it. They're not really jazz artists, but they'll sell some records. That's not taking too much of a risk.

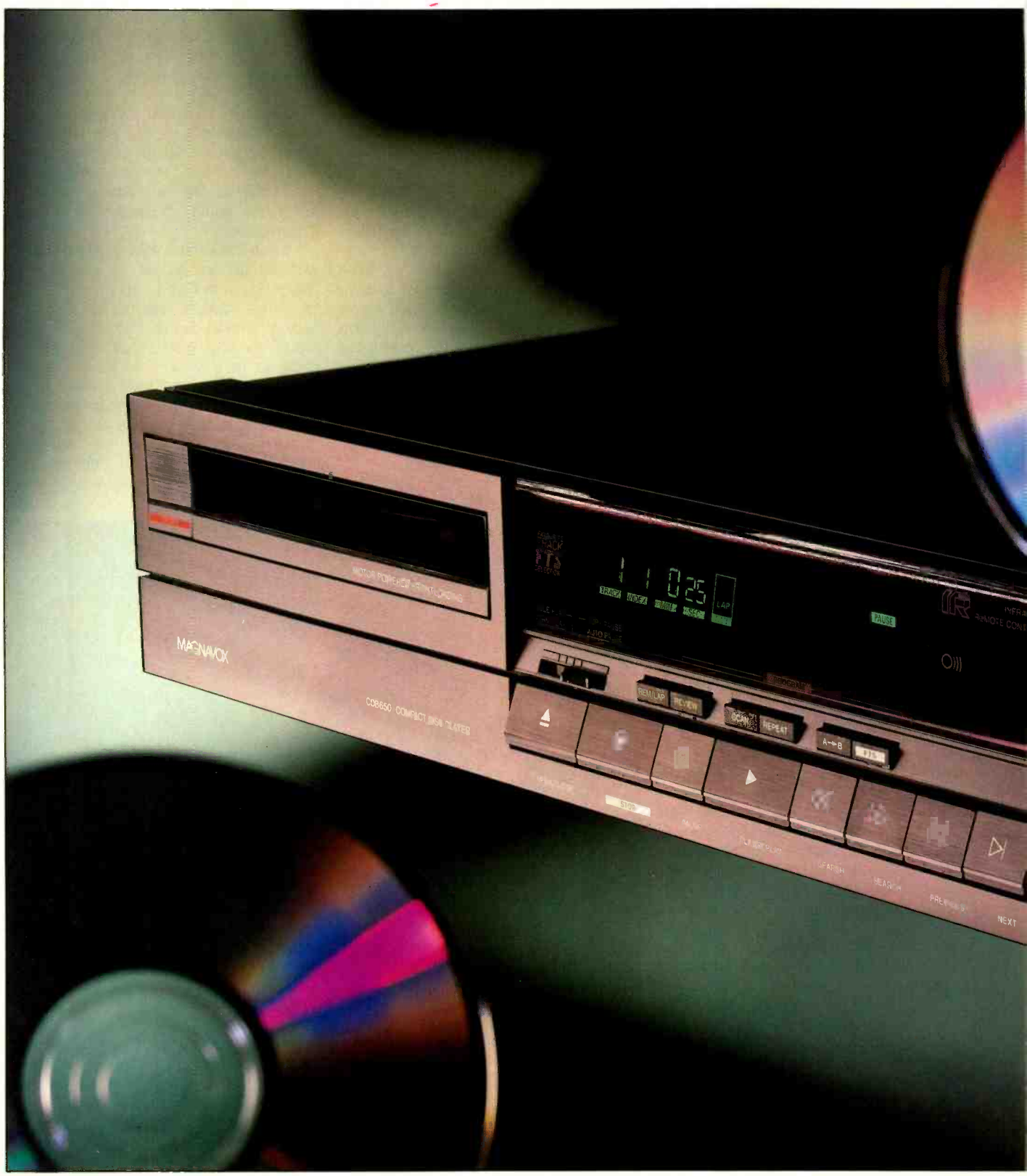
But you should hear the record. It's a new way of doing the old stuff. Somehow, it fits into Blue Note perfectly. It's like they went through the feeling of older Blue Note material and then made this up. Benny Wallace is a very intelligent, soulful musician. It's a new interpretation.

I don't know if the new Blue Note will want to go out as far as we did 15 years ago with Cecil Taylor or Ornette Coleman—which was so absolutely radical. I'll tell you the truth, it took me a long time, even after I made those records, to hear what they were doing, and I still need time today! Now, how far Blue Note will go I don't know, but I really feel that they will be advanced. I hope so. Bruce and Michael are not just ordinary executives looking to make a fast buck. They've both got that Blue Note spirit. A



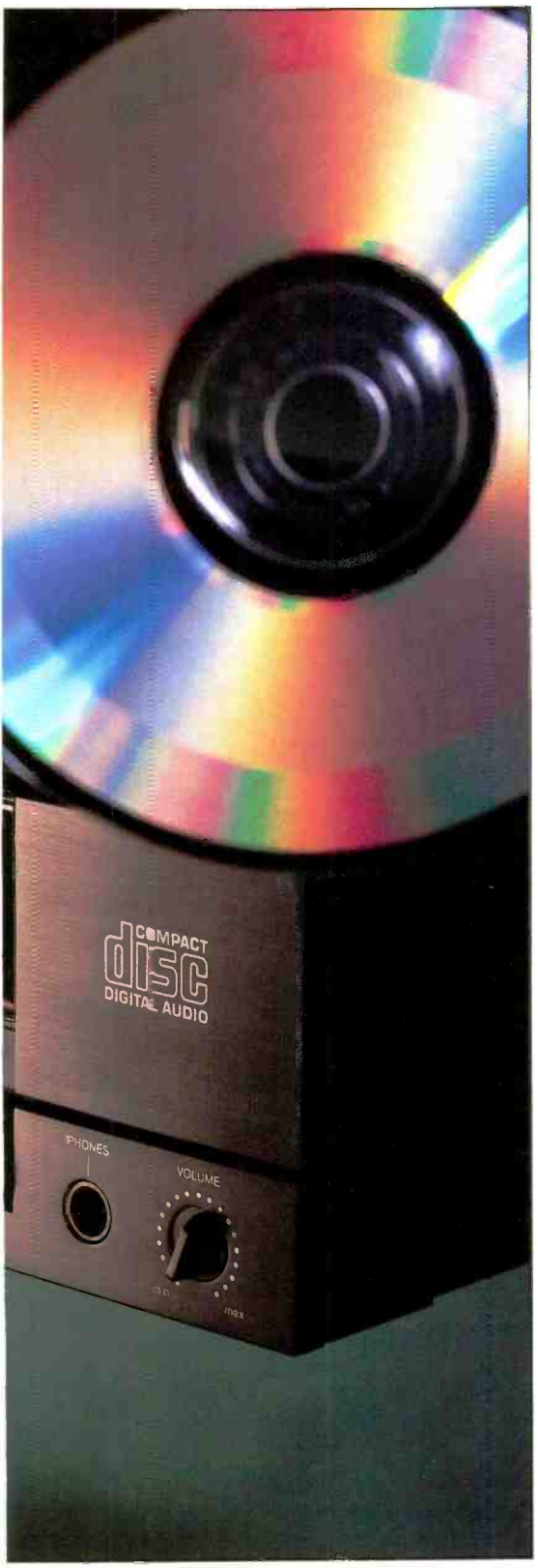
Photograph: Steve Smith

THE MAGNAVO



Photograph: Robert Lewis

DX 16-BIT SERIES:



MAKING GOOD PLAYERS BETTER

WALTER G. JUNG

The new series of Philips/Magnavox CD players have quickly earned respect for their generally superior audio performance at affordable prices. (It was Philips, the parent company, that originated the CD system with Sony). The players are manufactured in Belgium and are sold under the Philips name in Europe and the Magnavox, Sylvania, and Philco names in the U.S. Steady improvements over the last several years have resulted in better and better sonics, while prices have dropped (or held) and features have been added.

The innovative Philips playback processing system is generally considered to be technically very advanced. Basic to this system are two key steps. First is signal filtering *primarily* in the digital domain (with subsequent low-roll-off Bessel-response analog filters). Second is an ingenious reconstruction process of the audio signal at four times the standard sampling rate of 44.1 kHz (i.e., at 176.4 kHz).

With the implementation of these techniques, the Magnavox players produce a cleaner, more accurate, and more noise-free CD output signal. Until recently, all Magnavox players were based on a 14-bit-resolution digital-to-analog (D/A) converter, the TDA1540, in each of the two stereo playback channels. Previous Magnavox players, from the early 1000 series up to the 2040 series, used this same D/A for the audio signal process, as did the FD1041, FD2041, and FD1051 models (which were available up until January of this year). More recently, Magnavox has introduced the long-promised 16-bit models, the CDB650 (reviewed in *Audio*, March 1987), the related CDB560 and CDB460, and the newest player in this family, the CDB465, which was introduced in May (more below). All of these players use the brand-new TDA1541 D/A, a single IC with two channels of 16-bit resolution. Related models are also available under the Sylvania and Philco brand names.

A 16-bit D/A extends the theoretical resolution and dynamic range of the audio signal from 14-bit's capacity of 16,384 (2^{14}) levels and 84 dB to 16-bit's 65,536 (2^{16}) levels—four times as many—and 96 dB, an obvious improvement. In addition, the new players use an associated set of digital chips which offer other improvements, such as enhanced error-correction algorithms and better digital filtering (see sidebar).

The CDB650 is the flagship of the current line of CD players from Magnavox, laden with all manner of bells and whistles, both in terms of operational features and with regard to sonic goodies. The CDB560, CDB460, and CDB465 are shorter on the operating bells and whistles, but about as long on the sonic ones. What I want to dis-

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cuss in this article are the technical features which distinguish these players and the sonic impressions they make in a high-resolution system using some high-quality CDs. I also wish to suggest some easily performed parts changes which will, I believe, improve the sonic performance.

The CDB650, CDB560, CDB460, and CDB465 have similarities as well as differences. The differences are, for the most part, in their operating features and their prices. Interestingly, there are more things alike than different, insofar as the audio signal path is concerned. Thus, the CDB560, CDB460, and CDB465 can deliver about the same sound as the CDB650 but at a lower price.

The CDB650's outstanding new feature is "FTS," which stands for Favorite Track Selection. This feature, under the control of its own dedicated, nonvolatile memory, allows one to store a unique track-sequence code for each CD. Thereafter, when a particular CD is loaded, the CDB650 will play its tracks as you have stored them via FTS. Up to 785 different tracks can be stored with this system. It even allows specific start/stop times *within* a track to be recalled. I can easily see this being used as a tool for instant replays during audiophile "CD shootouts"; it is a replay/evaluation tool which totally eliminates the search-and-stop game.

The CDB650 also has a full-featured remote from which just about all operations can be controlled. It's about as

THE NEW CHIP SET: The Essen

In the new high-performance CD players such as the Philips/Magnavox CDB650, CDB560, CDB460, and CDB465, a second generation of digital audio circuits is used. This new generation has a higher level of integration, with more sophisticated algorithms for the decoding. In addition, the number of circuits has been reduced; this helps to keep manufacturing costs low, making the players more affordable and competitive.

The new CD players use SAA7210 and SAA7220 ICs in the digital decoder section and TDA1541 and NE5532N or LM833N ICs in the analog section. Figure B1 shows a block diagram of the new decoder system, with an indication of the (dotted) first-generation circuits which were replaced; only an indication can be given because the new circuits have much superior performance over the first generation. This new decoder system architecture utilizes an Inter-IC Sound (I^2S) bus standard for design flexibility. The I^2S bus is a three-wire serial bus for data exchange between the integrated circuits, and it enables simplified digital audio data exchange between Compact Disc, Digital Audio Tape, digital sound processors, etc.

The SAA7210 is the new decoder circuit which completely replaces the first-generation SAA7010, which handled control and display signals, and the SAA7020, which handled servo control signals. The new SAA7210 also does much of the work of the older SAA7000 and provides many enhancements. It has a demodulator with adaptive data slicer, a fully integrated phase-locked-loop demodulator for bit-clock generation, a subcode data processor for control and display information, and an advanced motor-speed control to stabilize input data rate information and further reduce wow and flutter. It also has an improved error corrector with an adaptive strategy, an interpolation and sample-and-hold circuit, and an improved error-correction strategy to handle up to a 15-frame error burst out of a 32-frame block (as opposed to seven frames with the SAA7020). The adaptive error-correction approach discriminates between different types of errors found on a Compact Disc; this enables more corrections to be made, with greater reliability. The error-corrected and interpolated data are then transferred to the SAA7220 via the I^2S bus.

The SAA7220 is the digital filter circuit with enhanced concealment of uncorrectable errors. It has two identical phase-linear digital Finite Impulse Response (FIR) filters with 120 12-bit filter coefficients (as opposed to 96 in the SAA7030). This filter also does the four-times oversampling and offers better noise shaping than the older SAA7030. It performs linear interpolation of up to eight consecutive erroneous samples, thus leaving virtually no trace of errors. Also, the SAA7220 has a soft audio mute when starting, stopping, or pausing and

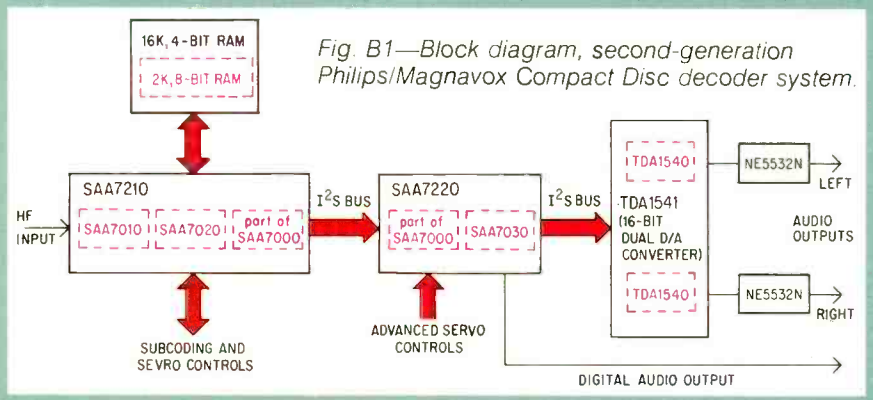

Fig. B1—Block diagram, second-generation Philips/Magnavox Compact Disc decoder system.

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complete a remote as you can find these days, save for the fact that it has no volume control. The related CDB560 has a more limited remote capability, and the CDB460 has none; neither of these two models has the FTS feature. The CDB465's claim to fame is that it has the basic features of the CDB460, plus FTS. The CDB650 also has a digital output in the form of a single rear-panel RCA jack. This output is transformer isolated and is intended to be used for future CD-ROM applications or external digital processors.

While the CDB650, CDB560, CDB460, and CDB465 all have similar audio paths, there are some distinguishing additions to the CDB650. It sports two sets of gold-plated audio output jacks. The first set has a filter like that of all Magnavox players made thus far, a three-pole Bessel-response low-pass filter using (in this case) two Signetics NE5532N or National LM833N dual op-amps. The second set of jacks adds an additional filter in the form of a pair of op-amps in a five-pole, low-pass configuration. This player also comes with a pair of stereo cables, as is typical, but these have gold-plated ends. The CDB560, CDB460, and CDB465 have output circuitry like that used for the CDB650's first set of outputs, and more conventional nickel-plated output jacks.

Listening to the CDB650 is a treat; there is little of the stridency so often mentioned as a characteristic of "CD sound."

As far as internal construction is concerned, all the newer Magnavox players use electronic parts and techniques that are of relatively high quality for what are reasonably priced consumer units. Parts quality has gotten generally better with succeeding generations of Magnavox units. For example, the now-obsolete 2040 player used a number of nonlinear, high dielectric-constant ceramic capacitors, while the newer units employ chip ceramics of higher quality for similar functions. The power supplies of the CDB650, CDB560, CDB460, and CDB465 are ±15 V for the op-amps (as opposed to ±12 V in previous units). All supplies are regulated and use the common 78M00 and 79M00 series of three-pin TO-220 IC chips. Additional capacitive bypassing is also employed across the output(s) of these regulators. I note one oddity, though, which is the fact that the players' designers have chosen to decouple the ±15 V supplies to the output op-amps with relatively large resistances in each supply line, even though these supplies are regulated. This effectively negates the virtues of regulation for these stages.

In the active filter stages which comprise the common output section of the players, 2% polystyrene capacitors are used with 1% MF-25 style metal-film resistors. The CDB650's additional filter stage also uses these higher quality capacitors and resistors. This filter circuit is housed on a completely separate board set off to the right inside the

ce of the ICs

PRASANNA SHAH

12-dB attenuation of audio output while scanning. It also provides a digital-format audio output for interface with digital sound processors that become available in the future.

The older SAA7020 could correct up to seven frames of data out of a 32-frame block (each frame having 256 bits) and could generate an error flag identifying unreliable data. To minimize the effect of erroneous data, a second IC, the SAA7000, replaces them with interpolated data. Where the data samples have very large numbers of error bursts, and thus do not lend themselves to signal interpolation, the SAA7000 generates a mute signal. This eliminates the audible annoyance which would result from erroneous data getting through the error-correction circuits, obviously an important feature for less-than-pristine discs. The SAA7220 replaces these functions, with the improvements noted.

The other major new IC is the TDA1541, the dual 16-bit D/A converter on a single chip. Like its tandem TDA1540 D/A predecessors, this converter also uses the dynamic-element-matching technique for high accuracy and stability. With true 16-bit D/A conversion and four-times oversampling and noise shaping from the SAA7220, an effective 18-bit resolution can be approached, providing greater than 100 dB of S/N. Since the dual D/A converters are on the same chip, there is no delay between the stereo channels; there is also good matching of full-scale and zero-scale outputs on both channels. The (sin x)/x response of the hold function on the D/A converters and the Bessel filter's response were taken into consideration when the filter coefficients for the SAA7220 were scaled, so that the overall digital-to-analog conversion function would provide a flat response in the audio band. The final low-pass filter is again a third-order Bessel type, using either the NE5532N or LM833N.

All these new and improved enhancements in the decoder electronics should enable the high-end Magnavox CD players (CDB650, CDB560, CDB460, and CDB465) to reproduce marvelous sounds and bring them closer to reality.

References

1. Matull, J., "ICs for Compact Disc Decoders," *Electronic Components and Applications*, Vol. 4, No. 3, May 1982.
2. Nijhof, J., "An Integrated Approach to CD Players, Part 2: The Decoding Electronics," *Electronic Components and Applications*, Vol. 5, No. 4, 1984 (Philips TP172).
3. *Signetics Linear Data and Applications Manual*, 1985.
4. Schott, W., "Philips Oversampling System for Compact Disc Decoding," *Audio*, April 1984.

These simple parts substitutions cost less than $20 and will not expose the player to any hazards. But proceed with caution!

CDB650; in the others, the corresponding space is simply empty. These filter circuits are d.c.-coupled within, and a single 220-μF/10-V electrolytic capacitor couples each audio channel to the outside world. The polarizing bias on these capacitors is 4 V (unlike the FD1041 and FD2041, which operate a similar capacitor with no bias).

The p.c. board construction in Magnavox players has lately used a mixed combination of component technologies. While the above-mentioned RC components are the traditional variety (with leads) that mounts on the top of a p.c. board, the FD1041 (and later) players began to also use surface-mounted chip components located on the *underside* of the board. This includes many 1206-size ceramic capacitors and thick-film resistors, as well as transistors. This is one way that the parts density on the boards can be increased. Perhaps more important, this design lends itself to automated assembly, thus ultimately producing a lower priced unit.

All the latest units use this type of construction also, on both sides of the main p.c. board (it mounts the decoder, microprocessor, digital filter, D/A converter, audio filters, and power-supply circuits). Most of the upper plane of this board is a ground plane, in copper for high conductivity. Additional CDB650 p.c. boards include the headphone driver, the control/display, the FTS board, the aforementioned additional filter, and a servo board.

This servo board is actually integral to the player mechanism, whose performance is, of course, highly critical to the overall success of the unit. The CDB650 uses a plastic mechanism, as did the FD1041/FD2041 series. It would seem that a plastic mechanism would not be adequately reliable, yet I personally have not had any problems with it, as used in three different players (an FD1041, an FD2041, and a CDB650). By contrast, I did have some problems with two early model 2040 servo mechanisms, so to me the newer unit seems to have proven itself.

Nevertheless, good lessons can sometimes be "unlearned." This same mechanism, as mounted in the CDB650, has a hangup: Its position is recessed slightly into the player chassis. As a result, you cannot simply run the tray out and conveniently drop a CD into place as you could in the FD1041/FD2041. One must tilt the CD down in the rear, to slip it under the overhang. Boo on this one, Magnavox!

For anyone interested in the more technical aspects of the Magnavox players, I can strongly recommend the purchase of the appropriate service manual. These are available for each series (even for now-discontinued units) from the publications division of NAP Consumer Electronics, Box 555, Jefferson City, Tenn. 37760. You can also call to order by credit card: (615) 475-3801. The prices are very reasonable; for instance, the CDB650 manual costs only $6.50. These manuals are truly excellent, with clear markings of parts, values, tolerances, and their locations via an X-Y map. "Three-dimensional" color views of the two board sides can help find the impossibly tiny chip components. (If you are at all interested in learning how to work on the chip components on these p.c. cards, you'd better think twice. Not only are there the usual standard disclaimers about voiding the warranty, but special tools are needed to do any sort of work with the surface-mounted chip components. It is all too easy to take these parts for granted because everything works so well and because the players do not cost an arm and a leg. However, don't lose sight of the fact that there still is a powerful assemblage of very high-tech stuff in each of them!)

Before I discuss perceived sound, I should note that in my experience just about all CD players are helped sonically by a long warmup and stabilization period. I know some audiophiles who keep their systems on continuously so as to avoid a waiting period each time they listen to CDs.

I should also preface the comments below by saying that they apply to what I feel is a system of higher-than-average resolution. Systems of lesser resolving power will likely not display the same level of detail as I describe. In any event, I will try to qualify my comments to maintain the perspective.

Several CDs which I have found useful to differentiate specific sonic effects are: Dire Straits' *Brothers in Arms* (Warner Bros. 25264-2, DDD); Mahler's *Symphony No. 5* (Chicago Symphony Orchestra, Georg Solti, London 414321-1, AAD); Holst's *The Planets* (London Philharmonic Orchestra, Georg Solti, London 414567-2, AAD); Stravinsky's "Le Sacre du Printemps" (Montreal Symphony Orchestra, Charles Dutoit, London 414202-2, DDD); Mozart's "Eine Kleine Nachtmusik" (Academy of Ancient Music, Christopher Hogwood, L'Oiseau-Lyre 411720-2, DDD), and Janáček's "Taras Bulba" (Vienna Philharmonic Orchestra, Charles Mackerras, London 410138-2, DDD).

Right up front, I'm willing to say that listening to the CDB650 is a treat compared to many other CD players. There is little of the harshness or stridency so often mentioned as a characteristic of "CD sound." Most discs sounded quite smooth on the CDB650, particularly those which put fewer demands on the playback system. (Many high-quality analog-mastered ones seem to do this, while high-energy, digitally mastered CDs can cause nonlinear players loads of grief, resulting in that "CD sound.") With the very best CDs, the CDB650 can sound quite exciting.

The CDB650 did extremely well on all the recordings, with good detail and a fairly broad but not very deep sound stage. On recordings which have a lot of depth and a good bit of hall ambience (such as the Holst and the Stravinsky), the CDB650 reproduced this depth and ambience well. However, it does seem to have a greater ability to reproduce a sonic image in width than it does in depth. Two other Magnavox players (a modified FD1041, with improved amplifiers and power supplies plus direct-coupled, servo-controlled outputs; and a modified CDB650 with similar amplifier/power changes, plus film coupling capacitors) extracted a greater sense of depth and space as well as smoother and finer detail on the Holst and Stravinsky, compared to the

stock CDB650. but the differences were not major. Those two recordings also give a good sense of the acoustic space or "air" around the instruments, which adds greatly to the overall natural liveness. Again, the stock CDB650 did fairly well in this regard, but not as well as the modified units. However, it outpointed a stock FD2041 in detail, imaging, and bass.

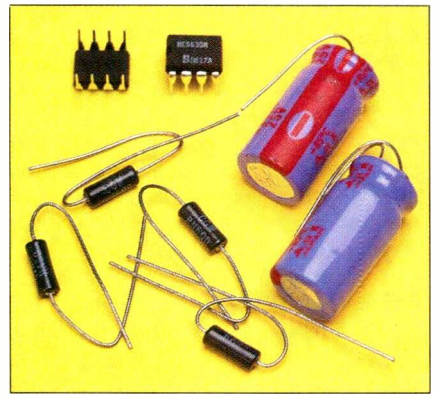
When listening to other types of recordings, such as those multi-miked for various special effects, the importance of the ambience factor becomes moot. On *Brothers in Arms*, there is virtually no depth, and that is what was heard on all players. The CDB650 and the two modified units did well on this one, while the FD2041 sounded a mite "zingy," with loss of detail. As resolution is lost, things blur towards a more homogeneous sound. On the other hand, a very high-resolution CD playback actually will "take apart" the mixdown process of many pop recordings. (You may not like all of what you hear, either.) The point is that if a player can be made which sounds excellent on the very best naturally miked recordings, it will likely give faithful reproduction on other material as well.

I did not spend a great deal of time listening to the CDB650's "additionally filtered" outputs for comparison, as the other players had no comparable function. It is valid, of course, to compare it to the CDB650's more conventional outputs, and this was done. The differences between the normal outputs and the additionally filtered ones left me somewhat cool. I could not perceive that the extra filter did anything to actually enhance the sound (at least in my system). The additionally filtered output was, in fact, a couple of dB down at the top of the audible range; the thinking here, presumably, is that the lower levels of ultrasonic energy will ease overload and/or high-frequency stress downstream. Regardless of the idea behind these outputs, their use was a step backward in sound quality when used in my system. Through them, the sound thickened up and lost the sense of space present at the normal outputs. Overall, I'd rate this extra filter as a nice idea in principle, but one that fell short in its execution.

The CDB650 sounds good just as it comes, but can it be easily made to sound better? The answer is generally yes, but with some very important caveats. First, don't attempt to modify your CDB650, CDB560, CDB460, or CDB465 without *fully* understanding what you stand to gain *and* lose. If you try it and have trouble, you are out on a limb, as you will have voided your player's warranty by opening it up and working on it. Even if you do decide to take this risk, you should be familiar with modern solid-state construction, use only a low-wattage miniature soldering iron, and be prepared to back out if any confusion develops. It is strongly recommended that you attempt these modifications only after obtaining the service manual for your player, and be sure to check out all steps thoroughly before you begin the first one.

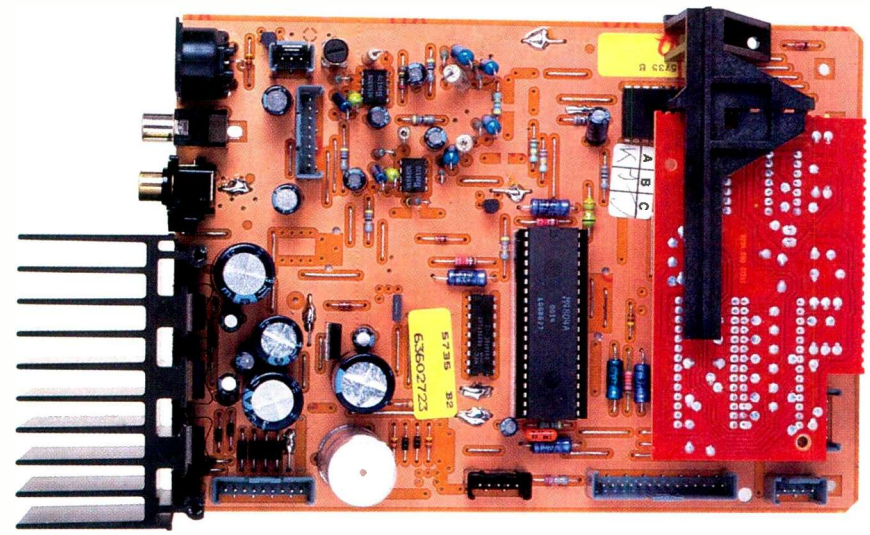
On the plus side. the modifications described below are quite low in cost (less than $20), relatively painless if you are skilled with electronics, and don't really expose the player to any hazards. The modifications are simple one-for-one substitutions of parts, plus a rebiasing of the op-amps for better linearity. A list of parts and sources is at the end of this article.

Begin by unplugging the CDB650 and taking the cover off. For this you'll need a Torx screwdriver, or a small-tip conventional unit which "just fits," to remove the back and side screws. The two NE5532N op-amps on the main board are seen near the 8-pin connector in the photo above. They are shown pictorially on page 6-3 of the service manual, as part numbers 6306 and 6307, and schematically on page 6-5. With the board still in the player, they may be seen in the rear right quadrant of the p.c. board, with part numbers NE5532N or LM833N. Note the orienta-



Installing these ICs, resistors, and capacitors in the CDB650 are most-for-least modifications that should take no more than 45 minutes.

Philips/Magnavox has increased the parts density in the CDB650 by using not only components that mount on the top of the p.c. board (shown), but also some that mount on the board's underside.



We haven't had many truly top-notch players, but I feel this is changing, and the latest Magnavox units may hasten the process.

tion of the notch; it is to the left, as noted in the service manual.

With this in mind, now remove the board. Doing so is a mite tricky, as you will need to disconnect the seven cable plugs, unscrew the four inner and one rear screws, and work the board up and out toward the front (some bending of the rear panel may be necessary). Very carefully de-solder the eight pins of the two above-mentioned ICs, taking care to use a solder dewicking braid. The ICs should drop out easily. Install two new NE5535N devices in their place. Double-check the pin orientation from the top side to make sure it is still correct, and then solder in the ICs.

While still in this area of the board, *very* carefully solder two 3.92-kilohm, metal-film resistors on the back side of the board, on each of the two op-amp IC pin patterns at 6306 and 6307. Connect one resistor from pin 4 to pin 1, and the other from pin 4 to pin 7. Note that this can be most easily seen using the reverse-side board view (shown on page 6-4 of the service manual). Take care that the resistor leads touch *only* the tracks noted; use insulating sleeving on the leads as appropriate. Make sure that no solder splashes are left around these two ICs, and dress the resistors slightly away from the board surface to finish them up.

Next, note the locations of the output capacitors, numbers 2366 and 2367, which are 5/16-inch-diameter electrolytic units back near the output jacks (again, see the manual pages noted above). Carefully de-solder the 220-μF/10-V units supplied, and install a pair of 330-μF/25-V low-ESR (equivalent series resistance) electrolytics in their place, using either of the two types noted in the parts list. *Be very careful that the polarity of the newly installed units matches that of the old, with the "minus" stripe toward the rear panel.* The "minus" polarity stripe is also indicated in the manual, by the dark capacitor plate. This finishes up the modifications. Carefully check your work and re-install the board, taking care to reconnect all cables as they were originally.

While there are many other things which might be done to the player, these relatively modest changes should provide a reward of more smooth, open, and detailed sound, with a minimal outlay of time and money plus a low risk factor in execution. The "most-for-least" modifications I have described should take only 45 minutes or less.

The adventurous reader can likely expand on my suggestions, perhaps substituting polypropylene or polyester film capacitors for the high-performance electrolytics (a large-value film capacitor will be needed, however). For those so inclined, the references below discuss other changes that are possible. For those not inclined to tinker, the four latest Magnavox players will still be a great source of enjoyment, no doubt!

I'll admit that I'm enthusiastic about the CDB650, and about CD reproduction in general. However, I also can understand the type of sound the CD critics have been rejecting. Admittedly, we have not had very many truly top-notch players with the transparency, imaging, and naturalness of the very best analog playbacks—certainly not at medium prices. But I'm also enough of an optimist to feel that this is changing, with quality players and discs.

The CDB650 and related models might impact this situation by moving CD playback a step closer to the best analog reproduction. They might even make some new believers. But even without the new believers, these players *will* make a lot of people happy, since they are plenty good "out of the box." My hat is off to the Philips organization for bringing these products to market. A

PARTS LIST

Op-Amps: Two Signetics NE5535N dual high-slew-rate ICs.
Resistors: Four 3.92-kilohm, 1% metal-film, MF-25 types.
Capacitors: 330 μF/25 V. Use two Panasonic "Z" series (stock #P6635) or two Panasonic "HF" series (stock #P6714).

The parts listed above may be purchased from Digi-Key Corp., P.O. Box 677, Thief River Falls, Minn. 56701, (800) 344-4539. Audiophile-quality parts (ICs, film capacitors, metal-film resistors, etc.) are also available from Old Colony Sound Lab, Box 243, Peterborough, N.H. 03458, (603) 924-6371.

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BRIDGESTONE

WHERE NEW IDEAS TAKE HOLD.

POTENZA RE71. PERFORMANCE UNDER GLASS.

Good news for all-out car enthusiasts: Bridgestone's all-out performance radial—the ultralow profile Potenza RE71—is now available in three new sizes. Including P255/50ZR-16 for Corvette. And P245/50VR-16 for IROC-Z and Trans Am SE.

The Vette size is particularly interesting, with its Z rating—the highest speed rating available. This on top of the performance that comes directly out of RE71's heritage. With its unidirectional tread pattern derived from our European Formula 3000 racing rain tire. And the race-bred crown contour and high-grip compound.

Look for the RE71 on the track in the upcoming SCCA racing season. And while you're at it, don't miss Potenza racing slicks under some of the hottest GTP cars in '87—we're looking for our third successful IMSA season in a row.

Experience Potenza for yourself. Your winning tradition starts at your Bridgestone retailer.

1

YAMAHA DSP-1 DIGITAL SOUND FIELD PROCESSOR

Manufacturer's Specifications

Conversion (A/D and D/A): 16-bit linear, 44.1-kHz sampling rate.
Processing Programs: 32 preset, 16 user-set.
Frequency Response: Main signal, 10 Hz to 100 kHz; processed signal, 20 Hz to 20 kHz.
Harmonic Distortion: Main signal, 0.002%; processed signal, 0.006%.
Dynamic Range: Main signal, 110 dBA; processed signal, 94 dBA.
Maximum Input and Output Levels: 3 V at 1 kHz.
Gain: ±0.5 dB.
Power Requirements: 120 V a.c., 60 Hz.
Power Consumption: 30 watts.
A.c. Outlet (Unswitched): 200 watts maximum.

Dimensions: 17⅛ in. W × 2 13/16 in. H × 12 5/16 in. D (435 mm × 72 mm × 312 mm).
Weight: 9.9 lbs. (4.5 kg).
Price: $899.
Company Address: 6660 Orangethorpe Ave., Buena Park, Cal. 90620.
For literature, circle No. 90

Photograph: Dubler/Tesky Photography

With the DSP-1, Yamaha claims—and delivers—exciting and realistic modification of the stereo sound field. The model designation stands for Digital Sound Field Processor, but this only hints at what the unit actually does. Used with auxiliary amplifiers and speakers, it can make music sound as if it were in any of a dozen types of acoustic space; the acoustic parameters of each simulated space (such as room size and liveness) can also be varied somewhat. In addition, the DSP-1 can be used for surround sound, including Dolby Surround, or for musical effects. In this last mode, it can alter an input signal by adding such effects as tremolo or flanging, raising or lowering the music's pitch, and rotating the sound field in the room.

Control combinations that are frequently used can be stored in any of 16 memories. Processed signals can be recorded on tape, or processing can be applied to tape playback.

Before getting into the details of the DSP-1, I would like to discuss the live listening experience, the recording process, and listening in the home. The great majority of audiophiles are music lovers who use live performances as their reference for rating the quality of home audio systems. There is general agreement, of course, that the two experiences are different and cannot be expected to be the same.

Even the casual listener can perceive such facets as the clarity of sound in one concert hall, the dullness in another, and the garbling of detail in a third. With experience, the budding critic may have very definite feelings that a room is too live (or dead) or too small (or large) for the music that is being performed. At Tanglewood, which is part of my local scene, trios and other very small groups perform on Friday evenings as a prelude to the main concert. Because of the popularity of most of the artists involved, the preludes are presented in the main shed, which seats about 6,000 people. Even with the reflecting surface that is erected behind such small groups, the character of a smaller room is missed. At the other extreme of mismatching was a 17-piece band that I heard recently in a small and very live room. Do I have to say that even without amplification, the brass approached discomfort-producing levels?

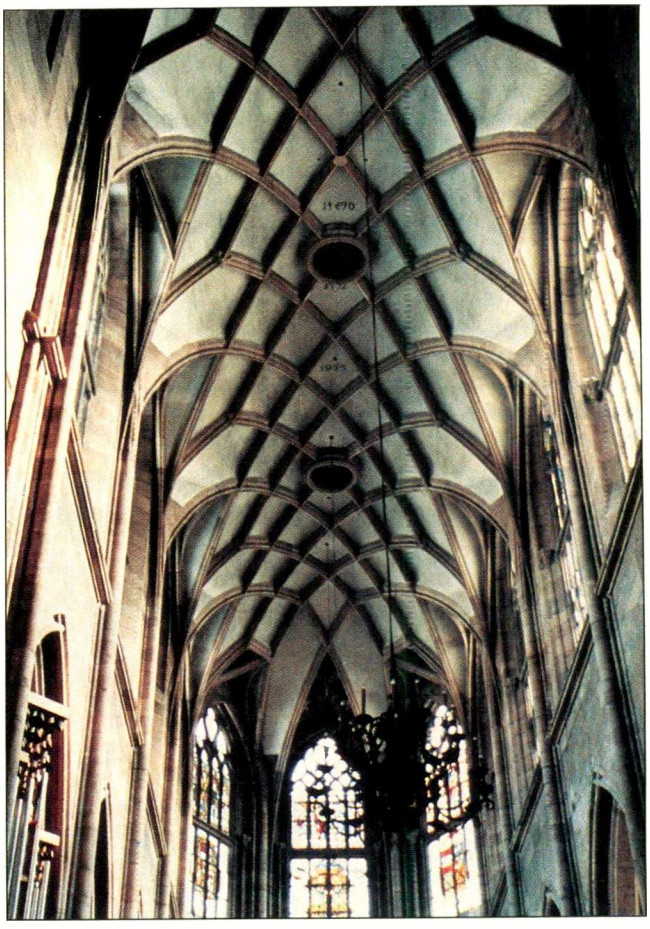
No matter where you sit in a performance venue, you will hear some combination of direct sound, early reflections, later reflections, and a continual decaying of reflected sounds (reverberation). The strength of any reflection will be determined by the angle of incidence, the spectrum of the wavefront, and the material the reflecting surface is made of. For lower frequencies, the rigidity of wall and ceiling panels also affects reflection and absorption characteristics. (Even music that is performed in a large stadium, such as a rock concert, is affected by the character of the surrounding space.) There may still be many opinions on how much the design of a good auditorium is art and how much is science, but there is no doubt that some halls are acoustically great and some are not.

When a performance is recorded, the engineer has many choices to make regarding the number, location, and type of microphones to use, not to mention the equalization he will employ. There is also the question of how the stereo character of the final two-channel master will be achieved: Will the microphones be located and aimed so as to make it true, direct stereo? Or will the microphones be panned electronically in the mixing console to create an amplitude-related left/right sound stage?

The goal, of course, is to generate a recording that will sell well, and good reproduction in the home will get favorable response from critics and buyers alike. The satisfaction of the listener can very well depend on whether there is any sensation of "being there."

There can be natural or artificial reverberation in a two-channel recording, but that does not turn the home listening room into the original hall. The sound still comes from the two stereo speakers, unless the system also includes a delay unit or other such device with additional speakers and an amplifier. Even so, the sound field created in the listening room bears little resemblance to that present at the site of performance. For a sense of "being there" at a movie, Dolby Surround does provide realistic listening experiences, if the source is good. It remains generally true, however, that stereo reproduction of music in the home has remained rather pallid in comparison with the experience of being at an actual performance.

Interior of the Munster in Freiburg, West Germany, one of the spaces whose acoustics were measured by Yamaha for the DSP-1.



The DSP-1 uses stored data from many actual venues to calculate the discrete early reflections which define a site acoustically.

Early reflections are very important in determining the timbre of music and thus defining a site acoustically. The subsequent reverberation is made up of many reflections that have bounced off more than one surface and overlap each other in time; this creates a diffuse sound field throughout the enclosed space. By means of four closely spaced microphones arranged to form four corners of a cube, Yamaha was able to gather and analyze data for the early reflections in many actual performance venues. The stored information told them the timing, level, and apparent source of each reflection for each location.

The DSP-1 contains stored acoustic data based on a number of different performance environments. An original Yamaha VLSI (Very Large Scale Integrated) circuit chip, operating in real time, is used to calculate dozens of discrete early reflections based upon this data. Each of the three Yamaha YM-3804 VLSI chips used in the DSP-1 incorporates a high-speed, 24-by-13-bit multiplier and a 26-bit adder and subtractor. These enable the DSP-1 to produce up to 88 discrete early reflections, 22 for each of four effect channels. Digital processing is carried out in 16-bit linear quantization at a sampling rate of 44.1 kHz.

The digitally processed delays create, in the relatively small listening room, the same time lag between the sound arrivals from the main and the effect speakers as would exist between the direct sound and the reflections from the walls in a concert hall. Thus, the boundaries of the home listening room are removed, as it were, and replaced by the characteristics of the selected performance hall.

The processor offers a great deal of operating flexibility by providing control over many of the parameters involved in the sound-field synthesis. Such things as liveness, initial time delay, and reverberation level can be varied over wide ranges for the most satisfying home listening experience.

Control Layout

The front panel of the DSP-1 gives very little indication that a great deal of sophistication is behind it. At the very left is the push-on/push-off "Power" switch. To its right are three "Mix Input" phono jacks, labelled "Mono," "L," and "R," and a "Level" control for them. These inputs, which provide convenient front-panel access to the DSP-1's processing, can be used to mix a second signal (such as a musical instrument) with the main input source. This would be particularly helpful to a performer when using the "Sound Effector" programs, which will be discussed later. The mono input is a worthwhile inclusion because so many keyboards and other musical instruments have mono outputs. In case these inputs are used infrequently, they can be concealed by a supplied push-on rubber cover.

Farther to the right is the three-position "Tape" knob ("Effect Rec/Norm/Monitor"). The "Effect Rec" position allows the processed stereo sound to be recorded on tape. In "Monitor," the processing is applied to tape playback. To the right of the "Tape" knob is the playback level ("PB Level") pot; like the "Mix Input Level" control, it is calibrated from "0" (off) to "10," with the calibration numbers placed exactly where they'd be on a clock face. The arrangement is unusual, but it makes clear where the off position is, and it is best to keep unwanted signals at zero. All three rotary controls on the front panel have small bar-grip knobs.

The right side of the front panel is occupied by the display area. At the display's left are two red LED indicators which illuminate when the main and/or effect channels are muted. The receptor for the supplied remote control is just below. To the right are annunciators for the various processing modes: "Acoustic," "Surround," and "Effector" are in red, and "User Prog" is in yellow. To their right, program numbers (from 1 to 16) are shown on a red LED numeric display. At the far right is the alphanumeric program display, in amber LEDs against a dimly lit background. The 16-character display provides essential information on the program parameters and values being used.

The need for an alphanumeric display and the lack of buttons and controls on the DSP-1's front panel make more sense when you look at the 30-button remote control. Since the DSP-1 is designed to create or alter sound fields at the listener's seat, it's only logical to make its main controls available at the listening position.

The remote control's layout provides a key to the DSP-1's operation. First, one selects a processing mode, then an effect parameter to adjust; after adjusting the parameter, one can fine-tune the system's levels. (I should point out that all the programs and parameters affect only the signals to the effect outputs and have no influence on the main stereo outputs.)

Mode selection is handled by a row of four small pushbuttons nearest the infrared transmitter end of the remote. The two inner buttons select either the "Acoustic/Surround" or "Sound Effector" modes for spatial simulation or musical effects, respectively. The "Memory" button at the left and "User Program" button at the right allow one to enter and store up to 16 user-modified program settings in memory. (The "User Program" memories contain duplicates of the preset "Acoustic/Surround" programs when the DSP-1 leaves the factory, but modified "Sound Effector" programs can also be stored there.)

Below the four mode buttons are 16 numbered "Program"

Continued on page 93

Part of Yamaha's measuring setup in the Alte Oper in Frankfurt, West Germany.

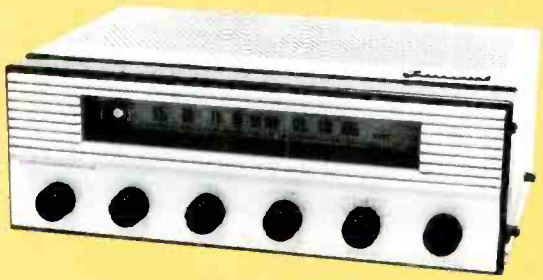
"What is past is Prologue."

William Shakespeare

The bard knew that continuity is as fundamental to life as change. Because the past—the history of an individual, a nation or a corporation—is often an important key to understanding both the present and future, Sansui is taking the occasion of our 40th anniversary to reflect on past achievements in audio.

The pages that follow touch on the technology bred into our present generation of high fidelity products as well as looking ahead to future decades.

The first four decades.



THE FORTIES

In 1947 a young engineer named Kosaku Kikuchi founded Sansui Electric Company, Ltd., with the equivalent of $600. Though housed in an old wooden building in the Yoyogi-Uehara section of Tokyo, Kikuchi, an idealist, found its name in the Japanese words for mountain and water; the former symbolized strength, the latter beauty, clarity, and movement. Kikuchi's ideals were also manifest in his firm's first products, power transformers for radio sets, and are reflected by Sansui's high fidelity components to this day.

THE FIFTIES

By the 1950s Sansui's focus was on the development of amplifiers, where we have since made major contributions. Our first amps, the HPR-100 and HF2A3S, were unveiled in 1954 and, two years later, Sansui amplifier technology was integrated into the PM-R500 receiver. In 1959 our first stereo amplifier and receiver were produced.

THE SIXTIES

In 1965 our model AU-111 integrated amplifier was the first to incorporate Sansui's 6L6GC push-pull configuration which sharply lowered both intermodulation distortion and THD. The AU-777, was the first amplifier to use all silicon-transistor circuitry. During this period, too, American audiophiles discovered Sansui; many veterans recall with affection their model 2000 and 5000 receivers, purchased at Post Exchanges.

THE SEVENTIES

By the time the 1970s dawned Sansui already held a score of patents in the U.S. And we continued to achieve breakthroughs in high fidelity amplification. Our AU-717, was the first to employ DC circuitry. This significantly improved the amplifier input stage and made possible bandwidth ranging from DC (or zero Hz) to 300 kHz for unprecedented dynamic capability.

A refined DC circuit, Diamond Differential DC, later appeared in our AU-919 integrated amp; this substantially reduced transient intermodulation distortion. And our acclaimed "G" Series receivers were the first to employ DC amplifier sections.

THE EIGHTIES

In the current decade Sansui's research into amplifier technology continues. Our Super Feedforward system suppressed internal distortion while external ground noise was eliminated by our revolutionary X-Balanced circuit and, more recently, the refined "Alpha" X-Balanced configuration employed by our remarkable AU-X901 integrated amp.

The innovations continue.

Technology can be employed for a vast number of purposes, only some of which benefit mankind or enhance the lives of the men and women who occupy this planet. We at Sansui are proud that the technology we continue to develop and employ is in the service of art. Because, as the English playwright William Congreve put it, "music hath charms to soothe the savage breast."

AU-X901: BREAKING NEW GROUND IN AMPLIFIER TECHNOLOGY

It has often been said that the ideal high fidelity amplifier would be a straight wire with gain. While it's virtually certain this will never be achieved, it is the direction that decades of research into amplifier technology have taken at Sansui.

Our hi-fi amplifier breakthroughs, previously detailed, have led to the technology incorporated in today's state-of-the-art Vintage AU-X901 "Alpha" X-Balanced integrated amplifier. This audiophile product amplifies and transmits balanced signals without reference to ground.

In recording and broadcasting studios today, audio signals are transmitted through balanced systems in order to avoid any degradation that may be produced by external sources or ground-related problems. Such signals, however, are low level. It took Sansui to develop a balanced amplification system suitable for the high power, high fidelity sound reproduction requires.

In most modern amplifiers, input, output and power supply are all referenced to ground, causing a variety of currents—such as ripple current created by rectification in the power supply and counterelectromotive current generated by speaker cone excursion—to flow through the common grounding circuit. These are perceived by the listener as noise and distortion.

To eliminate such degradation of musical signals, the "Alpha" X-Balanced AU-X901 employs a pair of amplifiers, one for the positive or hot side and one for the cold side of each channel. These are bridged so that a speaker wired to that channel is driven by the difference signal. The output is balanced: therefore, no current or electromotive force can affect the performance of the amplifier.

Not only is the output of the AU-X901 balanced, but the unit's input stage and power supply operate independently of ground as well. Therefore, its balanced input effectively rejects noise. And since the balanced power supply circuit forms a closed loop, completely isolated from the ground, both power-line noise and Interface Hum Modulation are eliminated.

A balanced system is even used in the feedback loop and the power amplifying stage of the AU-X901. Negative feedback is derived from a differential output and applied to a differential input. Since both circuits are isolated from the ground, even if the output or input is grounded by accident, circuit operation is unaffected. Because power amplification is achieved with no reference to ground, steady operation of the AU-X901 is assured, even when power supply voltage surges or when a voltage differential occurs in its power stage.

The AU-X901 combines Sansui's "Alpha" X-Balanced technology with 130 watts of RMS power per channel, both channels driven into 8 ohms, from 10 to 20,000 Hz, with no more than 0.005 percent total harmonic distortion. The 40 pound unit is constructed of solid materials and dou-

The innovations continue.

ble-insulated to eliminate resonance and vibration.

So that listeners can enjoy optimum fidelity from Compact Discs, the AU-X901 includes a balanced Cannon-type input for direct connection of CD players featuring matched output. This manner of hookup means complete freedom from ground-related interference as well as digital noise that can occur at the interface between amp and CD player.

Other features of the AU-X901 include gold plated input and output terminals, an independent record selector with off position, power amp direct connection, high-gain phono equalizer for both moving magnet and moving coil cartridges and tone control with turnover frequencies at 75 and 150 Hz.

S-X1200: A RECEIVER FOR ALL SEASONS

An integrated receiver need not mean compromise. Particularly when the name on its faceplate is Sansui.

Our dramatically-styled flagship receiver, the S-X1200, is packed with all the power and performance it takes to make home music listening a joy for years to come. At its core is an amplifier section that results from decades of experimentation and breakthroughs in the technology of high fidelity amplification. This produces 120 watts per channel, both channels driven into 8 ohms, from 20 to 20,000 Hz, with no more than 0.015 percent total harmonic distortion. The S-X1200's muscularity is clearly reflected in the two large vertical LED power meters boldly designed into its front panel.

The unit's amplifier section was specifically created to meet the challenges of the digital age. Program material with the wide dynamic range of digital audio makes unique demands on amplifiers and, depending on the energy and frequency makeup of the music, can reduce speaker impedance from eight to as low as four ohms. The S-X1200's amplifier section easily handles low impedance loads to reproduce digital dynamics with exceptional fidelity.

For enhanced reception of stations that are far enough away to add an annoying level of noise to stereo transmission, the S-X1200 incorporates a Hi-Blend control that reduces noise without switching the station into mono.

Sansui's S-X1200 was designed for the needs of audiophiles and videophiles alike. A sound attacker is built-in to emphasize TV and movie transients such as cymbals and other percussive sounds. The unit also synthesizes ultra-deep bass from the actual bass frequencies present on a videocassette's soundtrack to make special effects even more special.

The S-X1200 also makes it simple to integrate an audio and video system. It gives users the ability to connect a pair of video program sources, two VCRs or a VCR and videodisc player, and enables dubbing from either to the other at the touch of a button.

For maximum convenience, the S-X1200 provides presets for 16 FM and AM stations, any of which its Quartz Phase-Lock Loop tuner section will home in on with true drift-free precision.

CD-X901: A RE-ENGINEERING OF COMPACT DISC TECHNOLOGY

The new design of the CD-X901 starts with the chassis construction. The player

mechanism is copper clad, separate and suspended from the main chassis. This isolation of the pickup system from the drive system prevents internal vibration and shock from affecting absolutely stable disc tracking. A precision brushless/slotless spindle motor with high rotational accuracy improves Signal-to-Noise Ratio. A new disc centering system precisely aligns the center of the rotating disc with the spindle motor and provides even more vibration damping. The disc tray itself is made of a hard, precision finished, Bulk Molded Compound (BMC) which also adds to the unit's vibration and resonance damping.

The CD-X901 utilizes three power supplies and photo Digital to Audio coupling which isolates the digital circuitry from the analog and prevents digital noise from being added to the output signal.

The CD-X901 utilizes four times oversampling (176.4kHz) with a digital filter for smooth, ripple-free bandpass response with negligible pre-echoes and virtually noiseless performance. To improve channel separation the unit utilizes discrete Digital to Analog converters. Discrete components, rather than IC's, are used in the audio circuitry to ensure delivery of high performance characteristics.

Cannon-type balanced outputs are provided for use with similarly equipped amplifiers to eliminate the noise and other negative characteristics of grounding. The unit utilizes a master clock system in which a single clock mechanism controls digital, servo, and control circuits, thereby eliminating yet another noise-inducing possibility.

Among the unit's control features are a numeric keypad for direct track access, AMPS (Automatic Music Program Search) with Up/Down keys, Music Scan, Index Search, Auto Space, Repeat (one track, point A to B, and all tracks), comprehensive display, 20-track random access, timer-controlled play, and headphone output with volume control.

Specifications of the CD-X901 are: Frequency Response—5Hz-20kHz; Dynamic Range—98dB; Signal-to-Noise Ratio—110dB; Total Harmonic Distortion (1kHz)—0.002%; Wow & Flutter—Unmeasurable; Channel Separation—95dB; Output Voltage—2V; Weight—23.1 pounds.

Its sophisticated display shows track time, remaining time, elapsed time and total play time. In addition, the 20-programmed tracks can be displayed.

The innovations continue.

GT-X7000: CAR AUDIO THAT SETS THE PACE

The high fidelity tuner section and precision cassette deck at its heart are only the beginning of the GT-X7000 story. Sansui's top-of-the-line car audio cassette/tuner combines great sound with a degree of convenience that means not only luxury but added safety for driver and passenger alike.

It's no exaggeration to say the GT-X7000 thinks for itself, and a single thought is ever on the microchips that compose its electronic mind: optimum performance.

From an FM transmitter's point of view, your car is a moving target. Sansui helps remedy this difficult situation with the GT-X7000's Automatic Stereo Reception Controller. This system governs four functions—separation control, high blend, high cut filter and soft mute—and activates each automatically as FM signal strength changes. The result is noise-free reception, even at the fringes of a station's listening area.

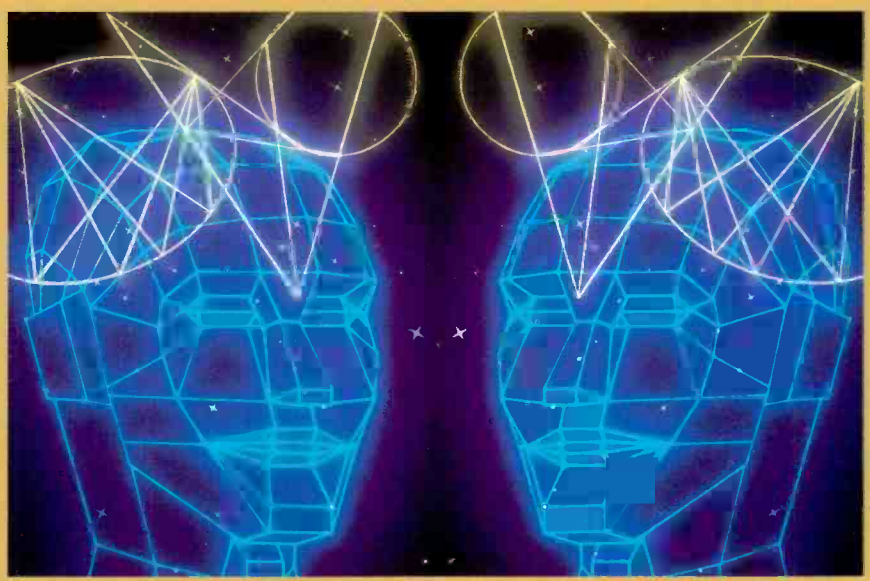
Our Multipath Distortion Blocker further reduces noise by automatically switching the GT-X7000's tuner to mono during periods when multipath reflections are present, and the unit's Pulse Noise Blocker serves to cancel noise from such sources as an engine ignition system or lightning.

Sansui engineers equipped the GT-X7000 with an Intro Memory that functions in tandem with the unit's 24 station presets, three groups of six for FM and a single group of six for AM. Together these features allow you to call up a combination of presets without deleting the others from the GT-X7000's memory, a highly useful feature where more than one person drives the car: each can have their own set of presets. Other auto-tuning features built into this cassette/tuner include Preset Scan and Auto Seek.

The GT-X7000's cassette deck is auto-reverse, of course, and is equipped with both Dolby B and C noise reduction systems along with a wealth of computerized features. Intro Scan, for example, consecutively previews the first ten seconds of every song recorded on a cassette, while Automatic Music Program Search serves to locate the next selection on tape or reverses to the start of a given selection for repeat play. When there are more than ten seconds of unrecorded tape between selections, the unit's Blank Skip feature moves quickly to the next one. For maximum convenience, these features operate regardless of the direction in which the tape is moving.

Superb ergonomic design enables operation so simple that it belies the number of functions built into the GT-X7000. The size of its controls were determined by the frequency with which they are commonly used, and they're arranged so those for tuner operation can be distinguished from the ones that command cassette functions. Both light and sound are utilized to feed information to the driver; lighted function and tape running indicators enable quick recognition of operating status, and beep tones sound to confirm the GT-X7000's acceptance of user commands. The unit even includes a buzzer that reminds drivers who have forgotten to turn off their headlights to do so before leaving the car.

A future that reflects our past.



The microprocessor, the video tape recorder and the compact disc player have revolutionized home entertainment and forever changed our lifestyles.

Imagine, for a moment, the make-up of a typical enthusiast's audio/video system. A high power, low distortion integrated or power amplifier capable of handling exceptional dynamic range. An AM stereo, FM stereo tuner that is impervious to multipath and phase distortion and is capable of receiving digitally encoded broadcast material. A satellite receiver connected to an 18" dish that can receive regular audio and video signals plus digitally encoded material.

The system player/recorder uses a laser to play CDs, VHD discs, and laser discs. It can digitally record video or up to 12 hours of audio. The unit is random programmable and access time is in milliseconds. The 280 channel digital video monitor has 560 line definition and is available in flat screen sizes ranging from 35" to 72" (diagonal). It has a special effects generator that permits zoom and provides picture-in-picture performance with up to 8 pictures on screen simultaneously. The super hi-fi, digital video tape recorder also has a special effects generator that additionally provides noiseless slow motion, still frame and high speed (15X normal), fastforward and rewind. It provides a 560 line picture, and 12 hours of video or PCM audio material that can be on-screen programmed.

Two digital signal processors are included in the system. The audio unit can process digitally encoded material and control the total ambiance in the playback environment. By reading an encoded signal on the pre-recorded material, it is capable of reproducing the ambiance of the original performance. For surround applications it has its own built-in amplifiers. The video processor can be used with a camera and/or multiple video sources to create professional video tapes and discs. In addition to wipes, fades, solarization and negative picture effects, it provides built-in titling capabilities.

To complete the system four speakers are used in a surround configuration. The entire system is operable or programmable through a universal, hand-held remote.

Believe it or not, most of the technology described already exists, much of it in Sansui's Research and Development Laboratories. Sansui, in fact, already holds patents on optical lasers and a DC-PCM transmission system. Sansui engineers have presented technical papers on these and other technologies including: X-Balanced amplification, FM super linear decoders and AM stereo before the prestigious Audio Engineering Society (AES).

Typical of the research underway is the work being done on Write Once, Read Many (WORM) laser technology which provides 700 megabyte storage on a double-sided 5-¼" disc. Stored data is retrievable in milliseconds as compared to minutes in other media. Unlike ordinary discs, the software is totally protected and the Read/Write opening is accessed by a drive-actuated shutter. One cartridge holds the equivalent of 16 reels of tape and could ultimately revolutionize home entertainment by making it possible to record and store perhaps a dozen or more hours of musical program material on a single cartridge.

A recent industrial product resulting from the collaboration of Sansui and McDonnell Douglas Electronics hints at our future-tech capabilities. This is a highly advanced interactive videodisc system that employs inexpensive film technology. The system includes capability to master, replicate, and play back a film disc that is primarily designed for industrial and commercial use. The inexpensive film technology allows individual ownership of complete systems. The system can store and play back linear or compressed audio, motion video, single pictures, and digital data.

These are by no means consumer products yet. But the directions in which they have led our engineers are almost certain to result in highly sophisticated audio and video components built by Sansui for homes of the 1990s.

SANSUI ELECTRONICS CORPORATION
1250 VALLEY BROOK AVENUE, LYNDHURST, NEW JERSEY 07071

Main controls are on a remote unit, a sensible design since the DSP-1 is intended to alter sound at the listener's seat.

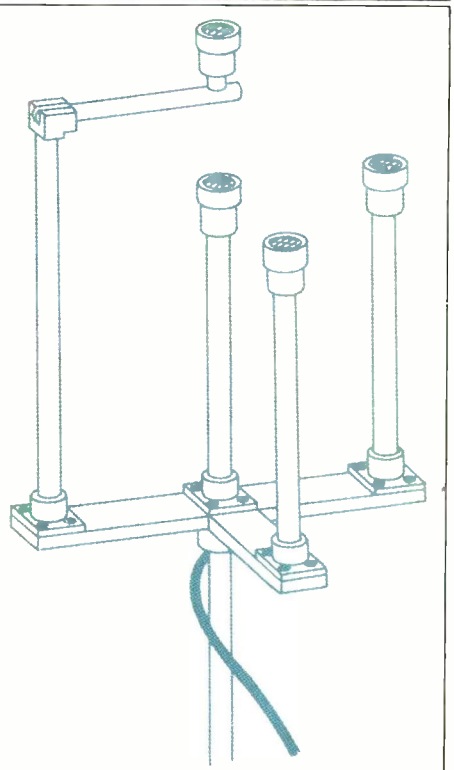
Continued from page 84

buttons, in four rows of four. Their meanings, which change with the program mode, are spelled out on the front-panel display. In "Acoustic/Surround" mode, the first dozen choices are specific types of space: "Hall 1" and "Hall 2" (a large and a medium-size hall, respectively), "Hall 3" (a multi-purpose hall seating about 1,000), "Chamber" (a grand ballroom), "Munster" (a cathedral), "Church," "Jazz Club," "Rock Cnct," "Disco," "Pavilion" (an indoor stadium), "Whse Loft" (a concrete warehouse), and "Stadium." Then comes "Presence" (separate delays to front and rear effect speakers) and three surround modes: "Sur 1" (added depth for A/V sources), "Sur 2" (added width for A/V sources), and Dolby Surround (indicated on the remote by Dolby's double-D symbol).

In "Sound Effector" mode, the buttons, in the same order, are: "Delay" (which varies delay independently for all four effect channels), "St Echo" (stereo echo with independently variable feedback and delay for left and right channels), "St Flange A" (echo modified by out-of-phase signals to produce a "varying and swirling" tone), "St Flange B" (a faster and lighter flanging effect), "Chorus A" (modulating the delay time and amplitude of different tones to produce "rolling and swaying"), "Chorus B" (slower and less pronounced chorus effect), "St Phasing" (a periodic tonal variation that shifts between right and left), "Tremolo" (a more pronounced chorus effect), "Symphonic" (also like "Chorus," but with irregular timing), "Echo Room," "Pitch Change A" (which changes the pitch of the input tone ±1 octave, with variable echo feedback and delay), and "Pitch Change B" (similar to A, but with independent left and right settings). There are also four image-motion buttons: "L Turn," "R Turn," "F-R," and "L-R." These move the effects image continuously, at a user-variable speed, in any of six directions: Counterclockwise, clockwise, front to rear or rear to front, left to right or right to left, back and forth between left and right, or back and forth between front and rear.

The remote's program numbers (which are white on a black background) and its "Acoustic/Surround" designations (which are black on a beige background) are easy to read, but its blue "Sound Effector" labels do not stand out clearly from their black background. (Yamaha says this is intentional, to de-emphasize the "Sound Effector" mode in favor of the "Acoustic/Surround" mode, which they feel will be used 90% of the time.) The remaining 10 buttons on the remote unit have white designations, so they are easy to read. They are: "Parameter," for selecting parameters in the current program for modification; "Dec" and "Inc," for decreasing or increasing the value of the selected parameter; "Rear" and "Front" balance controls; "Down" and "Up" level controls; "Main" and "Effect" mute keys, and "Title Edit" to generate names for user programs. This last button is used with the "Dec" and "Inc" buttons to select and place the letters, numbers, and symbols of each title on the 16-character display. The characters available include complete upper-case and lower-case alphabets (including vowels with umlauts), the 10 numerical digits, 18 math symbols and punctuation marks, and right and left arrows.

It's not impossible to list each parameter for each program, but the list would be very long and complicated. So let me just summarize:



Microphone setup used for Yamaha's acoustical measurements.

There are what amount to two hall subtypes for each of the three "Hall" programs and four subtypes ("Live," "Spacious," "Reverse," and "Dynamite!") for each of four pop/rock venues ("Jazz Club," "Rock Cnct," "Disco," and "Stadium"). Other adjustable parameters affecting some or all of the acoustic and surround programs include: Room size, liveness (attenuation characteristics of primary reflections), the initial delay applied to first reflections, high- and low-pass filters, reverberation time, relative high- and middle-frequency reverberation times, and rear reverberation level. For Dolby Surround, only the delay time is adjustable. For "Sur 2" (which, Yamaha says, follows the Dolby Surround pattern but has additional enhancements), one can adjust liveness, room size, initial delay, and filter settings; in addition, different hall subtypes can be selected. The "Sur 1" mode has similar parameter choices but apparently does not follow Dolby Surround. For "Presence," there is independent delay selection for each of the four effect channels, plus high- and low-pass filter control.

For the "Sound Effector" programs, parameters that can be adjusted include delay time, high- and low-pass filter settings, amount of echo feedback, modulation frequency and depth (for variable-rate programs such as flanging, phasing, chorus, and tremolo), reverberation time, pitch (coarse and fine), and panning speed and direction.

The rear panel of the DSP-1 has 14 phono jacks. Twelve are stereo pairs: Input, main, and processing (front and rear) outputs, and record and playback connections for a tape recorder. The other two jacks provide mono outputs for a center-position speaker ("Full Band") and a subwoofer ("Low Pass, f_c 200 Hz"). Also on the rear panel are an input-

Not Evolutionary,

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Audiophiles, take note: The preamp and amplifier you've been waiting for are finally here.

Introducing the Pioneer Elite Hi-Fi C-90 Preamp and M-90 Power Amplifier. Together, they combine the finest in both audio and video to retrieve every detail and nuance found in your cherished records, tapes, compact discs, LaserVision™ discs and other software. Imagine a soundstage spread throughout your entire listening room! Stunning, transparent, three-dimensional music, the likes of which you've never heard, apart from a live performance.

We paid fantastic attention to detail to gain this level of musical truth. One example: the C-90 volume control is a motorized, high precision rotary potentiometer. This permitted us to create the world's first high-end preamp with a no-compromise hand-held "SR"™ remote-control unit.

The C-90 features three separate power transformers—two to power left and right audio channels for vanishingly low crosstalk, and a third transformer to drive the preamp's unique video capabilities, relays, display and microprocessor. All switching functions are accomplished by electronic relays. Thus the signal paths are as short as possible, improving signal-to-noise ratio and channel separation. Anti-vibration measures taken to further the C-90's sonic excellence include a solid aluminum volume control knob, polycarbonate chassis feet, and rubber-cradled PC boards. Soft copper-plated screws insure a snug fit of chassis, transformers, transistors, and help to dampen vibration.

The C-90 Preamp readies you for the video revolution, with six video inputs, a built-in video enhancer, and two-buss switching (separate "Record" and "View" selectors). The C-90's unique system remote-control unit features volume adjustment, input source selection, and control of audio and video input devices such as Pioneer's "SR" compatible VCRs, CDs, LaserVision players and cassette decks.

The M-90 is a superb high-power stereo amplifier, utilizing dual-mono construction. It is conservatively rated at 200 W/CH into 8 ohms[1] and delivers 800 W/CH of dynamic power at 2 ohms.[2] The wide dynamic range of digital sources can now be reproduced effortlessly, with any loudspeakers. The M-90's high current capacity of 47 amps can handle the challenge of the most complex speaker loads. To further enhance S/N ratio and channel separation, relay-operated electronic switches and a long shaft volume control keep the length of signal paths down to a minimum. Why include a high quality volume control on a power amp? Simple. To pursue the straight-wire-with-gain philosophy when using a CD player connected directly. Pure sound, redefined.

The exquisite finish of the M-90 and C-90 reflects their quality. Elegant rosewood side panels and front panels with a deep hand-brushed lacquer finish emphasize the care of craftsmanship we've lavished on these two components. The Pioneer C-90 Preamp and M-90 Power Amp. Evolutionary? Hardly. Revolutionary? Most definitely.

For your nearest Pioneer Elite Hi-Fi dealer, phone 1-800-421-1404.

 [1]Based on FTC rules regarding measurement of amplifier power ratings.
[2]Measured by EIA method.

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Small changes in frequency or in program caused big changes in measured output from the effect channels.

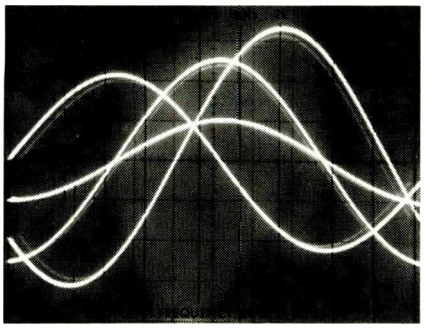

Fig. 1—Output from the four effect channels for a 477-Hz input in "Church" program mode. The interchannel phase and amplitude differences will vary with input frequency and program mode. (Horizontal scale: 0.2 mS/div.)

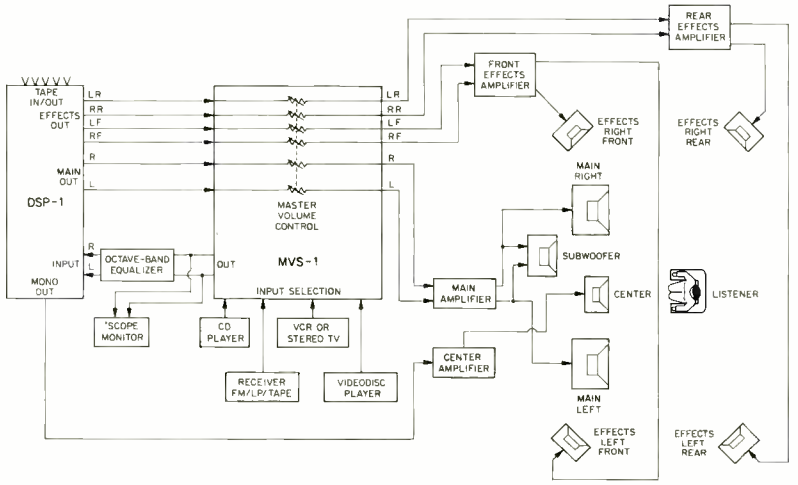

Fig. 2—Author's setup using the MVS-1 master volume control with the DSP-1.

balance pot with a center detent (primarily for Dolby Surround) and two slide switches. The "Front Mix" slide switch is set for six-channel or four-channel operation to match the amplifier and loudspeaker configuration used. The normal combination is conventional stereo plus front and rear dual-channel processed sound. If just the rear speakers are used for the processed sound, putting the slide switch to "4ch/On" adds the processed front sound to that going to the main stereo speakers. The other slide switch reduces the main output by 10 dB, if needed, to get a better level match between the main and the effect speakers. The final item on the rear panel is an unswitched a.c. outlet rated at a maximum of 200 watts.

Removing the top and side cover of the DSP-1 revealed three large p.c. boards. One was a little more than one-half chassis size; the others were a bit smaller and stacked one above the other. The boards and the components were of high quality, and the soldering was excellent. Interconnections were made with multi-conductor cabling. Fixed resistors and capacitors were not identified, but other components were, and function areas were labelled. All ICs were soldered in, including the three impressively large VLSI YM-3804s. There was little springiness to the boards, and the chassis support was quite rigid. No fuses were noted, although one or two of the power-supply resistors might serve that function.

Measurements

All of the test results reported here were actually obtained at the conclusion of the use and listening tests. I did not attempt to measure all of the electronic characteristics, but I did check the DSP-1 against Yamaha's specifications to verify some of the parameters and to find out what the resolution was for all of the parameter steps.

The maximum input voltage varied a great deal, being very dependent upon the program and the exact frequency of the test tone. The specified 3 V is a good figure for the great majority of circumstances. The worst case was an input limit of about 0.9 V, which occurred only in the front channels, and then under *very* restricted circumstances (only in the "Church" program, and only with a steady tone between 504.9 and 505.2 Hz).

Figure 1 shows the output from the four effect channels at 477 Hz in "Church." The oscilloscope was locked to the front left signal. The front right signal lags by 90° and is the lowest in amplitude. The rear right signal lags by the same amount but is higher in amplitude. The rear left output lags more and has the highest amplitude. Small changes in frequency caused large changes in the amplitudes and their relationships, as did changes in program at the same frequency. The characteristics of the processed sound are very complex and not easily stated or measured.

I measured signal-to-noise ratios of 103.7 dBA for the main outputs and 86 dBA on the average for the effect outputs, both referred to 1 V. Distortion was 0.0018% for the main outputs and 0.0055% for the effect outputs. The main outputs were down just 0.4 dB at 20 Hz and 0.8 dB at 20 kHz. The effect outputs were down the same amount at 20 Hz and down 2.7 dB at 20 kHz. (In Dolby Surround, the required high-frequency roll-off occurred.) There was a small level change in the signal through the main channels: −0.4 dB for the left and −0.5 dB for the right.

For easy adjustment of all six channels simultaneously, I used the accessory MVS-1 level control—a $149 option—with my system configured as shown in Fig. 2. (If your system allows the DSP-1 to be connected between your preamp and main power amplifier, this option is not absolutely necessary.) With the MVS-1 connected to the DSP-1's outputs, the overall level drop from the DSP-1's input to the MVS-1's output was 1.6 dB for the left and 1.7 dB for the right. I judged this to be acceptable, considering the benefits of using the MVS-1.

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Throughout the evaluation, everything was completely reliable, and for all its complexity the DSP-1 never left me confused.

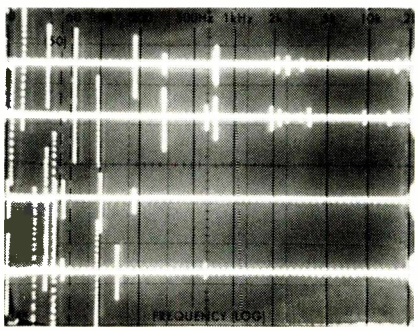

Fig. 3—Output from the four effect channels for a 977-Hz, single-cycle tone burst fed to both input channels in "Hall 3" program mode. Traces are (top to bottom): Left front, right front, left rear, and right rear. (Horizontal scale: 50 mS/div.)

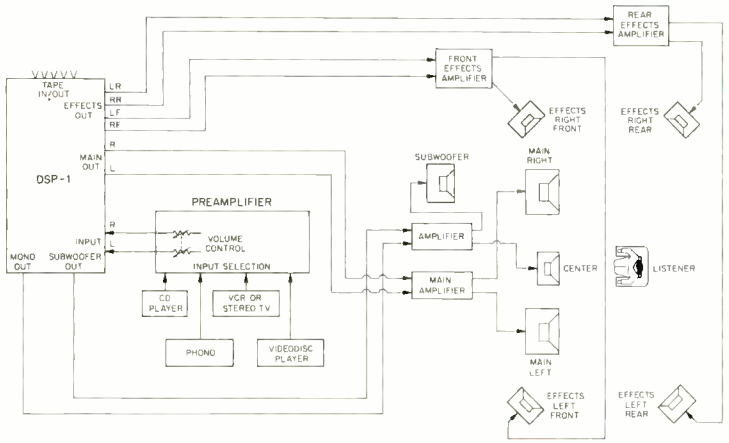

Fig. 4—Setup without MVS-1 showing all channels in use, with master volume controlled by the system preamp and effect-channel levels and balance controlled by the DSP-1. Using an amplifier with volume control for the center and subwoofer channels would simplify balancing.

Input impedances were 51 and 31 kilohms for the DSP-1 and MVS-1, respectively. The DSP-1's output impedance was 1.4 kilohms; that for the MVS-1 was 1.7 kilohms at maximum setting, with an increase to 2.9 kilohms at the 3 o'clock position. All six sections of the control tracked each other within 1 dB from maximum output down to 75-dB attenuation—absolutely sterling performance.

Figure 3 shows the four effect-channel outputs for a 977-Hz single-cycle burst with the DSP-1 set to its "Hall 3" program. There are some similarities between the front-channel outputs and between the rear-channel outputs, but all four outputs are different with respect to their initial reflections. Without any external signal fed in, there was leakage of 44.1 kHz at −112 dB (re: 1 V); there was also a 31.1-kHz tone at −92 dBV, with lower-level sidebands 250 Hz above and below this frequency.

I measured the range and step-size (resolution and number) for all parameters but did not perform listening evaluations for them all (particularly those for the "Sound Effector" programs). My check of the parameters and the possible steps showed the following: "Room Size" could be set anywhere in an 80-step range; "Liveness" had a 10-step range; "Initial Delay" could be set from 5 to 150 mS in 1-mS steps; the high-pass filter could be set in what amounted to 32 one-sixth-octave steps from 32 Hz to 1.0 kHz, plus flat, and the low-pass filter could be set in 26 one-sixth-octave steps from 1.0 to 16 kHz, plus flat. "Reverberation Time" allowed settings from 0.3 to 5.0 S in 0.1-S steps, from 5.5 to 10 S in 0.5-S steps, from 11 to 20 S in 1-S steps, and from 25 to 95 S in 5-S steps, plus a final step to 99 S. "Reverberation Time Ratio" (high-frequency reverberation decay relative to mid-frequency reverberation time) could be set from 0.1 to 1.0 in steps of 0.1, and "Presence Delay" from 0.1 to 600 mS in 0.1-mS steps.

For "Sound Effector" programs, parameters included: "Stereo Echo Delay" from 0.1 to 270 mS in 0.1-mS steps; "Feedback Gain," ±95% in 1% steps; "Modulation Frequency" from 0.1 to 20.0 Hz in 0.1-Hz steps; "Modulation Depth" from 0 to 100% in 1% steps; "Modulation Delay" from 0.1 to 100 mS in 0.1-mS steps; "Delay Time Modulation Depth" from 0 to 100% in 1% steps; "Amplitude Modulation Depth" from 0 to 100% in 1% steps; "Echo Room Delay" from 40 to 270 mS in 10-mS steps, and "Pan Speed" from 0.1 Hz to 20.0 Hz in 0.1-Hz steps. Also "Pitch Change" (coarse), ±12 semitones in 1-semitone steps; "Pitch Change Fine," ±100 cents in 1-cent steps (1 cent = 0.01 semitone); "Effect Level" from 0 to 100% in 1% steps, with a bar illuminated for each 10%, and front-to-rear "Effect Balance" from 0 to 100% in 1% steps. (The "Effect Balance" display shows the front-rear ratio graphically, on a 10-bar scale, and numerically.) A couple of other delays and one gain parameter, not listed here, had the same steps as the delay and gain settings detailed above.

I find the resolution provided for all of these parameters to be more than impressive but less than overwhelming. For all parameters in each of the programs, there are default settings which can be changed as often or as infrequently as desired. I did check the accuracy of the pitch changes, and all of the steps were within 0.2% or better. Using the fine adjustment, I trimmed a 1-octave shift (+12 coarse) to be within 0.015%. It was very easy to run all of the above tests using the remote control for program/parameter changes and reading the selected functions on the excellent panel display. Holding in the "Inc" or "Dec" buttons produced speedy value changes.

Setting Up

I started off with a four-channel configuration, mixing the processed front sound with the regular stereo signal. I tried various combinations of amplifiers and loudspeakers, and the preliminary results were impressive. However, I tempered my eagerness to hear what the DSP-1 would do,

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The bass has depth and body and no resonant boom.

The mid- and high-frequencies have a new sparkle and definition.

And, for the first time ever, the natural decay of reverberation is heard exactly as it's heard in a live performance.

The familiar, but greatly unloved hangover effect is dead. Long live the Matrix.

This revolution was achieved with an idea so very simple that B&W practically invented the Matrix by accident.

They discovered that all that is required to virtually eliminate unwanted sound radiation from the cabinet is a honeycomb-like structure of unique design inside it.

They also discovered that this so improved the performance of the cabinet that they also had to improve the quality of all the drive units.

Consequently, as well as the drivers with homopolymer cones manufactured under licence from CBS Inc., Matrix also features a newly designed ferrofluid tweeter.

The new Matrix series itself features three digital monitors. Matrix 1, 2 and 3.

Each has a different size, maximum acoustical output and bass extension. All have the same enhanced stereo imagery, improved transient response, low distortion and total freedom from colouration.

The Matrix series takes its place in the B&W range, succeeding loudspeakers that in their time have made history. You just cannot miss them at your B&W stockist.

They are truly the only loudspeakers that are seen but definitely not heard.

LISTEN & YOU'LL SEE

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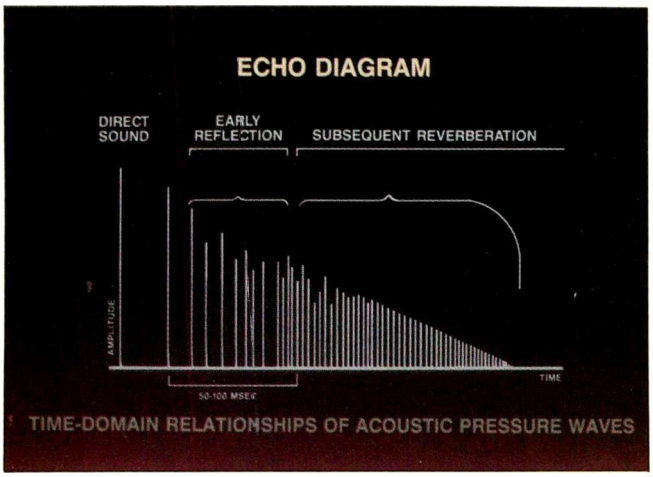
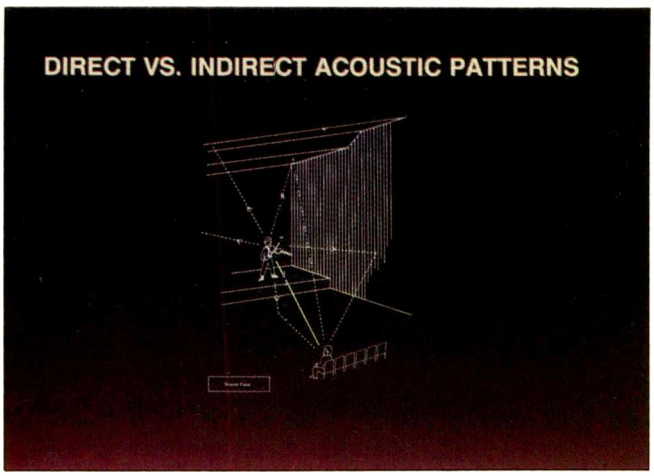
The Yamaha's great appeal is how easily it changes the apparent character of the "performing hall" to match personal preferences.



Early reflections, which arrive 50 to 100 mS after the direct sound, help determine the timbre of music and define a site acoustically.



The DSP-1 is designed to simulate the direction, volume, and timing of early reflections in the concert hall.

taking the time to get all equipment installed as shown in Fig. 2. The Yamaha MVS-1 master volume control served as the input selector for the system. (The DSP-1 can be used without the MVS-1, however; see the sample hookup illustrated in Fig. 4.) Sources included a Pioneer PD-9010X CD player, an Onkyo TX-2500 receiver for FM broadcasts, an Akai VS-555U VHS VCR for stereo TV broadcasts, and a Yamaha LV-X1 Digital videodisc player. Tape recorder and turntable outputs were fed through the receiver.

The main stereo loudspeakers were JBL 4301Bs driven by an AB Systems 205 amplifier, the four effect speakers were Dynaco A25s powered by Yamaha's M-35 four-channel amplifier, and the center speaker was a JBL 216 driven by a Lafayette amplifier. A self-powered Triad subwoofer was connected in parallel with the 4301Bs.

Because all of the speakers were placed high on the walls, there was an unwanted reinforcement of bass energy. A Soundcraftsmen DC2214 dual-channel octave-band equalizer was inserted between the MVS-1 and the input of the DSP-1. I adjusted the equalization to find what I considered the best compromise between flattening overall response and maintaining the impact of relatively low-frequency attacks. After running a number of preliminary checks, I decided that I had better control of main and effect levels if I used the level switch on the DSP-1's rear panel to reduce the main output by 10 dB. An oscilloscope monitor was connected to the left and right outputs of the MVS-1 to check all sources for stereo content.

Use and Listening Tests

The 40-page manual that I used during the evaluation has much detail in it. The illustrations are good, and there are well-written explanations. It's hard to fault the manual, but I'm certain that many users would benefit from more discussion on speaker selection and placement, possibilities and limitations with equalization, and the relationships between parameter values and their perceived character. Other supplied literature helped me to understand how the unit was developed and how its data base was secured.

Everything was completely reliable throughout my evaluation, and for all its internal complexity, the DSP-1 never left me confused about what I had done. I did find that I could not read the program/parameter/value display from more than 10 feet away, but that was frustrating only at the beginning. I did have to step closer at times to verify what was happening, but most often I was making adjustments for the best sonic results, using my ears as the reference. At those times, the fact that I didn't know the exact reverberation time, for example, was completely unimportant. The remote control was effective over a very wide angle—up to 60° off axis—and up to 25 feet away. I would have liked remote control of overall level, but I was glad to have both main and effect muting as well as remote control of effect balance and level.

The DSP-1's great appeal is how easily it can change the apparent character of the "performing hall" to match any personal preference. When I first started listening, I tried all the "Acoustic/Surround" programs; with experience, I learned that some programs would be bad choices for particular types of music. I also tried modifying some of the parameters; I'll say more about that when I get to specific examples. Most listening was done with CDs as sources, but I did try several other sources and I'll discuss them first.

Stereo TV

There aren't many stations broadcasting stereo TV yet. Though my local cable system passes stereo signals, only one-quarter of its channels are in stereo. The cable company uses simulcast FM for stereo sound from MTV, Showtime,

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About the DCD-1500 Compact Disc Player, *Digital Audio* proclaimed, "The Denon engineers who created the DCD-1500 should be honored in public." Denon's expertise in making pro digital recorders and blank tape is reflected in the three-head DRM-30HX Cassette Deck. The DRA-95VR Receiver uses the same power supply and output circuitry as Denon's acclaimed integrated amps.*

So before you buy components whose most impressive feature is a remote control, get yourself to a Denon dealer. And listen to the remote control whose most impressive feature is the components it controls.

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*Model DRA-75VR Receiver (not shown) also supplied with remote control.

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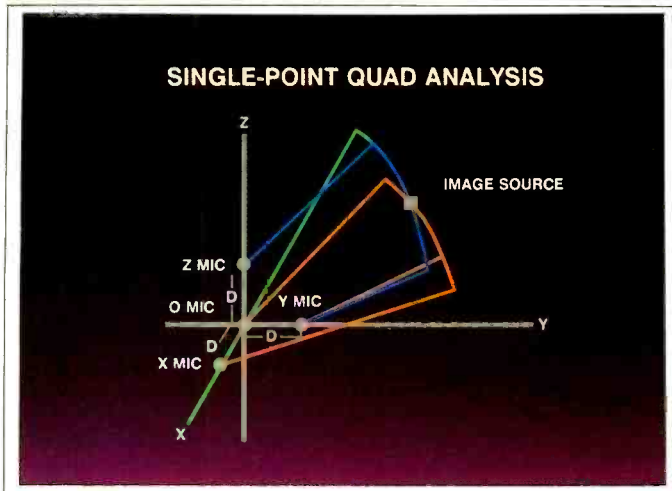
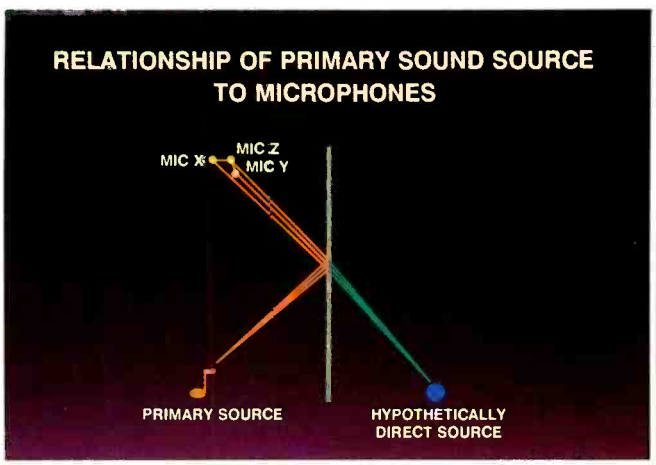
CIRCLE NO. 27 ON READER SERVICE CARD

A great improvement was heard when listening to FM stereo with the DSP-1. Regular stereo is a poor thing by comparison.



To measure listening-space acoustics, Yamaha used four microphones arranged to form four corners of a cube.



How three microphones can identify a sound's source, in a reflective space, as being at either of two points. Adding the fourth microphone allows the one correct point to be identified.

and HBO, but transmits broadcast signals with MTS stereo. Of the major-network broadcasters, the NBC stations provided the best signals, but one of the nearby PBS stations, WMHT in the Albany, N.Y. area, delivered stereo that was superior to the other channels in all respects.

Because of the prevalence of dialog in the TV offerings, most of the DSP-1's acoustic programs could not be used—an actor in the center of the screen did not sound right with reflections and reverberation. The "Presence" program did sound very acceptable a number of times, however. The most appropriate program choice was usually "Sur 1," "Sur 2," or Dolby Surround. The center speaker was generally helpful, but no TV program benefited from the subwoofer. With some music programs, it was worthwhile to switch to an appropriate acoustic program, accepting the odd effects on speech or muting the effect channels when there was speech only.

With the simulcast sources, which delivered low signal strength to my receiver, noise was noticeable in the surround programs, and "Presence" was the preferred choice. A broadcast of the movie *F/X* appeared to have limited stereo content, but there were definite and worthwhile improvements when I used the DSP-1. The limitations of most current stereo TV sources were obvious much of the time, but the spread and depth added by the DSP-1 were desirable enhancements anyway.

Videocassettes and Videodiscs

A number of videocassettes with Dolby Surround encoding were tried. The results were always far superior to simple stereo. Karl-Lorimar Home Video's *Maximum Overdrive* had really good surround sound throughout. I found the best choice a toss-up between "Sur 2" and Dolby Surround, with "Sur 1" and "Presence" pleasurable but less satisfactory.

In some ways, it was easier to make extra-critical judgments with videodiscs than with videocassettes, because the quality of the discs was obviously superior. "Presence" and the three surround programs remained the most acceptable choices; of these, "Sur 2" or Dolby Surround was always the first choice of all listener/viewers whose comments I solicited. The center speaker was helpful even when its effect was on the subtle side.

FM Stereo

There was no doubt about the great improvement the DSP-1 made in the overall FM stereo listening experience. Muting the effect channels (which collapses the sound field to a simple frontal stereo image) showed regular stereo, by comparison, to be a poor thing indeed.

While listening to music stations, I kept changing my mind on what was best: If I considered just the music, the DSP-1 had many acoustic programs to choose from, but if I wanted the announcements to sound somewhat normal, I had to stick to a surround mode or use "Presence." Sometimes I found that "Hall 3" with reduced initial delay was a good choice. Programs I selected quite regularly to match the music were "Hall 1," "Hall 2," "Hall 3," "Chamber," "Church," "Pavilion," "Whse Loft," "Stadium," and "Presence." You may find it hard to believe that some of these would be any good at all, but they were. I reduced initial delays and reverberation times for "Chamber" and "Church" and stored these modified programs in user memory. They proved to be the best choices a number of times.

The center-channel speaker was best kept off when playing music, even if the announcements seemed better with it turned up at least to a low level. The subwoofer was of value a limited number of times.

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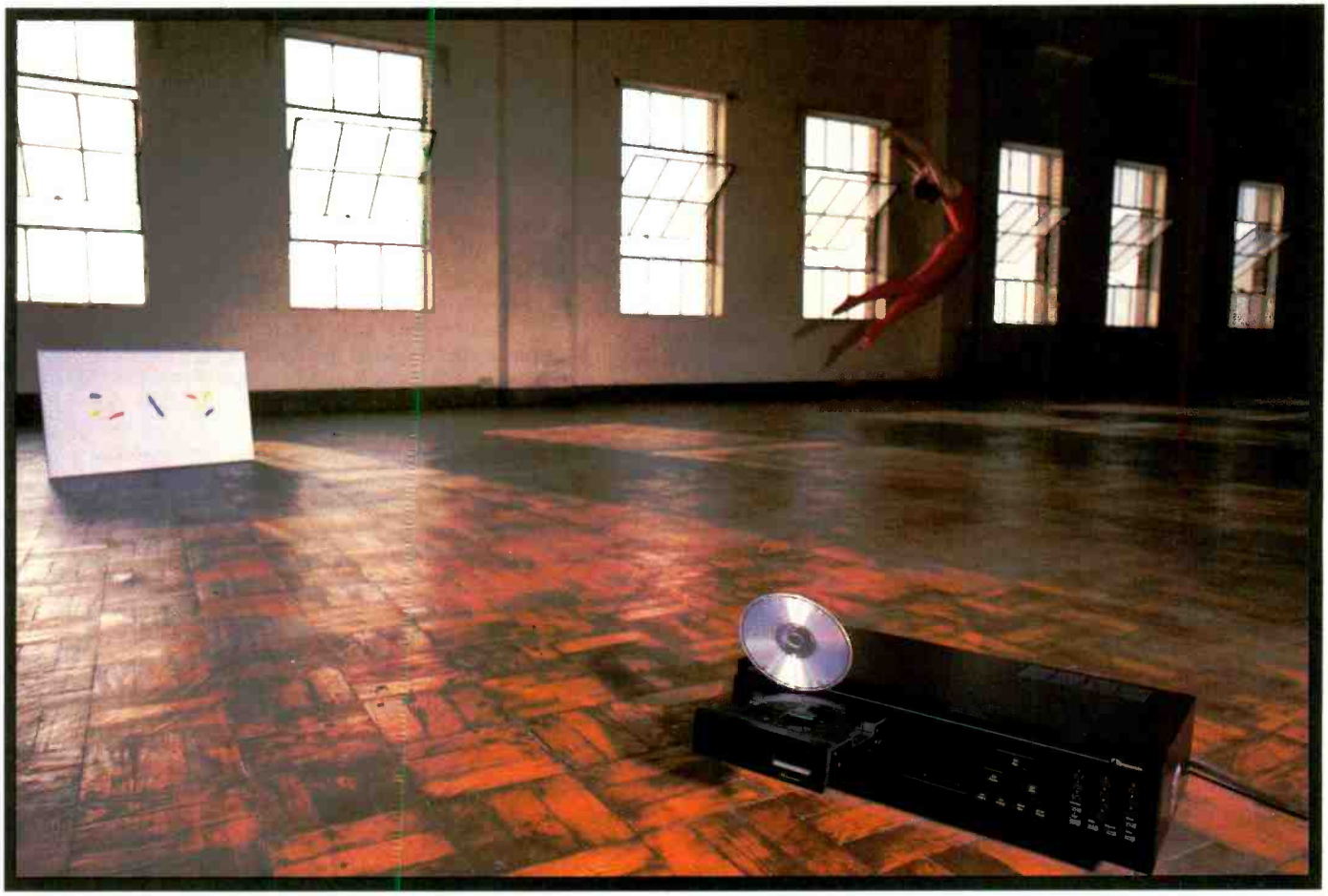

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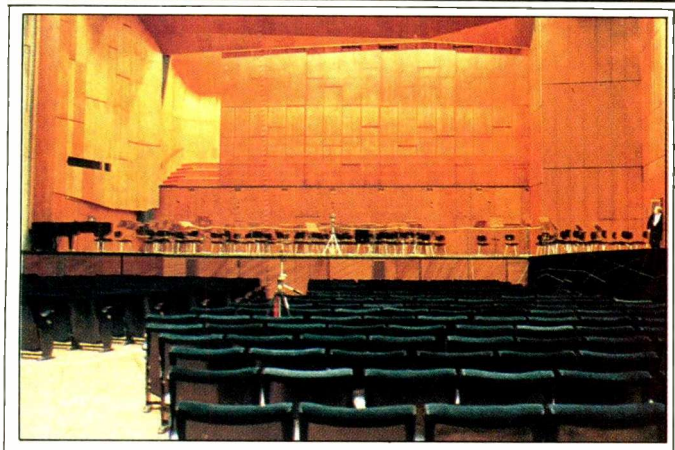
I had a ball using the "Sound Effector" programs on my *Bachbusters* CD. Most effects were both interesting and enjoyable.



Another Yamaha research setup, here measuring the acoustics of the Beethoven Saal in the Liederhalle in Stuttgart, West Germany.

I tried various combinations of main and effect levels, and various types of balance between front and rear effect levels. I usually preferred the effect level higher than the main level and found that equal front and rear effect levels sounded good. A check with a sound-level meter showed that my usual preference was for the main level to be about 6 dB below the effect level, measured at the listening position. The range of the difference was from 3 to 10 dB, with the main level never set as high as the effect level.

LP Records

Many program selections were possible for LPs, with the best choice depending, of course, on the type of music. Here's one example of the choices I made: Ravel and Chausson piano trios with the Beaux Arts Trio (Philips 411 141-1) sounded best with my user-program version of "Chamber." I also liked "Hall 3" (with the "On Stage" type of primary reflection), "Hall 1" (with "Type B" reflections), and "Hall 2" (with "Type D" reflections). I expect that others would make different choices.

The one negative element that I noticed with LPs was that ticks from scratches became particularly distracting when coming from so many speakers and with the delays from the DSP-1's processing. I'm sure, however, that I would continue listening to records through the DSP-1, since my own LPs have very infrequent clicks. In any event, the overall enhancement of the sound makes those clicks seem of relatively minor importance.

Audio Tapes

I did not try a large number of tapes, but all of them were ones that I had recorded myself. Thus, I was very certain of the acoustical character of each of the original performing sites. I also knew, of course, what arrangement I had used for the recording microphones.

One of the tapes that I spent a fair amount of time with was of Handel's "Messiah." The church in which it had been recorded is not large; because a portion of the ceiling has acoustical tile, it is not as live as its other surfaces would indicate. The "Church" program was too reverberant, even in my user-program version. My modified version of "Chamber" was the best, with "Hall 3 (On Stage)," "Hall 2 (D)," and "Hall 1 (A)" the next best choices, in that order.

Another tape was made at a larger church, one that has a stone and wood interior with a high nave. Franck's "Fantaisie in A Major" for organ and Fauré's "Requiem" were the major works. This was one of the very few recordings of any type (LP, tape, CD) that sounded good with the "Munster" program, and that program was a close match, in general, to the church's characteristics. In the "Requiem," I did prefer the results when I reduced the reverberation time from 4.0 to 3.2 S, the initial delay from 95 to 75 mS, and the reverberation level from 100% to 90%. These may not seem to be major changes, but they made a definite improvement as far as I was concerned. What is described here points out the broad capability of the DSP-1 to deliver many different possible acoustical environments and then to allow fine tuning for maximum listening pleasure.

While listening to the tape playback, I was puzzled by one effect that I heard from the applause at the end of the performance. During the music, the sound from all the speakers blended well, but I heard what seemed to be separate sounds of applause from the main and effect speakers. Checks with an RTA showed that the spectra were the same, although they didn't sound that way. When I matched the main and effect levels, there was smooth blending of the applause. My conclusion was that the higher level of the applause from the effect speakers produced a flatter perceived response than that for the lower level main speakers. I relegate this oddity to the class of the very unimportant, for I rarely spend time listening to applause.

Compact Discs

A total of 23 CDs were used in assessing the performance of the Yamaha processor. I listened to them in groups according to music type, and, within each group, in chronological order of the music's composition. Mozart's 39th and 40th Symphonies (Bamberg Symphony Orchestra led by Eugen Jochum, Orfeo C 045 901A) and Tchaikovsky's Fourth Symphony (Cleveland Orchestra, Lorin Maazel, Telarc CD-80047) made up the first group. For this music, all three "Hall" programs and "Chamber" were good choices overall, but the best choices for specific pieces were: "Hall 3 (Live)" for Mozart's 39th, "Hall 1 (A)" for Mozart's 40th, and "Hall 1 (B)" for Tchaikovsky's Fourth.

For Vivaldi's "The Four Seasons" (Boston Symphony Orchestra, Seiji Ozawa, Telarc CD-80070) and Mozart's "Eine Kleine Nachtmusik" (Prague Chamber Orchestra, Charles Mackerras, Telarc CD-80108) I did prefer the "Chamber" program, although with the Mozart a reduction in reverberation time seemed in order.

There was general agreement as to the appropriate settings for Tchaikovsky's "1812 Overture" (Cincinnati Symphony Orchestra, Erich Kunzel, Telarc CD-80041), Debussy's "La Mer" (Saint Louis Symphony Orchestra, Leonard

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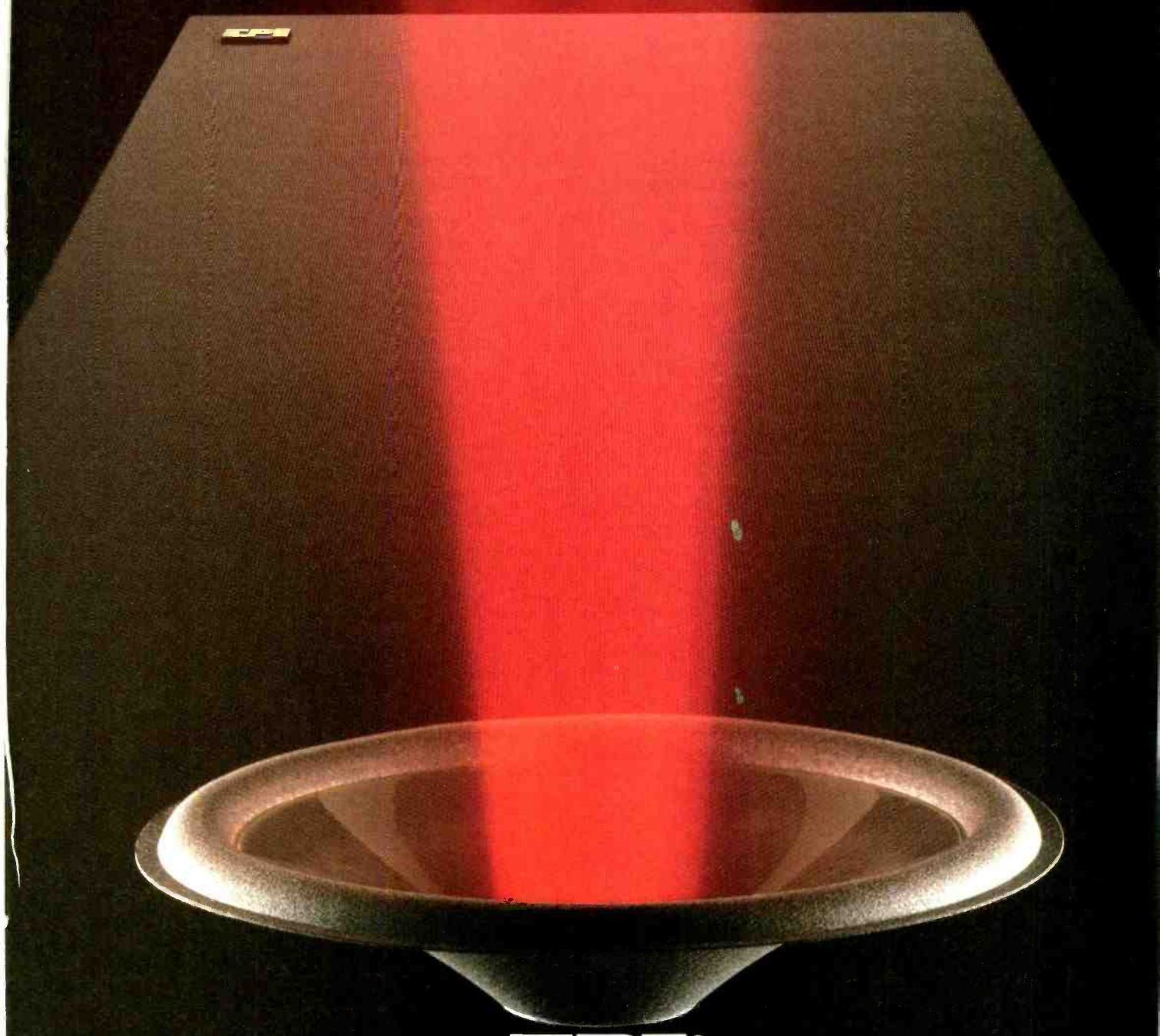

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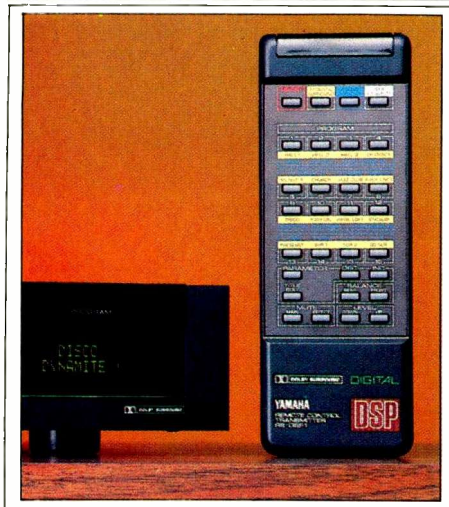

Functions of the numbered "Program" keys depend on the mode being used.

Slatkin, Telarc CD-80071), and Stravinsky's "Firebird Suite" (Atlanta Symphony Orchestra, Robert Shaw, Telarc CD-80039). The "Hall" modes were the favorites for these works, with "Hall 3 (Live)" the best for the Tchaikovsky and the Stravinsky, and "Hall 1 (B)" the choice for the Debussy.

Another group consisted of orchestral music by Wagner, Waldteufel, Rossini, Elgar, and others, plus a collection of movie music, *Star Tracks* (Cincinnati Pops, Erich Kunzel, Telarc CD-80094). All listeners preferred the "Hall" programs, with "Hall 1 (B)," "Hall 2 (C)," "Hall 2 (D)," and "Hall 3 (Live)" the most popular. For organ works, "Munster" was *not* the first choice most of the time. *Bach: The Organs at First Congregational Church, Los Angeles* with Michael Murray (Telarc CD-80088) was better with "Church." Saint-Saëns' Third Symphony (Philadelphia Orchestra with Michael Murray, led by Eugene Ormandy, Telarc CD-80051) was very good with "Church," but I had a slight preference for my user-modified version of "Church," with its shorter reverberation time.

I tried comparisons between settings for a CD of Charpentier motets with the Concerto Vocale (Harmonia Mundi HMC 901149) and for Simon Estes singing spirituals with the Howard Roberts Chorale (Philips 412 631-2). My user-modified version of "Chamber," with its shorter reverberation time, was my favorite for both discs, but my second and third program choices were not the same for the two CDs.

Bachbusters by Don Dorsey (Telarc CD-80123) sounded best with "Presence," "Rock Cnct," "Jazz Club," or my user-modified "Chamber," but my first choice changed from track to track. *Let's Dance, Vol. 8*, with the Columbia Ballroom Orchestra (Denon C32-7897) had the same collection of choices, but user-modified "Chamber" was preferred. *Peaches and Cream: Music of Sousa* (Cincinnati Pops, Erich Kunzel, Vox Cum Laude MMG MCD 10005) was poor with "Munster," "Church," "Disco," and the surround programs, but it sounded good with substantially everything else, including "Whse Loft," "Pavilion," and "Stadium." I could almost visualize the band playing in any of the "spaces" created by the DSP-1.

Popular music was represented by Creedence Clearwater Revival's *Chronicle* (Fantasy FCD 623-CCR2), Dire Straits' *Brothers in Arms* (Warner 25264-2), Emmylou Harris' *The Ballad of Sally Rose* (Warner 25205-2), and *Synchronicity* by The Police (A&M CD-3735). "Jazz Club" and "Rock Cnct" were the first and second choices, respectively, for all except the Harris CD, for which the order of choice was reversed. "Disco" and "Presence" were also likable, although the "Disco" bass was too heavy on some tracks. Notice that for these CDs the program choices are not the same as those made for classical music, and that the best choices are those that might be expected from the names of the programs. This is further evidence that Yamaha did its homework to deliver a collection of acoustical/surround choices to satisfy all types of music.

The "Sound Effector"

I had the chance to discuss the characteristics of the "Sound Effector" programs with people who are more knowledgeable than I on what they might do in specific situations—with a keyboard, for example. Their response was enthusiastic, but I thought I should give myself an actual demonstration. I decided to use *Bachbusters*, which is primarily keyboard. Well, I had a ball! I tried all of the "Sound Effector" programs, and most of them created something that was both interesting and enjoyable. I found that the Presto from the "Italian Concerto" was particularly amenable to being delayed, flanged, modulated, phased, and panned around the room in all directions. These manipulations were not pleasurable with any of the other music I tried, but it was great fun while it lasted.

Conclusions

In presenting so much detail on what I did (and what can be done) with the DSP-1, I certainly hope I don't convey the impression that the user must be pushing buttons continually to listen to music. Any of the controls can be operated as little or as much as desired. Even if the DSP-1 is used without the modification of any parameters, there are many useful choices to make from the acoustic and surround programs. If changes are made, they are easily stored and recalled to ensure maximum listening pleasure.

The Yamaha DSP-1 stands as a unique device in its ability to create the illusion of hearing music in many different performing venues. It is far superior to many previous devices that have attempted to accomplish similar things. If the goal is to simulate "being there," the DSP-1 has achieved more over normal stereo reproduction than anything else, including the introduction of the CD. Muting its effect channels causes an emphatic collapse to the frontal stereo sound stage, with a tremendous loss in realism. I have noticed too that with the DSP-1, the sound in *adjoining* rooms is *also* far better—as though the orchestra really were in the next room.

The Yamaha DSP-1 is not an inexpensive device, but with an inexpensive amplifier and two even moderately priced rear effect speakers, it can deliver more easily observable improvements for its cost than any other component. Front effect speakers can be added as the budget permits, allowing further enhancement in the acoustic/surround sound fields.

Howard A. Roberson

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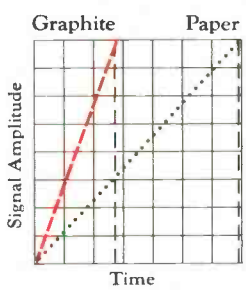

The rigid graphite cone responds more quickly and accurately to changes in the music than a conventional paper cone. This improved impulse response results in a greater sense of realism and immediacy than possible without the graphite. The heightened level of realism is the graphite difference, it's what you've been listening for.

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2

ADS CD4 COMPACT DISC PLAYER

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz, ±0.25 dB.

S/N: 102 dB, A-weighted, re: 1 kHz, 0 dB.

THD: Less than 0.01%, 20 Hz to 20 kHz, at 0 dB; less than 0.1%, 20 Hz to 20 kHz, at −30 dB.

Channel Separation: Greater than 86 dB, 20 Hz to 20 kHz.

Channel Balance: Within 0.5 dB at 1 kHz, 0 dB.

Disc Fault Correction: More than 900 microns for faults in data layer; more than 800 microns for black surface spots.

Low-Pass Filter: Digital plus multipole analog.

Phase Shift: Less than 5°, 20 Hz to 20 kHz, between or within channels.

Output Level: Main, 2.0 V rms at 1 kHz, 0 dB; headphone, 0 to 2.0 V rms into 30 ohms.

Dimensions: 17½ in. W × 2¾ in. H × 14 13/16 in. D (44.5 cm × 7.0 cm × 37.6 cm).

Weight: 20 lbs. (9 kg).

Price: $900; RC1 remote control, $100.

Company Address: One Progress Way, Wilmington, Mass. 01887.

For literature, circle No. 91

Like the earlier CD3 (see *Audio*, June 1985), ADS's CD4 Compact Disc player is part of that company's Atelier series. It is categorized by ADS as a "reference" component, and its ergonomics and performance, like those of the CD3, deserve that classification.

The CD4's most often-used controls are grouped in full view on the front panel. Controls used less often are behind a covered panel below the disc drawer. These controls permit toggling between display modes (elapsed or remaining time, and track or index number), programming up to 16 selections, tagging any passage on the disc for A-B repeat, setting whole-disc repeat, or playing a stored program.

The CD4 is extremely rugged, both internally and externally. Its strong steel side rails easily support the weight of stacked equipment. Like other ADS Atelier components, the CD4 uses steel top and bottom covers for mechanical strength as well as for electrical shielding. The die-cast transport mechanism is internally shock-mounted on four tuned rubber-and-spring mounts. A linear-motion laser pickup housing rides on precision guides and is driven by a high-speed gear motor. The disc spindle is driven by a heavy-duty brush-type d.c. motor that offers high torque. In typical fashion, ADS has paid attention to small details that make for product elegance. For example, a push-to-access, push-to-recess headphone level control knob keeps the front panel looking smooth and flush when the knob is not being used.

As for the electronic innovations in the CD4, perhaps the most important of these is what ADS calls their "Variable Window" error-correction system. This system dynamically controls the size of the data block used when separating clock (timing), subcode, and audio data. When refractive errors (or other problems) in a disc cause clock and audio data to be confused for one another, the data window widens. The widened window can then take in adjacent clock signals, so that the system can tell where the confused clock signal should be. As the errors diminish, the window is narrowed again, to reduce time jitter and to give the system more time to do its computations. According to ADS, this process results in fewer errors caused by the contamination of audio data by other data types.

For uncorrectable errors, the CD4 does not repeat the last properly read data sample or mute the audio output, as some players do. Instead it uses linear interpolation, computing the approximate value of each missing data sample from the values of the data on either side of it.

The CD4 has three separate power supplies, one each for the digital, analog, and control circuits, so these circuits will not introduce noise into each other. There is also a noise filter on the incoming a.c. line, to block interference from or to other equipment.

Separate D/A converters are used for each channel, with full 16-bit linear conversion. The converters run at a 67-MHz clock rate. Two-times oversampling with steep digital filtering is employed, along with hypersonic multiple-pole analog filters that have steep cutoff characteristics above 35 kHz. As I discovered during my bench tests of the CD4, this combination of analog and digital filtering provides extremely good spurious-response rejection both inside and outside the audio pass band.

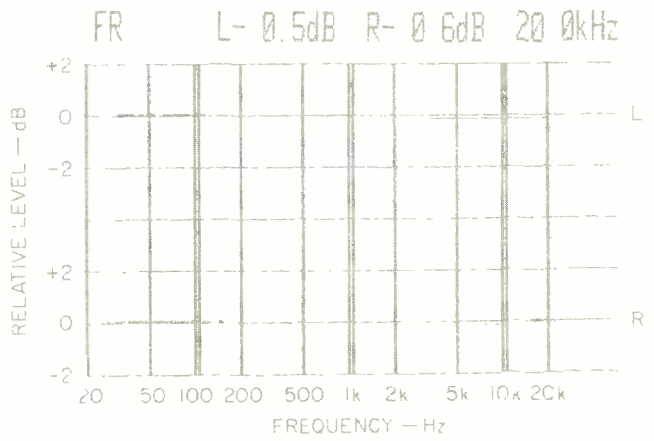


Fig. 1—Frequency response, left (top) and right channels.

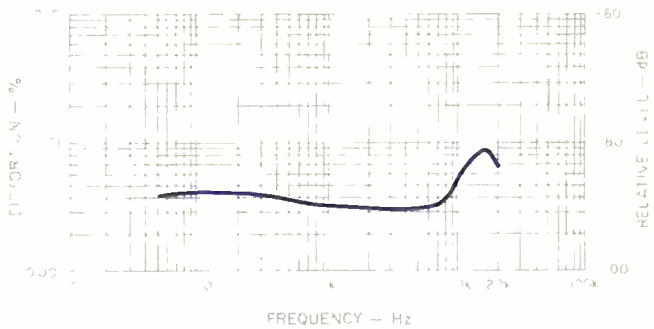


Fig. 2—THD vs. frequency at maximum (0-dB) recorded level.

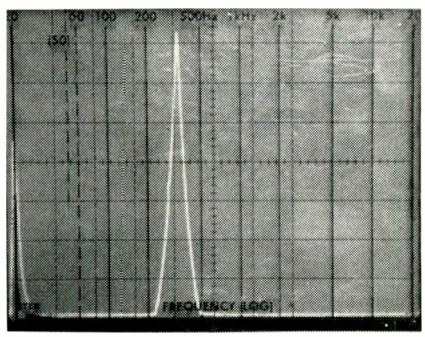
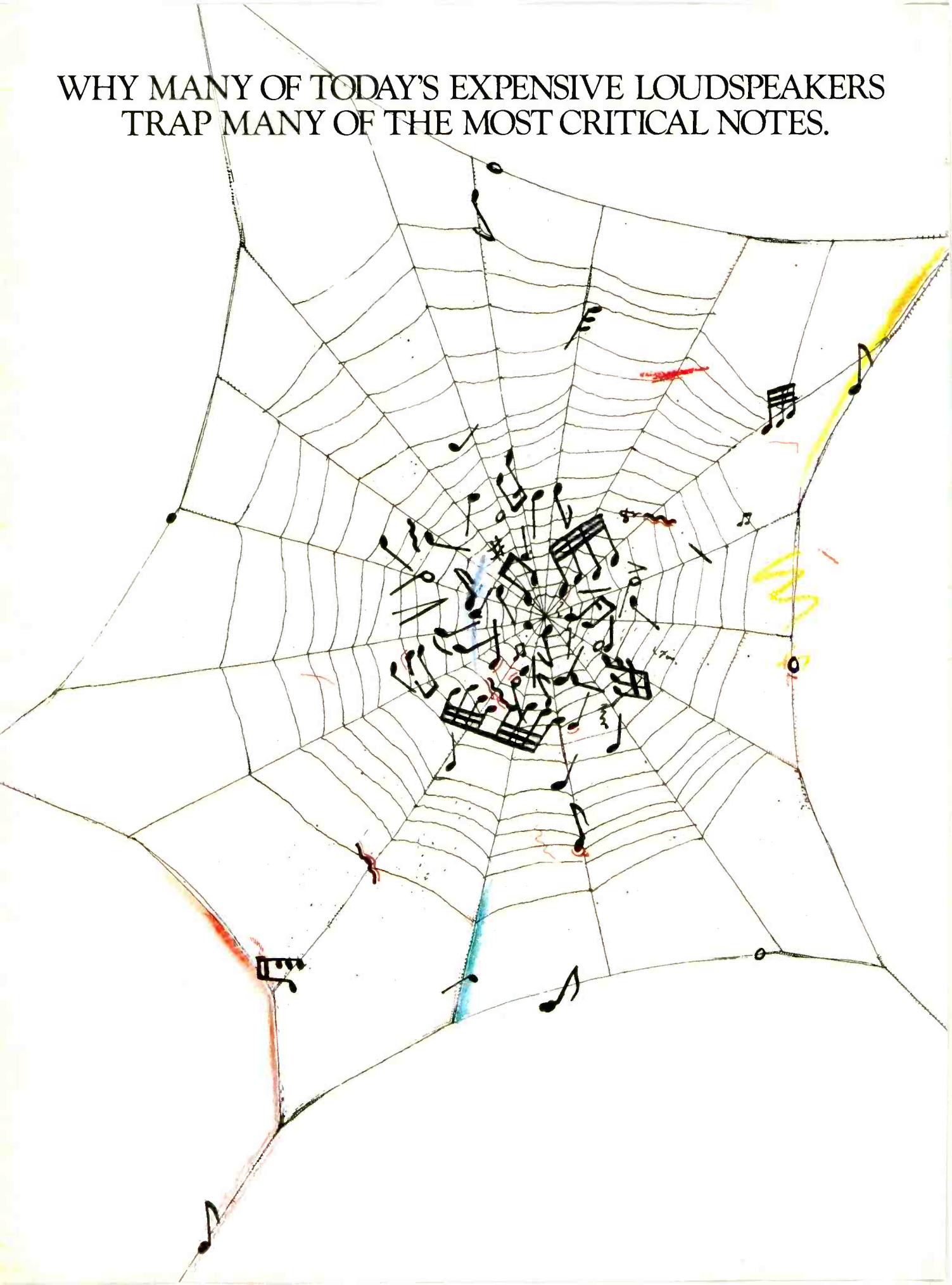


Fig. 3—Spectrum analysis of reproduced 20-kHz test signal; note absence of any of the usual "beat" tones.

WHY MANY OF TODAY'S EXPENSIVE LOUDSPEAKERS TRAP MANY OF THE MOST CRITICAL NOTES.



The music that goes into many of today's highly priced loudspeakers isn't always the same music that comes out. Many of the finer notes and nuances are often trapped or lost. Why? Because advanced recording techniques and digital processing demand a dynamic range of over 90 dB and an extended frequency response. Demands that are often beyond the limits of ordinary loudspeakers.

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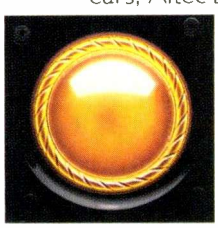

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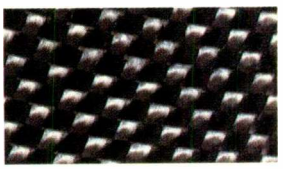

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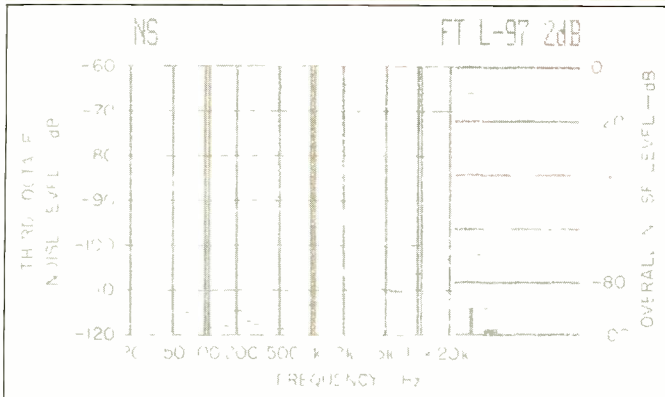
There was no peaking or wobbling of response at the high end, indicating a near-perfect post-D/A analog filter design.



A

B

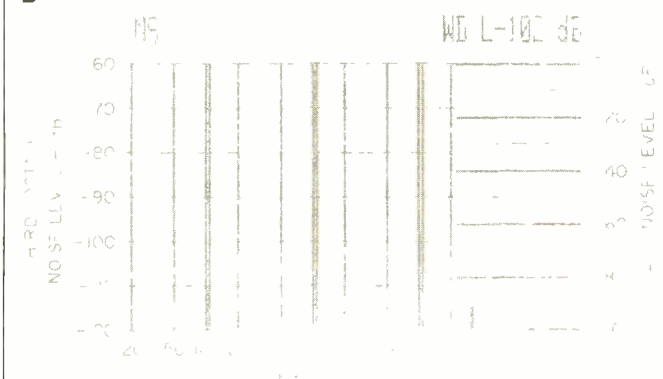


Fig. 4—S/N analysis, both unweighted (A) and A-weighted (B).

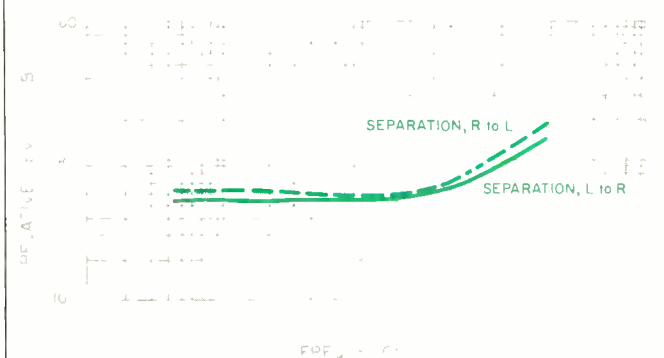


Fig. 5—Separation vs. frequency.

Control Layout

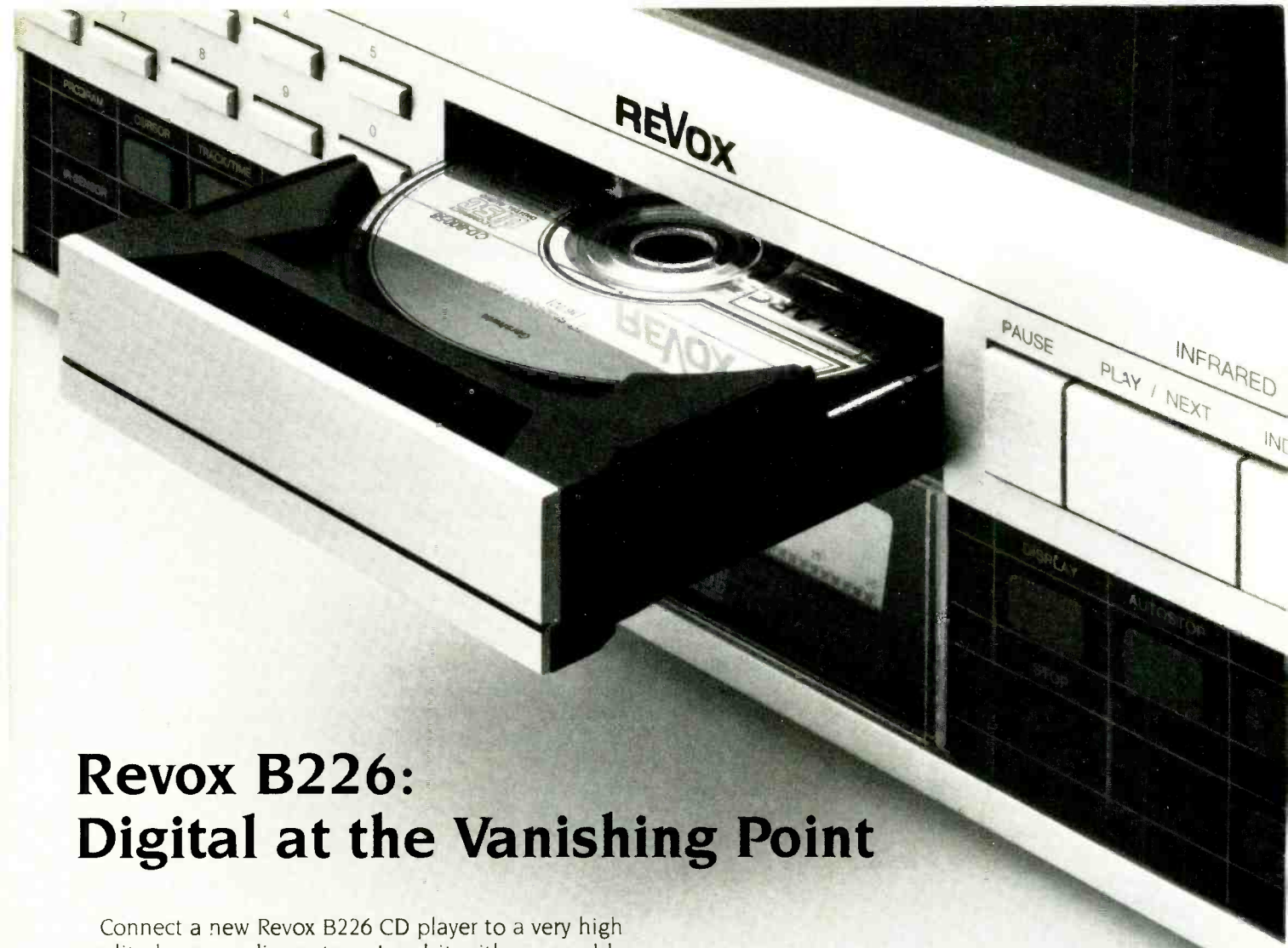
Seven basic control buttons are positioned beneath the display on the lower right side of the front panel. These include: "Start" (play), forward and reverse "Skip" for jumping from track to track, forward and reverse scan (placed between the two "Skip" buttons and marked with directional arrows), and "Return," which stops play and sends the laser back to its rest position. Holding either scan button down for more than 5 S increases the scanning speed. A headphone jack and headphone level control are located at the right end of the panel. The "Slider" button, which opens and closes the disc tray, is just to the right of that tray, while the "Power" switch and pilot light can be found at the panel's extreme left.

The display window above the major controls shows track or index numbers up to 99, and either time elapsed within the track or time remaining on the disc. It also indicates which display, program, and repeat modes are in use, and whether there is a disc in the drawer.

A gentle push on the panel beneath the disc drawer opens a swing-down section to reveal 11 less often-used controls. The first two toggle the track/index and time display modes. The next four control the repeat modes: "Single" repeats the current track over and over, "Repeat" plays the entire disc repeatedly, "A–B" marks the beginning and end of a user-selected passage to be repeated, and "Clear" returns the player to normal mode. The last four buttons are for programming. Up to 16 selections can be programmed, in any order; this requires stepping back and forth through the disc's tracks. To program track 7 followed by track 3, for instance, you would first press the "+" button six times, then press the "–" button four times.

The rear panel of the CD4 has the usual main output jacks as well as a "Digital Out" connector. The latter should more properly be called a "digital interface," for it not only delivers audio and non-audio data for use with future equipment, but also accepts digital control signals from an integrated, multi-room remote control system that ADS plans for the near future. A rear-panel cover cleverly conceals all input and output cables as well as the power cord, to give a clean, uncluttered look to the unit even when viewed from the back. Special slots permit easy mounting and removal of this cover, but it can also be swung out of the way, once it's installed, for easy cable access. Indentations on the top cover line up with the feet of other ADS Atelier components for safe and stable stacking.

In addition to the CD4, ADS supplied me with their optional RC1 master remote control, which operates all current (and some future) Atelier components. When you move a slider to the name of the component you want to control and press the "Open" button, the remote unit opens like a desktop telephone directory, to show the buttons controlling that particular component and the appropriate legends. The RC1 controls only the seven major control functions of the CD4. You can't program the player from the remote, nor can you access a given track directly (instead of skipping through intervening tracks). The numeric keypad on the RC1 can be used for track selection and programming with the CD3 (which now carries a suggested price of $1,250), but those features were left off the lower priced CD4.



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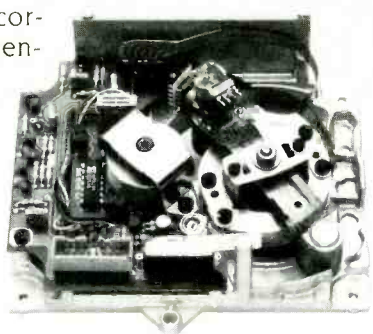
This "vanishing act" does not come easily. For example, the B226 transport chassis is made from solid die-cast aluminum alloy to provide long-term stability. The entire mechanism is suspended on damped isolation mounts to minimize potential problems from vibration or resonance.



Also, the B226 incorporates the newest generation of European-developed LSI chips for D-A conversion, interpolation, error correction, and digital filtering. Resolution is full 16-bit, with quadruple oversampling and dual D-A converters for precise phase linearity. New adaptive error correction selects the best error correction strategy (from 60 possibilities) to greatly improve performance on d rty or damaged discs.

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This is only the fourth or fifth player I've ever measured that showed no out-of-band beats or spurious responses.

Measurements

Figure 1 shows the frequency response obtained at the output of each channel when playing a swept-frequency test signal from below 20 Hz to above 20 kHz. At 20 kHz, I measured an attenuation from reference level of only 0.5 dB on one channel and 0.6 dB on the other. Perhaps more important, there was no evidence of any "peaking" or "wobbling" of the response at the high end, indicating a near-perfect post-D/A analog filter design. Harmonic distortion at 0-dB (maximum) recorded level was far lower than ADS's conservative spec. At 1 kHz it measured only 0.0035%; more important, *even without interposing a low-pass filter*, the distortion measurement rose no higher than 0.009% when high-frequency THD was measured (Fig. 2). In other words, the usual "beats" outside the audio band simply weren't there. This is only the fourth or fifth CD player that I have ever measured which did not exhibit such out-of-band beats or spurious responses. Confirmation of this result was obtained when I played a 20-kHz test tone and ran the output of the CD player into my spectrum analyzer, sweeping the analyzer from 0 to 50 kHz. All that is visible in the 'scope photo of Fig. 3 is the 20-kHz signal itself, represented by the single tall spike. Compare this with the corresponding photo for almost any of the units I've tested over the last couple of years and you'll see why I was impressed.

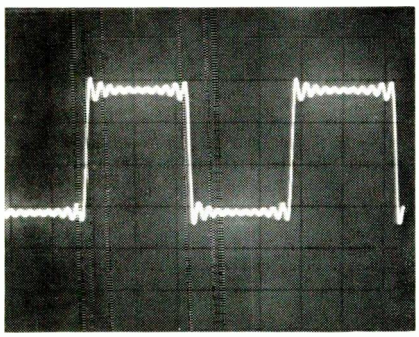


Fig. 6—Square-wave reproduction, 1 kHz.

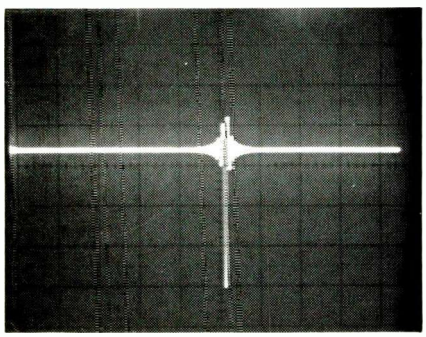
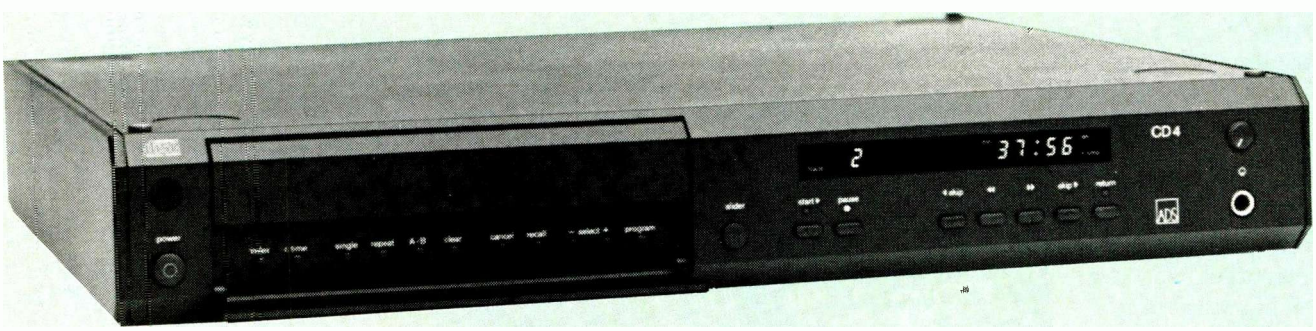


Fig. 7—Single-pulse test.

Unweighted signal-to-noise ratio measured 97.2 dB (Fig. 4A). When an A-weighting network was added in the measurement path, S/N increased to 102 dB (Fig. 4B), exactly the number claimed by ADS. Dynamic range, not specified by the manufacturer, measured a very high 111.5 dB. This figure is obtained by measuring the difference between maximum (0-dB) recorded level and the THD amplitude (in dB) generated by a 1-kHz tone at −60 dB. In the case of the CD4, THD for a 1-kHz signal at −60 dB measured 0.266% or 51.5 dB below the test-signal level; adding 60 dB to this figure yields 111.5 dB.

Linearity of the CD4 was accurate to within 0.1 dB all the way from maximum recorded level to −80 dB recorded level. Below that point, my test instruments begin to introduce measuring errors. Wow and flutter was too low to be measured, and the level difference between channels was 0.01 V for a nominal output of 2.05 V rms at maximum recorded level. SMPTE IM measured 0.007% at maximum recorded level, while twin-tone CCIF-IM distortion was only 0.002% at both maximum recorded level and at −10 dB.

Stereo separation, including the effects of my connecting



A swing-down panel conceals the programming, display-mode, and repeat controls until they're needed.

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*100 Watts/ch., continuous RMS, both ch. driven, 8 Ohms, 20 Hz-20 kHz, 0.02% THD

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The CD4 sounds just as good as the more costly CD3—not too surprising, since much of the circuitry is the same.

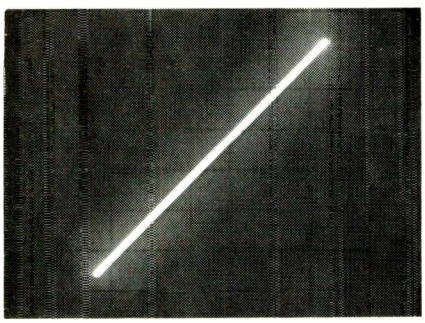

Fig. 8—Lissajous pattern shows absence of phase error between left and right channels when reproducing a 20-kHz tone.

The RC1 controls all present and future Atelier components.

cables and measurement instruments, is plotted in Fig. 5. At mid-frequencies, I measured channel separation of approximately 85 dB from left to right and from right to left. The symmetry of the 1-kHz square wave shown in Fig. 6 and of the unit pulse in Fig. 7 provides ample proof of ADS's use of digital filtering and oversampling. The absence of any phase error or time delay between left- and right-channel outputs when reproducing a 20-kHz test signal, as evidenced by the straight-line Lissajous pattern shown in Fig. 8, indicates the use of separate D/A converters for each channel of the CD4.

Use and Listening Tests

It is difficult to justify a $900 price tag for a CD player—until you start using a player like the ADS CD4. Its slim and graceful appearance is somewhat deceptive. This player is so ruggedly built and its mechanism is so well shock-mounted and isolated from external vibration that I literally had to pound its surface to make it mistrack. As for tracking through scratched discs and opaque surface dirt, it goes without saying that this player had no trouble traversing my simulated-defects test disc. I've also created (largely by accident) a few actual defects discs of my own, and it was interesting to see that the CD4 played through two of the most severely damaged of these. Nearly all the other CD players that I've tested since these discs were inadvertently created were unable to play them through without muting or skipping.

As for sound quality, it is every bit as good as the sound I remember hearing and noting when I tested the more expensive CD3. That's not really very surprising, since much of the circuitry is the same. According to ADS, the economies that were made resulted primarily from simplification of mechanical details. The LED displays found on the front of the CD3's disc drawer have been moved to the front panel of the CD4, directly above the three control buttons that they designate ("Start," "Pause," and "Return"). The triangular, tilt-out panel of the CD3 has been replaced by a simpler panel for the CD4's secondary controls. These changes, along with some simplification of the p.c. board layout, account for much of the price difference between the two units.

From my point of view, the chief reason for selecting the more expensive CD3 might be a desire for its more elaborate remote-control capabilities. I must admit, too, that I sort of wished ADS had thought of choosing a different model number for this new player. Those of us who have been in the audio business for more than a decade associate the name CD4 with a quadraphonic system that was not exactly a big winner. I hope that ADS's CD4 will enjoy infinitely greater success in the marketplace; it certainly deserves to. Finally, regardless of whether you choose the CD3 or the CD4, you'll still have to pay extra for remote control. I resented that a bit when I tested the CD3 and I must confess that I still think ADS ought to have included the remote at no extra cost—if not the all-embracing RC1, then a simpler, dedicated remote for the player alone. The omission is a minor point, though, compared with the overall user benefits and performance level of this superbly designed and executed CD player.

Leonard Feldman

Until now, car stereo systems let you equalize sound through two speakers, at best. Which is hardly best, if you have four speakers. The highs and lows you control in only two speakers are virtually cancelled out by the levels you can't control in the other speakers.

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And the EQA-280 gives you seven EQ bands. Five LEDs to indicate power levels. A selectable EQ defeat switch. A high/low gain switch. An automatic remote on/off.

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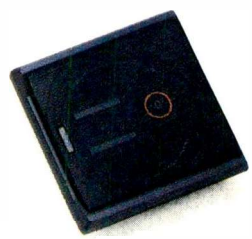
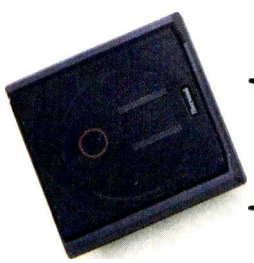


Sherwood Goes To The Four Corners Of Your Car To Equalize Sound.



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3

A.V.A. TRANSCENDENCE 250 SERIES TWO AMPLIFIER

Manufacturer's Specifications
Power Output (20 Hz to 20 kHz): 140 watts per channel, continuous, both channels driven into 8-ohm loads; 200 watts per channel into 4-ohm loads.
THD: Less than 0.1% at rated output.
Frequency Response: 10 Hz to 210 kHz, +0, −3.0 dB.
S/N: 90 dB unweighted peak re: rated output.
Input Sensitivity: 1.4 V rms for rated output.
Input Impedance: 100 kilohms.
Output Impedance: 0.04 ohm.
Phase: Noninverting.
Rise-Time: 3 μS at rated power.
Slew Factor: "Infinite."
Dimensions: 16 in. W × 5¼ in. H × 10 in. D (40.6 cm × 13.3 cm × 25.4 cm).
Weight: 26 lbs. (11.8 kg).
Price: $1,250; $900 if customer furnishes Hafler DH-220 or DH-200 power amplifier.
Company Address: Audio by Van Alstine, 2202 River Hills Dr., Burnsville, Minn. 55337.
For literature, circle No. 92

I've known about Frank Van Alstine for quite some time, and so I was eager to put one of his amplifiers through its paces. Mr. Van Alstine runs a stereo shop in Minnesota, but unlike most audio retailers, he does a lot more than just buy and sell equipment. For many years now, Van Alstine has been designing and producing high-quality preamplifiers, power amplifiers, and other audio components and accessories. He strips out the insides of amplifiers and preamps originally made by such respected firms as Hafler, Dyna, and Crown and uses their metal chassis and structural parts to house his own circuits. As Van Alstine puts it, "By taking advantage of mass-produced, low-cost metal parts, selected for excellent mechanical layout and durability, we can provide a more useful range of choices at realistic prices."

Van Alstine's breezily written catalog lists more than a dozen preamplifiers, a dozen amplifiers, and a couple of integrated amps, as well as "Other Good Stuff" (as he puts it) such as cartridges and a CD player. He also offers non-rebuilt components from such makers as Harman/Kardon, B & W, and Hafler.

The catalog describes the amplifier I tested, the Transcendence 250 Series Two, as a "best-selling 280-watt delicate and detailed classic." This powerful amp uses the metalwork as well as the power transformer from a Hafler DH-220 or DH-200 power amplifier. As Van Alstine stresses in his brief (two sides of a single sheet) "Operation Instructions," all internal circuits are brand new, including five printed circuit cards of his own design (two audio boards,

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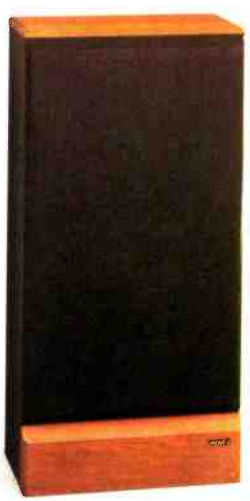

Wherever you put an Advent, you know it will look great. Our famous solid hardwood tops and bases go perfectly with any decor and there's an Advent for virtually any size room.

If you want to hear music with a little something extra, listen to any loudspeaker. If you want to hear the truth, listen to an Advent.

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DIGITAL READY

This powerful amp uses the metalwork and transformer from a Hafler unit, but all of its internal circuits are brand new.

two full ground-plane shielded output boards, and a power-supply board containing 40,000 μF worth of filter capacitors). Audio by Van Alstine (A.V.A.) products can be purchased by mail order directly from the firm, but you might prefer to write for a catalog and order form. You can order a new unit or send in an old one (which need not be in working order) for rebuilding.

According to Van Alstine, there is a patent pending on the pre-driver circuit, and he requested that we not publish the schematic. Without readers being able to refer to a diagram, it would be rather pointless on my part to try to describe the circuit on a stage-by-stage basis. This much, however, can be said about the topology of the Transcendence 250: The amplifier has a 100-kilohm input impedance that is independent of feedback, so it does not vary with frequency. As a result, any preamplifier can drive it successfully without being "loaded down." The pre-driver section has no noticeable dynamic phase shift; a compensation capacitor determines the phase and gain of the circuit independent of voltage and current through the pre-driver. Furthermore, the pre-driver circuit has a very low output impedance and can therefore drive the gate capacitance of the power MOSFETs used in the output stages without current limiting.

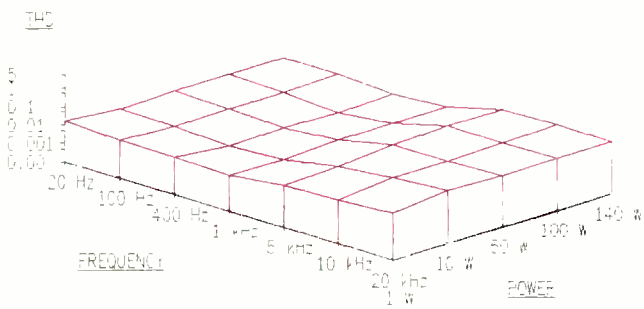

Fig. 1—THD vs. power and frequency, with amp driving 8-ohm load. THD scale is logarithmic.

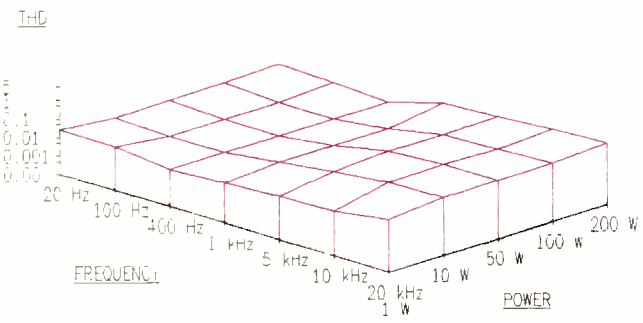

Fig. 2—Same as Fig. 1 but with 4-ohm load.

Van Alstine claims—and I was able to verify—that the amplifier is d.c. stable. It has no on or off pulses and exhibits no d.c. center-line drift even when the a.c. line voltage is varied over a wide range.

The amplifier has what might best be described as an infinite slew factor (not to be confused with "slew rate"). As decreed by the IHF (now EIA) Amplifier Measurement Standard, slew factor is determined by sweeping upward in frequency (after first having set input levels to produce full output at some mid-frequency) until distortion levels reach 1.0%. What usually happens is that when you get high enough in frequency (outside the audio band), the wave shape becomes triangular and exhibits higher and higher levels of measurable distortion. In the case of the A.V.A. amplifier, the output waveform, though decreasing in amplitude as higher and higher frequencies are reached, never deviates from its sine-wave shape. Since slew factor is calculated by dividing the high frequency needed to produce 1% THD by 20 kHz, and since that level of distortion cannot be reached before the signal is attenuated to minuscule levels, Van Alstine is justified in claiming "infinite" slew factor, or at least a slew factor that is unmeasurable with practical test equipment.

Externally, the amplifier resembles a Hafler DH-220—as indeed it should, since the metal parts are the same. New Switchcraft input jacks have been substituted for those originally found on the Hafler unit, and color-coded "banana" output jacks are provided on the apron of the amplifier chassis. Fuse-holders next to the output jacks contain 4-ampere quick-acting fuses that will normally pass the full power of the amplifier under music-signal conditions. These are wired in series with the speaker terminals. Five more fuses are inside the amplifier: The main a.c. line has a 7-ampere slow-blow fuse, and two pairs of 4-ampere quick-acting fuses protect the power supply. These are wired in series with the output circuits.

Thermal overheat sensors are located on each heat-sink. The sensors are connected in series with the a.c. power line, ahead of all circuits, and will open if either audio channel overheats. In the event of a thermal shutdown, a Transcendence 250 built into the DH-220 chassis (as the test sample was) will make its power-indicator lamp blink. The amplifier will turn back on automatically once the overheated heat-sink cools down.

Mono operation can be accomplished by removing the power-supply fuses from the unused channel, thereby making the entire power supply available to the channel that remains, or by using an external bridging kit. According to Van Alstine, removing one channel's power fuses adds only about 1 dB or so of power to the other channel, but using the bridge will yield an output in excess of 300 watts, steady-state. I didn't test the amplifier for mono operation since I was not supplied with this bridge. (The latest version of the Transcendence Bridge is a $100 p.c. board that uses a preamplifier's power supply and can be built into most models; Van Alstine will do the building-in. The Hafler mono bridging kit, normally used with the Hafler DH-220 amplifier, cannot be used with the Transcendence 250.)

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Mr. Van Alstine certainly belongs in the class of amp producers whose units are a cut above the rest, and that's a very small group.

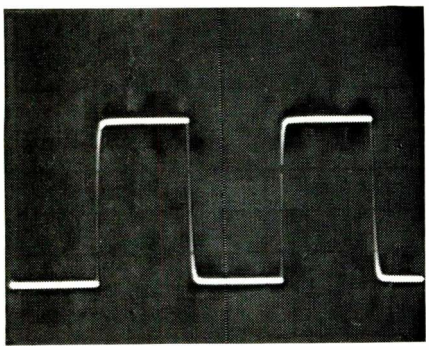

Fig. 3—Reproduction of a 20-kHz square wave (see text).

Measurements

The amplifier easily delivered its rated power into 8-ohm loads over the entire audio range from 20 Hz to 20 kHz. In fact, at mid-frequencies, THD for 140 watts output per channel was only 0.01%, as against a rated THD of 0.1%. At 20 Hz, THD was no greater, but it did tend to rise a bit at the high-frequency end of the band, reaching 0.06% at 20 kHz. Dynamic headroom, a truer measure than steady-state power of what the amplifier can do when fed typical music signals, was a high 2.0 dB. This means that with short-duration input signals such as those likely to be encountered in real-world use, the amplifier can deliver power peaks of close to 190 watts per channel into 8-ohm loads. A "3-D" graph showing harmonic distortion as a function of both frequency and power output is plotted in Fig. 1. SMPTE-IM distortion was also low, measuring only 0.013% at rated output.

The amplifier did not do quite as well during static bench tests when driving 4-ohm loads. Although mid-frequency THD remained very low at rated output (200 watts per channel), THD at higher frequencies tended to climb more rapidly as continuous power-output levels were increased. At 20 kHz, THD reached 0.2%, though SMPTE IM remained low, with a reading of only 0.022%. Figure 2 is a plot similar to that of Fig. 1 except that the load impedance has been changed to 4 ohms. Because of the value of the fuses installed in the speaker lines (and the admonition by Van Alstine that installing higher rated fuses might damage the output devices), I was unable to check operation of the amplifier at high levels for even lower impedances. However, later experiments with several of the speaker systems that I have in my lab (at least one of which has given some high-powered amplifiers a hard time because of its low impedance at certain frequencies) suggest that the A.V.A. is not likely to be upset by unusual speaker loads.

Frequency response was flat within ±1.0 dB from 20 Hz to 115 kHz, and the −3 dB point was reached at 175 kHz. Input sensitivity, measured in accordance with IHF Standards, was 0.12 V for 1 watt of output. I have a sneaking suspicion that Van Alstine supplied me with an incorrect manufacturer's specification for signal-to-noise ratio. (All of the specs for this amplifier were detailed in a letter that he sent me after I had finished measuring the sample; neither the operating instruction sheet nor the Van Alstine catalog lists technical specifications for the product.) The S/N ratio he gave me was 90 dB unweighted peak noise below rated output. If, in fact, the amplifier had only done that well it wouldn't have been anything to rave about. In my tests, conducted as usual using the IHF (EIA) Measurement Methods, the amplifier exhibited a 90-dB signal-to-noise ratio *referenced to 1 watt of output!* If I were to translate that to a signal-to-noise figure relative to rated output, I'd have to add another 21.8 dB to the measurement—which would bring the S/N (relative to full rated output) up to a much more impressive 111.8 dB. That's more like it!

The excellent rise-time and slew factor of this unit prompted me to take some 'scope photos of square waves as they appeared at the output terminals. I have generally given up this practice because the results are nearly always the same: Perfectly square for a 1-kHz square wave and severely rounded for any square wave having a frequency above 10 kHz or so. Well, consider the result shown in Fig. 3. What would you guess was the frequency of this test signal: 1 kHz? 5 kHz? 10 kHz? Wrong in each case. What you're looking at is the Transcendence 250's output when a *20-kHz* square wave is applied to the input! How about *that* for fast rise-time and fast transient response?

Use and Listening Tests

The more I listened to this outstanding amplifier, the more I came to believe that Van Alstine is my kind of amplifier designer. Adjectives such as "smooth," "warm," and "clean" have been overused in trying to describe the sound delivered by amplifier/speaker combinations that are more or less faithful to the original music. I won't resort to them here. Instead, let me say that the music I heard was accurate and very pleasing. Regardless of loudness levels, I experienced absolutely no sense of fatigue, even after several hours of careful listening to musical fare that ranged from archival jazz recordings to recent all-digital CDs of some of my favorite classics. One recent Denon CD has two clarinet quintets: The well-known Mozart quintet in A and a Brahms quintet in B minor. The Mozart had sounded ever so slightly harsh even when I used my reference CD player. Refusing to blame the player and not willing to admit that I had bought a less than outstanding CD, I inserted the Van Alstine Transcendence 250 in the signal chain. Amazingly, the slightly strident sound was gone. I imagine that even Mozart and Brahms would have been enthralled and pleased with the way their efforts were reproduced in my listening room. Perhaps this is what Van Alstine meant when he wrote in his catalog, "These amplifiers are opening eyes and changing minds among those who thought a solid-state amp could never sound as natural as a tube amplifier."

Well, I never believed that in the first place, and I've heard other solid-state amplifiers which imparted that warm quality of sound attributed to tube amps, but I must confess that the few that did so cost considerably more than the A.V.A. Transcendence 250. Mr. Van Alstine certainly belongs in the class of producers whose amplifiers are a cut above the rest—and that's a very select group, indeed.

Leonard Feldman

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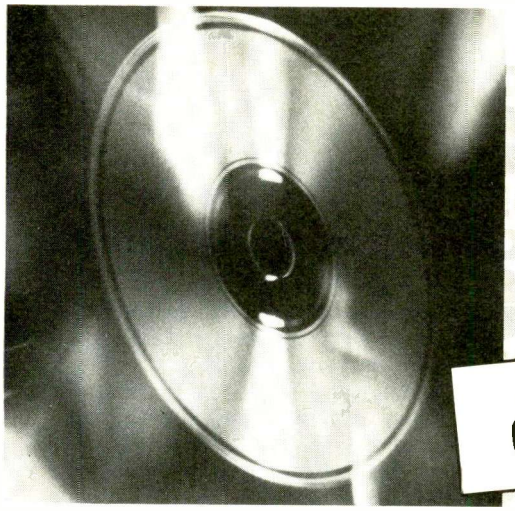
4

AKAI CD-A70 COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 5 Hz to 20 kHz.
Dynamic Range: 95 dB.
S/N: 95 dB.
THD: 0.003% at 1 kHz.
Channel Separation: 90 dB at 1 kHz.
Line Output Level: 2.0 V.
Number of Programmable Events: 27 (see text).
Dimensions: 17.3 in. W × 3.1 in. H × 10.2 in. D (44 cm × 7.9 cm × 26 cm).
Weight: 8.6 lbs. (3.9 kg).
Price: $379.
Company Address: Akai Div., Mitsubishi, 225 Old New Brunswick Rd., Piscataway, N.J. 08854.
For literature, circle No. 93

Manufacturers of first-generation CD players, some three years ago, were perhaps a bit overzealous in their description of those products. I suppose one can forgive them for using such superlatives as "perfect sound"; after all, the startlingly wide dynamic range and noise-free, distortion-free character of music heard from those first players presented quite a contrast to what had come from analog playback systems. But now, after three generations of players, a number of manufacturers are turning their attention to some of the finer points of CD reproduction that haven't been addressed before, and their players are reaching new levels of performance.

A good example is Akai's top player, the CD-A70. Almost all recently designed CD players employ digital filtering and oversampling, but not all digital filters are alike. Some provide out-of-band attenuation of no more than 50 dB or so.



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Linda Ronstadt: For Sentimental Reasons, My Funny Valentine, etc. Asylum 154382

Bach, Organ Works • Daniel Chorzempa plays Toccata & Fugue in D Minor, more. Philips *DIGITAL* 115193

Dire Straits: Brothers In Arms • Money For Nothing, etc. Warner Bros. 114734

Rimsky-Korsakov, Scheherazade • Vienna Phil./Previn. Philips *DIGITAL* 115415

ZZ Top: Afterburner • Stages, Sleeping Bag, Velcro Fly, more. Warner Bros. 164042

Bob James & David Sanborn: Double Vision • #1 jazz album! Warner Bros. 123682

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Mozart, Requiem • Schreier leads the Leipzig Radio Choir & Dresden State Orchestra. Philips *DIGITAL* 115039

John Cougar Mellencamp: Scarecrow Lonely Ol' Night, Small Town, Rain On The Scarecrow, more. Riva 144512

Pavarotti: Mamma • Title song, Vieni sul mar, more. Arranged & conducted by Henry Mancini. London *DIGITAL* 115310

Kitaro: Tenku • Japanese New Age master returns with all-new magic! Geffen *DIGITAL* 104859

Robert Palmer: Riptide • Addicted To Love, I Didn't Mean To Turn You On, etc. Island *DIGITAL* 133507

Canadian Brass: High, Bright, Light & Clear • Masterpiece Theatre theme, Air On A G String, more. RCA *DIGITAL* 144529

Prince And The Revolution: Parade • Kiss, Mountains, Girls & Boys, others. Warner/ Paisley Park 140234

Richard Stoltzman: Begin Sweet World Amazing Grace, Air, Pie Jesu, others. RCA *DIGITAL* 150414

Daryl Hall: Three Hearts In The Happy Ending Machine • Dreamtime, Foolish Pride, Someone Like You, For You, etc. RCA 123691

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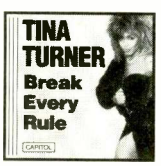

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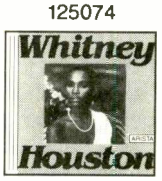

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Heart • What About Love?,These Eyes, Dreams, If Looks Could Kill, Nothin' At All, Never, etc. Capitol 144276

Mozart, Symphonies Nos. 40 & 41 (Jupiter) Chicago Symphony Orchestra led by James Levine. RCA *DIGITAL* 104810

Bizet, Carmen (Film Highlights) • Julia Migenes-Johnson, Plácido Domingo; Lorin Maazel conducts. Erato *DIGITAL* 154105

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Kenny Rogers: They Don't Make Them Like They Used To • Title song, Hold On To Love, After All This Time, more. RCA 151174

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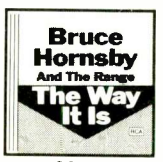

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The command structure of Akai's "Natural Logic" programming mimics English syntax, which makes it very easy to use.

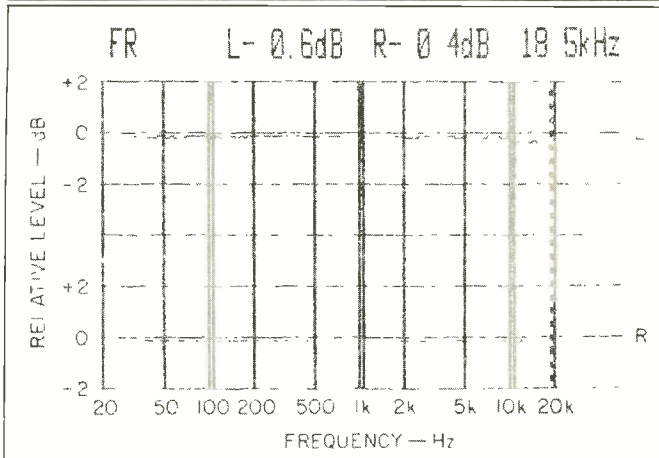
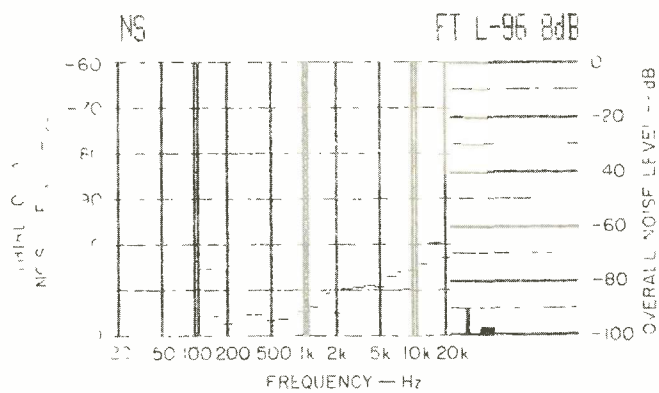


Fig. 1—Frequency response, left (top) and right channels.



A

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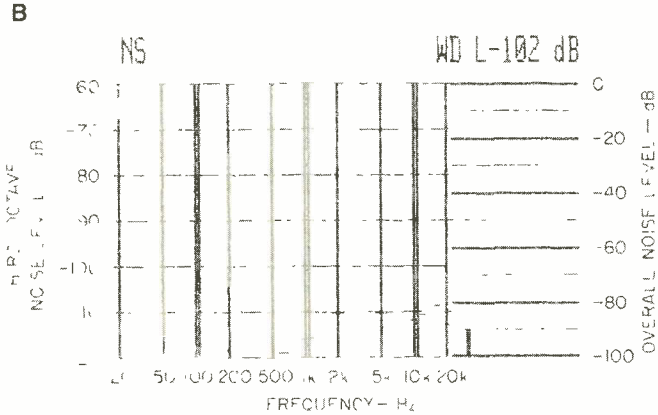

Fig. 2—S/N analysis, both unweighted (A) and A-weighted (B).

The high-performance digital filters employed in the Akai CD-A70 provide an attenuation of some 90 dB! The use of a three-beam laser is becoming almost standard practice these days, but the servo control systems that respond to deviations from perfect tracking vary widely in design from unit to unit. Akai's servo system is particularly good at maintaining accurate tracking even in the presence of substantial data dropouts, and is extremely well isolated and insulated from the effects of external resonance and vibration. The CD-A70 uses what Akai describes as a new anti-resonant composite metal construction in the chassis cover. Furthermore, the entire pickup assembly and disc tray are free-floating, suspended from the main chassis by anti-resonant rubber pads which further isolate these parts from external vibration.

Individually, most of these improvements may go unnoticed by the user, but added together they do contribute to audibly better sound reproduction. Improved error correction and tracking accuracy mean that less data interpolation is necessary, even in the presence of minor scratches or dust particles on the disc surface. That, in turn, means more accurate sound reproduction.

One feature that will appeal to many users is Akai's "Natural Logic Operation" system for random programming. (Some earlier Akai CD players had it too.) In addition to the 10 numbered keys usually used for programming, Akai has included buttons labelled "And," "To," "Index," and "Without." These enable you to enter instructions such as "1-To-5-And-7-To-10-Without-9." After this particular sequence, pressing the "Program Start" button will cause the unit to play tracks 1 through 5 followed by tracks 7, 8, and 10. Index points can also be programmed into the player's memory by following the same sort of logical instructions. A total of 27 steps can be programmed in this manner, but because some steps will call up several tracks, the programming capacity is actually greater than would be the case with a more conventional type of programming.

A number of search and play functions (music search, index search, manual search, A-B repeat, and program skip) are possible. Operations such as track selection and opening and closing of the disc tray can be controlled not only from the front panel but from the supplied remote control. Like so many other CD players introduced recently, the CD-A70 is equipped with a subcode output terminal in anticipation of discs that will create digital graphics (still pictures, text, etc.) when properly interfaced via a future decoder to your TV set or video monitor.

Control Layout

The disc drawer, "Power" button, and headphone jack occupy the left third of the front panel. A multi-function liquid-crystal display at the panel's center shows what mode the player is in. It not only displays total and individual-track elapsed time, track number, and index number, but also indicates when a program is operating. There are even indicators for the "And," "To," and "Without" functions described earlier. The type of repeat play selected is also shown in the display, as are indicators for "Play" and "Pause" modes.

A "Program Start/Pause" button, a "Selected Repeat" (A-

A visual representation of 16-bit/88.2 kHz oversampling, the current industry standard.

Yamaha's redefined HI-BIT standard
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The new Yamaha CDX-1100U brings a whole new definition to the term definition.

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Like quadrupling the sampling rate to 176.4 kHz, then combining it with our exclusive 18-bit

digital filter and 18-bit dual digital-to-analog converters. This unique combination produces waveform resolution accuracy four times greater than any other CD player on the market today.

What does all this accuracy mean? For starters, a more precise interpretation of the music that was always on your discs to begin with. A truer, more realistic soundstage, articulated without sacrificing musical warmth or smoothness.

Of course, there are other design features that put the CDX-1100U at the forefront of CD performance. Including a floating suspension system that eliminates vibration-induced signal modulation, and photo-optical couplings for a noise-free digital signal transmission.

And there's more than leading-edge technology to the CDX-1100U. There's also leading-edge convenience. By way of our 44-key wireless remote that has interactive control compatibilities, our 4-way repeat play, and our 24-track random programming that lets you play the music in the order you want it played.

If you'd like more details on Yamaha's latest advances in digital technology, write for a free technical white paper. But for the simplest and best explanation of our technological superiority, slip one of your compact discs into a CDX-1100U and push "Play."

Then you'll know you've finally heard it all.

YAMAHA 1887-1987

Yamaha Electronics Corporation, USA. P.O. Box 6660, Buena Park, CA 90622

The attention paid to this unit's analog stages and wiring layout is apparent from the separation at high frequencies—nearly 80 dB.

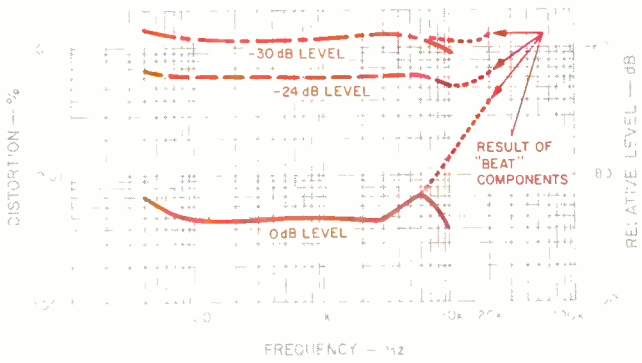

Fig. 3—THD vs. frequency, at three output levels.

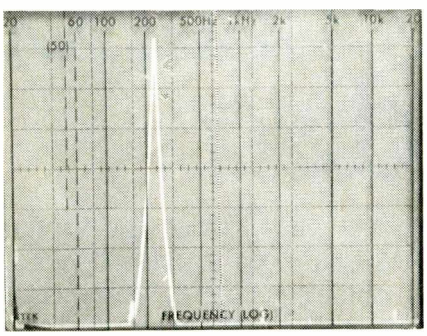

Fig. 4—Spectrum analysis of reproduced 20-kHz test signal.

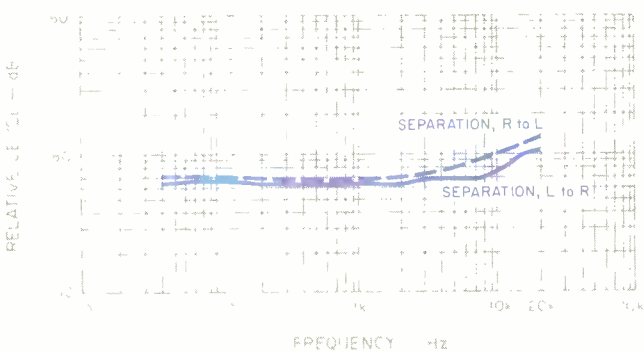

Fig. 5—Separation vs. frequency.

to-B repeat) button, a "Clear" button (for clearing a program), and a "Display" button (for altering the display mode) are to the right of the display area. Farther to the right are the numbered random-programming keys as well as the "Natural Logic" keys and a "Repeat" key. Clustered at the right end of the panel are the "Open/Close," "Play/Pause," "Stop," forward and reverse "Skip," and fast-forward and fast-reverse "Search" buttons. A slider control for adjusting headphone output level is at the lower right of the panel.

Measurements

Frequency response to 20 kHz, shown in Fig. 1, was flat within 0.4 dB for the right channel and within 0.6 dB for the left. Unweighted S/N for this player measured 96.8 dB (Fig. 2A); with an A-weighting network added, S/N increased to a very high 102 dB (Fig. 2B). Linearity was accurate to within 0.1 dB from maximum recorded level down to −60 dB and within 1.8 dB down to −80 dB. Output level for a 0-dB (maximum recorded level) signal was 1.94 V, and there was no measurable difference in output levels between channels.

Harmonic distortion is plotted as a function of frequency for three different recorded levels in Fig. 3. Here, the superiority of the Akai's digital filter design is immediately obvious. While many players produce high levels of "beat" components (often equivalent to several percentage points of distortion) when high-frequency test tones are reproduced, only very minor levels of such beats were observed for the CD-A70 when using a distortion analyzer to measure THD. In Fig. 3, the dotted lines extending above 10 kHz represent these beat levels; for the maximum recorded level (bottom curve), the beats at 20 kHz amounted to no more than 0.045%. Furthermore, even this low level of spurious output was totally outside the audible frequency range, as you can see from Fig. 4. The Akai CD-A70 is one of only a very few players that I have tested and found to produce such low levels of out-of-band beat components. Actual THD at mid-frequencies measured 0.005% at maximum recorded level, increasing to 0.06% at −24 dB recorded level and to 0.13% at −30 dB recorded level.

Separation between channels, shown in Fig. 5, was close to 85 dB at mid-frequencies. Again, the attention to detail in designing this unit's analog stages and its wiring layout is apparent from the separation at high frequencies. For most CD players I have measured, separation figures fall off rapidly as you approach the high-frequency end of the spectrum, often decreasing to 60 dB or less. Of course, that's more than enough separation for excellent stereo imaging, but the fact that Akai was able to maintain separation of nearly 80 dB even at 20 kHz speaks well for other aspects of this unit's parts layout and design.

Dynamic range, measured in accordance with the EIAJ Standard, measured 98 dB, 3 dB greater than claimed by Akai. SMPTE-IM distortion was a mere 0.002% at maximum recorded level and 0.017% at −20 dB. CCIF twin-tone IM, using 19- and 20-kHz test tones, measured just 0.0037% at maximum recorded level, increasing only slightly, to 0.0065%, at −10 dB. De-emphasis was accurate to within less than 0.1 dB.

Figure 6 shows a 1-kHz square wave as reproduced by

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I commend the Akai to you. With its utterly clean sound, it deserves to be classified as a genuine fourth-generation player.

the CD-A70. Notice how much lower the amplitude of the ripple is, compared to some earlier players that also used digital filters and oversampling. As I said earlier, not all digital filters are created equal. A unit pulse, as reproduced by the CD-A70, is shown in the 'scope photo of Fig. 7. The usual time delay between channels, approximately 11.3 μS, is evident in Fig. 8, in which 20-kHz signals from the left and right output channels are superimposed by my dual-trace oscilloscope. The horizontal sweep rate was set to 10 μS per horizontal division, and the delay between the two traces confirms that Akai is using a single D/A converter in this player.

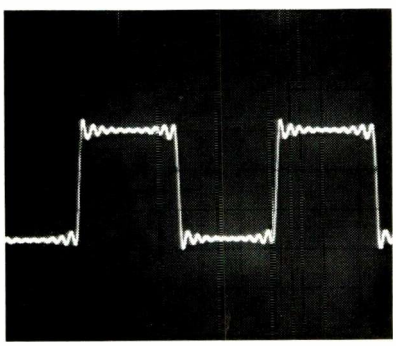

Fig. 6—Reproduction of a 1-kHz square wave.

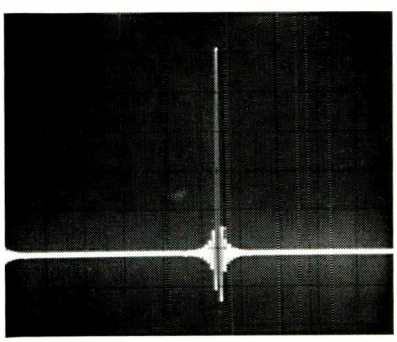

Fig. 7—Single-pulse test.

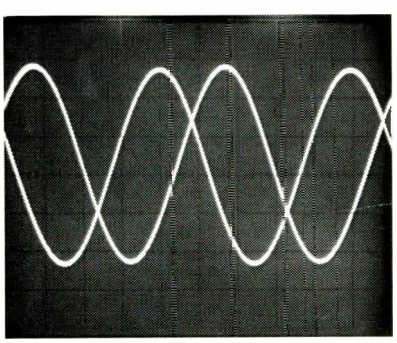

Fig. 8—Time delay between left and right channels at 20 kHz.

With all the sophisticated servo tracking systems and anti-resonant, vibration-resistant construction found in the CD-A70, I was not at all surprised to find that it managed to play through my standard defects disc without ever mistracking. The player was also particularly impervious to external vibration. Besides my usual finger-tapping tests on the sides and top of the unit, I mounted the CD-A70 atop one of my reference speaker systems and turned up the volume until I felt a fair amount of vibration from the speaker cabinet being transferred to the player itself. During this test I could detect no difference in sound quality, compared to the sound of the same program material when the player was well isolated from external vibration. (I don't recommend mounting CD players on top of speakers, however, unless you want to conduct this type of experiment.)

Use and Listening Tests

If there are still any of you out there who believe that all CD players sound alike, I commend the Akai CD-A70 to you. Its refined digital filtering, carefully designed analog output stages, and resonance-resistant construction all contribute to utterly clean and grit-free sound. It delivered that sound even from discs I had previously blamed for such imperfections as rather strident-sounding highs and less than perfect stereo imaging and depth. Of course, not even this state-of-the-art player can compensate for the sonic flaws on some of my earliest CDs. Given a reasonably well-recorded CD of recent issue, however, I think you will find that the CD-A70 will deliver highly satisfying sound reproduction, right along with the best of the current breed of CD players.

As for the features that aren't directly related to sound quality, I especially liked the "Natural Logic" programming system. It's easy to understand and easy to use, though there are a couple of ways in which you can upset the system if you don't follow the instructions in the owner's manual. For example, if you tried to enter "1-To-3-Without-2-And-5-To-8-Without-6," the second "To" entry would not be accepted. It seems that the "Without" command can be entered only after the last "To" command. The "Index" command, if used, must come before the "Without" command. For example, "1-And-2, Index-1-And-3" is an acceptable programming order, but "1-To-3-Without-2, Index-2" isn't. The system won't accept the "Index" command in the second example.

There were only two minor flaws in the CD-A70 worth mentioning. I found that the fast-search mode was entirely too fast. You need really nimble fingers when using it, or you'll skip right past the section of music you're looking for. I also found the display a bit hard to read. The display is yellowish amber on black; under certain lighting conditions, you must view it at just the right angle to be able to read it, a problem I think a brighter color might alleviate.

In every other respect, the CD-A70 deserves to be classified as a true fourth-generation CD player, incorporating just about all the improvements that manufacturers have learned to effect during the short history of the Compact Disc.

Leonard Feldman

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5

AUDIX UD-200S MICROPHONE

Manufacturer's Specifications

Transducer Type: Dynamic, moving coil.
Operating Principle: Pressure gradient.
Polar Pattern: Cardioid (unidirectional).
Frequency Response: 50 Hz to 16 kHz.
Nominal Output Impedance: 200 ohms, balanced.
Open-Circuit Sensitivity: 0.15 mV (−76.5 dB re: 1 V/μbar).
Maximum Sound Pressure Level: 128 dB (50 Pa) for 1% THD.
Front-to-Back Ratio: Greater than 20 dB at 180°, 1 kHz.
Output Connector: Integral XLR male.
Housing: Die-cast zinc alloy.
Grille Screen: Woven steel mesh with integral acoustic-foam pop filter.
Finish: Matte (non-reflecting gray), black, or gold.
Weight: 10.9 oz. (310 grams).
Dimensions: 6½ in. long × 2 1/16 in. diameter (166 mm × 52 mm).
Supplied Accessories: Microphone holder and padded carrying bag.
Optional Accessories: 20- and 25-foot double-shielded cable, XLR female-to-male adaptor, low-to-high impedance matching transformer, one-piece electronically cut windscreen.
Price: $165.
Company Address: 110 Ryan Industrial Court #3, San Ramon, Cal. 94583.
For literature, circle No. 94

The Audix UD-200S microphone is primarily intended for close-up vocal applications. It may also be used as a general-purpose microphone for voice and music pickup, particularly where a cardioid pattern is needed to reduce feedback, noise, or reverberant sound pickup.

Audix indicates that the UD-200S is designed to compete with the Shure SM-58, a professional-grade mike which is favored for vocal applications and which is used in many live and recorded performances of pop music. (The SM-58 has not been reviewed in *Audio*, but two other high-grade vocal mikes have been: The Shure SM-85 electret condenser, in May 1982, and the Beyer M500 ribbon hypercardioid, in February 1978.)

The heavy die-cast zinc case and matte gray wrinkle finish of the UD-200S appear to be extremely durable. (I have a minor criticism about the choice of zinc, however. The more costly cast-aluminum alloy is much lighter in weight and therefore less tiring for a vocalist to hold.) The steel grille seems equally durable and would likely survive a drop on its nose. The padded, soft pouch with zipper closure is very nice, particularly for people like myself who like to pack several microphones in a briefcase. I hate large, molded-plastic cases because they waste space.

Audix has chosen to supply the storage pouch, but the cable is an optional accessory. Other manufacturers may include the cable but sell the bag as an optional accessory. In my view, both cable and bag should be included (as should a data and instruction sheet). The only general accessory XLR-type extension cable available in my local stores is a stiff, kinky, gray plastic variety which would not look good hanging from a hand-held mike. I did not review any of the optional accessories; in some cases the optional

transformer may be needed. This is because the impedance of the UD-200S is low and is designed for unloaded 150- to 250-ohm inputs. The output voltage, therefore, is lower than that from mikes with impedances of 600 ohms or higher, which are used with cassette recorders.

Casual consideration may lead one to believe that the requirements for a vocal microphone are not stringent. A frequency range of 200 Hz to 6 kHz will transmit the entire information spectrum of the human voice. However, both talkers and vocalists are extremely critical of how their voices sound. Listeners too are highly critical of voice reproduction, particularly if they are accustomed to hearing live performances. Microphones favored for speech and singing usually have a rising response, e.g., bass roll-off and treble boost. A cardioid or hypercardioid mike is preferred by pop music groups for two reasons: The pickup pattern reduces feedback from speakers placed in the rear hemisphere of the microphone, and the bass boost due to proximity effect allows the vocalist to change the sound quality by varying his or her distance.

Measurements

Figure 1 shows that the impedance of the UD-200S in the resistive region above about 500 Hz is, at 270 ohms, a bit higher than the nominal value. However, the maximum impedance at diaphragm/coil resonance (550 ohms) is only about twice as high, due to damping, which is good. This lessens the microphone's susceptibility to loading by preamplifier inputs whose impedance is less than a few thousand ohms; such loading could increase bass roll-off.

Figure 2, showing the axial frequency response of the UD-200S at three distances, illustrates the influence of proximity effect. (My precision sound source, which is 2 inches in diameter, allows me to accurately measure the proximity bass boost as close as 6 inches from the microphone.) These curves agree with the manufacturer's data down to about 125 Hz. Below this frequency, my curves roll off more rapidly. It is obvious from a consideration of the microphone's mechanical system that the response will roll off below the resonant frequency. I can only guess that the differences between my curves and the manufacturer's at very low frequencies are due to differences between our sources and test setups. Anyway, this region is below the vocal range, so the question is moot. At 6 inches, bass boost due to proximity is 4 dB; at 12 inches and beyond, bass boost for voice is negligible. Treble rise is 7 dB at 4 kHz, which is similar to other vocal mikes. This response tailoring is well suited to pickup of brass instruments. The response dip above 5 kHz may be undesirable for some musical instruments but will not be a factor on vocal pickup. Output level is quite close to the specification.

Figure 3 shows how frequency response varies with direction. The response 90° off axis is approximately 6 dB below the on-axis response from about 200 Hz to 6 kHz, but is only 3 dB down at 100 Hz and rolls off rapidly at the high frequencies. The 180° discrimination is 12 dB at 200 Hz, 18 dB at 1 kHz, and 12 dB at 5 kHz. I would be willing to assume that the 180° response would meet the manufacturer's 20-dB specification in a good anechoic room. I rate the UD-200S as a good cardioid.

Fig. 1—Impedance vs. frequency. (Impedance scale is logarithmic.)

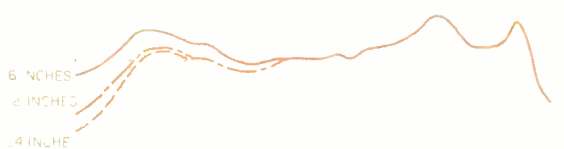

Fig. 2—On-axis frequency response at three distances. (0 dB = −57 dBV/Pa)

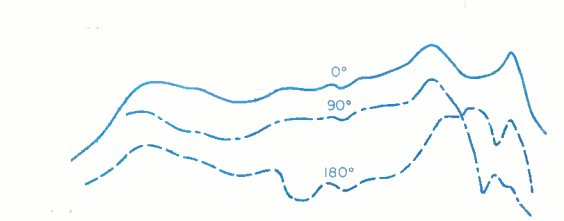

Fig. 3—Frequency response vs. angle for plane wave. (0 dB = −57 dBV/Pa)

I believe this mike offers exceptional sound quality at a moderate price, with a good polar pattern plus desirably smooth response.

The phasing of the UD-200S is pin-2 positive with positive sound pressure, in accordance with EIA Standards.

Use and Listening Tests

I used the Beyer M500 as a reference for tests involving subjective comparison. The Beyer is a more expensive mike, with smoother and wider frequency response, but its ribbon element is more fragile and so it is not suited to rough duty—in a rock music group, for instance.

The UD-200S has some "pop" noise relative to the Beyer when used 1 inch from the mouth. The Beyer, with its multiple blast screens and larger spherical grille, showed no pop noise. This contradicts the popular myth that ribbons are more wind-sensitive than dynamics. I do not think that pop or wind noise will be a problem with the Audix mike, but if in doubt, order the windscreen (which I think should be an included accessory). Sensitivity to 60-Hz magnetic hum is very low for the Audix, as it is for the Beyer.

The vibration sensitivity of the Audix microphone is much greater than that of the Beyer. Peaks of noise caused by tapping the stand were 20 dB higher from the UD-200S. The mass of a moving-coil microphone's diaphragm is much greater than that of a ribbon, hence it acts as a more sensitive vibration transducer. Therefore, I also tested a Shure 548 moving-coil mike, whose transducer elements are similar to those of the Audix and include rubber isolators for the cartridge. The sensitivity of the Shure—which is a less expensive mike than the Audix—was 5 to 10 dB lower than that of the UD-200S. The noise from the Audix sounds like a bell-like resonance of the case. I hope the manufacturer will work on this, because vocalists frequently remove and replace a mike in its swivel mount during a performance, and a "bong" sound each time would be unacceptable. (*Editor's Note*: Audix informs us that a similar microphone with less sensitivity to handling noise, the UD-300, is available at the same price.)

Next, I made a stereo tape of my own voice, with the UD-200S on one track and the Beyer on the other. At a 6-inch distance, the Audix sounded very similar to the Beyer except it had more bass boost due to proximity effect. At a 1-inch distance, I thought that both of the mikes sounded excessively boomy and less intelligible. It is difficult to understand how entertainers can effectively use any mike at such close distance. I made a similar comparison with the Shure 548 at 6 inches. It sounded similar to the 200S except for more highs, which added crispness.

Except for vibration noise, which could be a problem in some applications, I think that the Audix mike offers exceptional sound quality at a moderate price, with a good polar pattern plus a desirably smooth response. I can only guess at reliability, but the outer shell seems capable of surviving the harshest rock music environment. *Jon R. Sank*

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6

PIONEER VSX-5000 AUDIO/VIDEO RECEIVER

Manufacturer's Specifications

FM Tuner Section

Usable Sensitivity: Mono, 10.8 dBf.
Sensitivity for 50-dB Quieting: Mono, 15.3 dBf; stereo, 37.1 dBf.
S/N: Mono, 80 dB (at 65 dBf); stereo, 75 dB (at 85 dBf).
THD: Mono, 0.08% at 100 Hz and 1 kHz, 0.2% at 6 kHz; stereo, 0.2% at 100 Hz, 0.15% at 1 kHz, 0.3% at 6 kHz.
Capture Ratio: 1.0 dB.
Alternate-Channel Selectivity: 65 dB.
Stereo Separation: At 1 kHz, 50 dB; from 30 Hz to 15 kHz, 35 dB.
Frequency Response: 30 Hz to 15 kHz, +0.5, −2.0 dB.
AM Suppression: 55 dB.
Image Rejection: 50 dB.
I.f. Rejection: 80 dB.
Spurious-Response Rejection: 70 dB.

AM Tuner Section

Usable Sensitivity: 300 μV/m with loop antenna supplied.
Selectivity: 20 dB.
S/N: 50 dB.
I.f. Rejection: 70 dB.
Image Rejection: 45 dB.

Amplifier Section

Power Output (8-Ohm Loads): Stereo, 100 watts per channel, 20 Hz to 20 kHz; surround-mode front channels, 70 watts per channel, 20 Hz to 20 kHz; surround channels, 15 watts per channel, 40 Hz to 15 kHz.
THD (for Rated Output): Front, 0.005%; surround outputs, 0.3%.
Damping Factor: 55 at 1 kHz (8 ohms).
Input Sensitivity (for Rated Output): Phono, 2.5 mV; high level, 150 mV; main amp direct input, 1 V; surround amp direct input, 150 mV.
Frequency Response: Phono, 20 Hz to 20 kHz, ±0.3 dB; high level, 5 Hz to 100 kHz, +0, −3 dB; video in to surround out (Dolby Surround mode), 30 Hz to 7 kHz, +0, −3 dB.
Phono Overload: 140 mV.
A-Weighted S/N: Phono, 77 dB; high level, 79 dB (both re: 1 watt at 1 kHz). Phono, 83 dB; high level, 98 dB (both re: rated output).
Channel Separation: 65 dB at 1 kHz, all inputs.
Tone-Control Range: Bass, ±8 dB at 100 Hz; treble, ±8 dB at 10 kHz.
Loudness Control: +6 dB at 100 Hz and +3 dB at 10 kHz.
VCR Noise Filter: 50 Hz and 5 kHz, −6 dB per octave.
Distortion, Surround Mode: 1% for videodisc input, surround out (Dolby Surround mode).

Video Section

Input/Output Impedance: 75 ohms.
Input/Output Level: 1 V, peak to peak.
Frequency Response: 5 Hz to 6 MHz, +0, −3.0 dB.
S/N: 55 dB.
Crosstalk: 55 dB at 3.58 MHz.
"Enhancer" Detail: 2 MHz, +3 to −4 dB.

General Specifications

Power Requirements: 120 V, 60 Hz, 380 watts (470 VA).
Dimensions: 16 9/16 in. W × 4 7/8 in. H × 15 in. D (42 cm × 12.4 cm × 38.1 cm).
Weight: 22 lbs., 1 oz. (10 kg).
Price: $620.
Company Address: P.O. Box 1540, Long Beach, Cal. 90801.
For literature, circle No. 95

What I am about to describe may sound like two, three, or even four separate audio and video components. In fact, however, all of the features and functions I'll be discussing are contained in a single receiver, and not a particularly large or heavy one at that. Frankly, it took me more than an hour to figure out how to operate all of the pushbuttons and controls on the Pioneer VSX-5000—and I think most of you will agree that I have had some experience with stereo receivers! Then, too, I had to refer quite often to the owner's manual—something I know most eager users do as a last resort. What I'm leading up to is this: Is it wise for a manufacturer to cram so much into a single component that users may actually have difficulty figuring out how to work the thing? Let's hold off making judgments about that until we've considered this unit in detail.

The VSX-5000 combines the functions of an AM/FM receiver, wireless remote control, audio/video program selector, surround-sound processor, and "Video Enhancer." Video facilities allow you to select the audio and the video signals of any one of three video program sources (two VCRs plus a videodisc player, for example) and to do audio/video dubbing and/or copying to as many as two VCRs from a single source. The audio/video switching facilities also let you enjoy and record simulcasts by allowing independent selection of audio and video sources.

If the surround-sound mode is selected, power for the main amplifier section is reduced somewhat, from 100 watts to around 70 watts per channel; a secondary power amplifier having an output of around 15 watts per channel is then engaged to feed the "surround" pair of speakers. Three surround-sound options are available, designated "Dolby Surround," "Studio," and "Stadium," and each offers a particular kind of sound enhancement. The Dolby Surround mode would be used while watching videocassettes or laser videodiscs that were recorded using the Dolby technique, and the "Stadium" setting is recommended for listening to (and watching) live sporting events. The "Studio" choice, suggested for listening to concerts, adds only ambience to the sound field via the rear-positioned speakers.

An extra antenna input allows you to receive FM programs

from your cable TV system. Thus, you can get stereo TV sound from those cable companies that still transmit their stereo sound via FM multiplex, and you can also receive any FM stations that may reach your cable system via satellite.

In the tuner section, Pioneer has included a feature that allows you to associate up to four letters with each of up to 20 AM or FM station frequencies that you store in memory. The letters can, of course, be station call letters. Alternatively, as Pioneer suggests, they can be your own four-letter designation of what type of programming the station features (e.g., "Jazz," "News," etc.).

The enhancer mentioned earlier is, in effect, the video equivalent of a treble boost control. It is useful when making copies of videotapes to minimize the loss of picture detail that would normally result from rolling off the higher video-signal frequencies. A split-screen function allows you to compare the enhanced and original images, so you can see when you've reached the right balance between increased picture detail and the increase in video "noise" that also results from high-frequency boost.

The VSX-5000 also has a VCR noise filter for use with older VCRs that don't offer "Hi-Fi" (AFM) recording, a dynamic expander circuit, and a simulated-stereo circuit.

Control Layout

Now, if your head isn't already swimming, let me overwhelm you with a brief (well, maybe not so brief) description of the myriad controls that are found on the front panel and the equally numerous jacks and connectors on the back. The "Split Screen" and "Enhancer" controls are at the extreme left of the panel, just above the "A" and "B" speaker selector switches, the headphone jack, and the main "Power" switch. Three buttons for selecting among the three surround-sound modes and another button for the "Dynamic Expander" are positioned in a row near the bottom left of the panel. Just below them are switches for the "Video Adaptor" (sort of a tape monitor loop for video accessories which might be connected to the receiver via rear-panel jacks), the "Video Enhancer," VCR mono/stereo selection, the "VCR Noise Filter," and "Simulated Stereo."

Among this unit's features are three surround-sound modes, a VCR noise filter, a dynamic expander, and a simulated-stereo circuit.

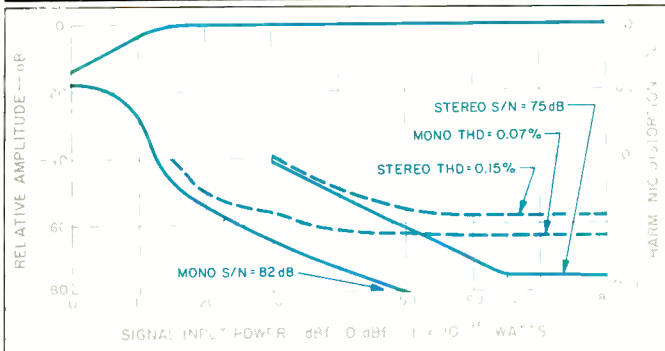

Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

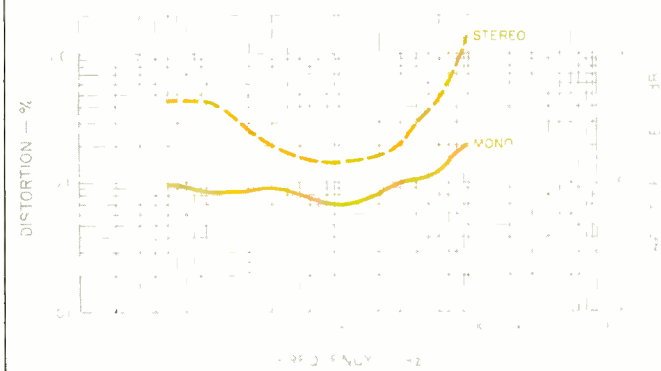

Fig. 2—Harmonic distortion vs. frequency, FM section.

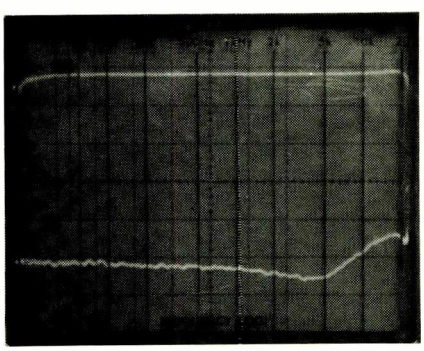

Fig. 3—FM frequency response (top trace) and separation (bottom trace).

Larger buttons for audio/video program selection are located at panel center, below the multi-purpose display area (which I'll get to in a moment). The four audio selector buttons ("Tape 1," "Tape 2," "CD," and "Phono") on the lower row operate much as you would expect. So do the first three audio/video selectors ("VCR 1" and "VCR 2," which are record/play, and the playback-only "VDP/VCR 3," for use with a videodisc player). The fourth button ("Video Signal Selector") is used only when viewing or taping with video from one source and audio from another (such as when taping simulcasts); it switches sequentially through the three video inputs.

The AM and FM selector buttons are farther to the right, along with a "Memory" button. Pressing this stores the station frequency and band as well as the current antenna-selector setting and mode (auto stereo or mono only) setting. (It can also be used to store the station's call letters or other information—more on that shortly.)

Still farther to the right are 10 numbered buttons for storing and recalling presets. Thanks to a shift key, these buttons can designate selections from 1 to 10 or from 11 to 20. They can also be used as a numeric keypad to enter a station frequency directly if the small "Direct Access" button, just above the FM and AM selector buttons, is pressed. The button to the left of "Direct Access" selects manual or automatic (seek) tuning, while the one to its right, labelled "Station Freq/Name," toggles the display and station memory between their station-frequency and station-name modes. To enter station names in memory, you need only press this "Station Freq/Name" switch, then press the "Memory" button. Once that's done, the tuning bar then serves as a quick scrolling control that works its way through the alphabet. When a desired letter is reached, you press "Memory" again, and then move on to the next letter. Simple, eh?

Three more small buttons can be found just above the numbered memory keypad. The first selects automatic stereo/mono switching or mono-only mode, the second selects FM reception from the 300- or 75-ohm (CATV) antenna input, and the third is used to feed the video equipment with either an r.f. signal from the TV antenna (even when the VSX-5000 is turned off) or a base-band video signal from the video inputs.

The upper right part of the panel houses the up/down "Tuning" bar, a "Freq/Ch" switch (which, in auto-tuning mode, selects whether the entire band or just the stations in preset memory will be scanned), and the major buttons that adjust listening parameters. The latter include a "Master Volume" up/down rocker bar, a "Mute" button, a "Surround Volume" bar, left and right "Balance" buttons, and "Bass" and "Treble" up/down buttons. There is also a "Select" pushbutton that sequentially chooses flat response, loudness compensation, and three—count 'em, three—of your favorite tone-control settings, which can be stored in the receiver's memory banks by means of another small "Memory" button nearby.

Since there are no rotary controls on the front panel, all settings are displayed visually in the elaborate fluorescent display area that takes up fully half of the panel's upper section. There are more symbolic and alphanumeric displays and indications than I can possibly enumerate within

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If you like video games and pinball machines that light up in all sorts of colors, you'll love the VSX-5000's display area.

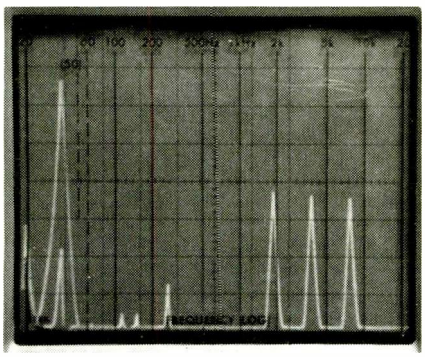


Fig. 4—Analysis of distortion and crosstalk for 5-kHz FM modulating frequency. (Vertical scale: 10 dB/div.)

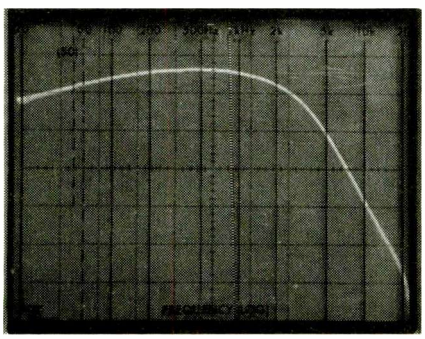


Fig. 5—AM frequency response.

the space allotted for this report. Suffice it to say that virtually every program, function, tuning mode, and surround-sound format you choose (not to mention frequency and channel numbers) will be appropriately displayed. If you like pinball machines and video games that light up in all sorts of patterns and colors, you'll love the display area of the Pioneer VSX-5000. In all seriousness, the display does help to unscramble what would otherwise be an almost unfathomable collection of pushbuttons spread all over the front panel.

As for the rear panel, it's about as crammed full of jacks and receptacles as the front panel is filled with pushbuttons. These include input and output jacks, speaker terminals, antenna inputs (300 ohm, 75 ohm, AM, and the spare CATV coaxial connector), and convenience receptacles (two switched, one unswitched). There's an impedance-selector switch which is set according to the impedance of your speakers and/or whether you are using extra speakers for surround sound. Preamplifier-out/amplifier-input jacks (normally interconnected by removable jumpers) are included for both the main and surround amplifiers. Also on the rear panel are a center-channel (L + R) output, a surround-sound on/off switch, a surround-sound balance control, a de-emphasis switch that also sets channel spacing for U.S. or overseas standards, and a couple of jacks for remote-control interconnection to other Pioneer components.

The wireless remote supplied with the VSX-5000 is fully as versatile as the receiver itself. Besides duplicating many of the control functions found on the front panel, this remote unit allows you to control any other Pioneer component bearing an "SR" mark, such as a TV monitor or receiver, VCR, videodisc player, tape deck, turntable, or CD player. A switch on the remote unit, labelled "A/V," selects whether audio or video functions are to be controlled by its multi-function keys.

Tuner Measurements

The FM tuner section of this elaborately configured receiver performed reasonably well insofar as sensitivity, distortion, and quieting were concerned. Usable mono sensitivity measured 11.5 dBf, and 50-dB quieting for mono was 16.0 dBf. Stereo threshold was just under 30 dBf and therefore represented the limits of usable stereo sensitivity; 50-dB quieting in stereo required an input signal of 38 dBf. Quieting characteristics and total harmonic distortion for a 1-kHz modulating signal are plotted as a function of signal input strength in Fig. 1. Ultimate S/N at 65 dBf or over was a very high 82 dB in mono and 75 dB in stereo. Harmonic distortion for a 1-kHz signal at that same input level was 0.07% in mono, very close to the figure specified by Pioneer, and 0.15% in stereo, exactly as specified.

Figure 2 shows how harmonic distortion varies with modulating frequency. If I had not employed a 15-kHz low-pass filter when conducting these tests, my distortion analyzer's readings for the 10-kHz stereo measurement would have been much higher than shown. That's because this receiver does a bad job of filtering out 19- and 38-kHz components generated in the stereo mode. Rejection of these undesired components was only 38 dB below the 100% modulation reference level. Of course, most people's hearing does not extend to 19 kHz (let alone to 38 kHz) at those levels. However, if you want to record a stereo FM program on tape, for example, using either Dolby B or C noise reduction, the presence of these steady, high-frequency components will certainly upset the Dolby circuits' tracking. If your deck has an MPX filter switch, you'd be well advised to use it when recording FM programs via this receiver.

FM frequency response, in mono as well as stereo, was flat within less than 0.5 dB from below 30 Hz to 10 kHz. Above 10 kHz, there was a slight rise (visible in Fig. 3) to about +1.2 dB at 15 kHz; then response rolled off quickly, as it should. Separation was far better than claimed: 55 dB at 1 kHz, 45 dB at 100 Hz, and 44 dB at 10 kHz.

The receiver's poor 38-kHz rejection is clearly evident in the 'scope photo of Fig. 4. In this linear sweep from 0 Hz to 50 kHz, the tall spike at left represents a 5-kHz modulating signal on one channel; the shorter spike contained within the tall one is the 5-kHz output from the unmodulated channel. The difference in amplitude is the actual 5-kHz separation; it measured about 46 dB. The first spike to the right of

The FM tuner section did reasonably well with sensitivity, distortion and quieting, but subcarrier rejection was poor.

the 5-kHz signals is the residual 19-kHz pilot signal, which has been relatively well suppressed. It is down about 55 dB relative to the 5-kHz signal, which itself has undergone about 8 dB of de-emphasis, and is down even more with respect to 100%-modulated signals at mid-frequencies, which are not de-emphasized. However, farther to the right you can see three unusually tall spikes. The center spike is at 38 kHz, and the others are sideband products 5 kHz to either side of the subcarrier. All three of these spurious signals are no more than 32 dB or so lower in amplitude than the desired 5-kHz reference signal.

Alternate-channel selectivity was 65 dB and AM suppression was 55 dB, both exactly as claimed. Image rejection, though a bit better than the 50 dB claimed, was worse than that of other current medium-priced tuners and receivers. On the other hand, i.f. rejection, measured as 85 dB, was quite satisfactory. Capture ratio, too, was excellent, measuring 1.2 dB. Spurious-response rejection, however, was only average, measuring 76 dB.

As for the AM section, the plot of frequency response shown in Fig. 5 says it all. In fairness, however, I should remind you that most "high-fidelity" stereo receivers offer extremely limited bandwidth in their AM tuner sections.

Amplifier Measurements

When I started measuring the amplifier section of the VSX-5000, I was dismayed to discover that the most power I could obtain was around 80 watts per channel—far short of the 100 watts claimed. Not willing to think that a company like Pioneer would have sent me a defective unit, I did some investigating and, sure enough, found that I had left the rear-panel switch in the "Surround" mode. Under these circumstances, the "front" or main amplifier is designed to deliver only 70 watts per channel, so in fact the amplifier was actually doing better than expected. Once the tiny switch was shifted to the "Stereo" mode, the amplifier easily delivered the claimed 100 watts per channel, with THD at mid-frequencies exactly equal to the 0.005% claimed. At the frequency extremes, THD tended to rise a bit, measuring 0.006% at 20 Hz and 0.16% at 20 kHz. Figure 6 is a "three-dimensional" plot showing how THD varied with frequency and power output levels into 8-ohm loads.

Although Pioneer does not specify power output for 4-ohm loads, I tested performance under those load conditions as well, increasing input levels until the output was just on the verge of clipping. At an output of 150 watts per channel, with both channels driven into 4-ohm loads, THD measured 0.009% at mid-frequencies, 1.0% at 20 Hz, and 0.3% at 20 kHz (see Fig. 7). Since the output voltage required to produce 150 watts into 4 ohms is significantly less than the voltage needed to produce 100 watts across 8 ohms, it is clear that the power-output limitations when using 4-ohm loads are due to current limiting rather than voltage limiting.

Dynamic headroom measured 1.58 dB using 8-ohm loads; it was 1.94 dB referred to 4-ohm loads and a reference output level of 150 watts per channel. Damping factor measured 40 for 8-ohm loads. The discrepancy between my result and Pioneer's claim of 55 may be due to the fact that they reference a test frequency of 1 kHz whereas I follow the

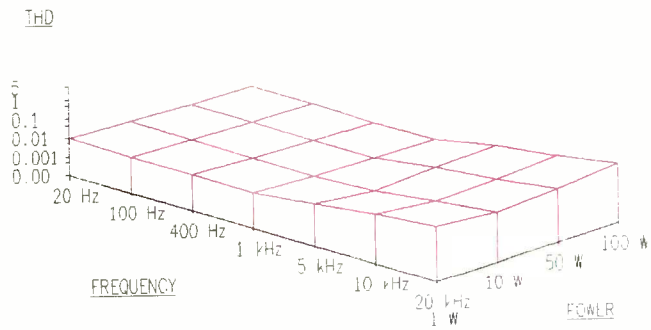


Fig. 6—THD vs. power and frequency for 8-ohm load. THD scale is logarithmic.

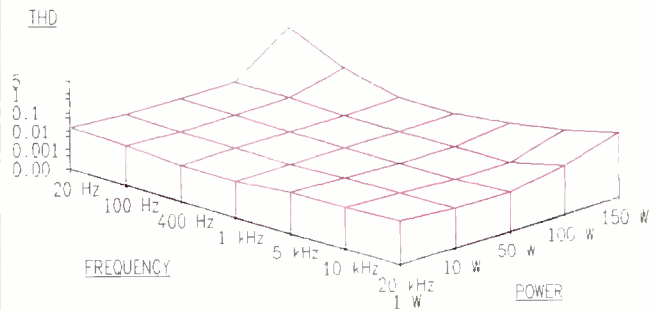


Fig. 7—Same as Fig. 6 but for 4-ohm load.

EIA standard, which calls for a 50-Hz test signal. SMPTE-IM distortion was 0.07% for rated output at 8 ohms and 0.01% for 150 watts per channel into 4-ohm loads. CCIF-IM distortion measured only 0.003% for either load condition at rated output (or at 150 watts per channel for the 4-ohm loads).

Frequency response with signals applied to any of the high-level inputs was flat within ±1 dB from 10 Hz to 70 kHz and within ±3 dB from 5 Hz to 125 kHz. Phono (RIAA) playback response was fairly accurate; it was off by −1.0 dB at 30 Hz and by 0.5 dB at 15 kHz. Input sensitivity for 1 watt output measured 0.25 mV for the phono inputs and 15 mV for the high-level inputs. Phono overload for a 1-kHz input signal occurred at 150 mV, slightly higher than specified by Pioneer. With a 0.5-V signal applied to any of the high-level inputs and the master volume control adjusted for 1.0 watt of output into an 8-ohm load, the A-weighted signal-to-noise ratio measured 80 dB as against 79 dB claimed. For a phono input of 5 mV, S/N measured 81 dB as against 77 dB claimed. At minimum volume setting, S/N was 91 dB with reference to 1 watt.

Pioneer deserves kudos for finding a way to cram so much into such a small package. But it's a chore to figure it all out.

Figure 8 shows the maximum boost and cut range for bass and treble. Strangely, adjusting the treble control for maximum boost or cut had a slight shelving effect upon response in the bass region, where the treble control should have had no noticeable impact. The extent of this shelving was as much as 3 or 4 dB from one extreme of the treble setting to the other. The effect is clearly visible in Fig. 8, where multiple horizontal lines can be seen for the sweeps in which the bass control was at its "flat" setting and only the treble control was varied (over its entire range from maximum cut to maximum boost).

As for the so-called loudness control, it is misnamed. When activated, this control simply added a moderate amount of bass and treble boost to the response regardless of the master volume control setting. Figure 9 shows overall frequency response at many loudness levels when the loudness circuit was activated. This is not what loudness controls are supposed to do. However, if a user understands the function of this circuit, he can introduce it when listening at appropriately low levels; it will then serve its purpose adequately.

Distortion levels of the surround-sound amplifier section were quite a bit higher than the THD of the main amplifier. I measured distortion of as much as 3% even before amplifier clipping. Suspecting at first that the distortion might have been caused by the matrixing circuitry (which "creates" the two extra rear channels from information supplied by the two stereo channels), I plugged my signal generator directly into the surround amp inputs, after first unplugging the jumpers that interconnected this amp with its preamp/matrix decoder section. Results were pretty much the same.

I didn't measure the video performance of the receiver. From my own viewing experience with a wide variety of video equipment, however, I am willing to say that the basic video frequency response was as good as or better than claimed. The video enhancer circuit did "boost" picture detail as claimed.

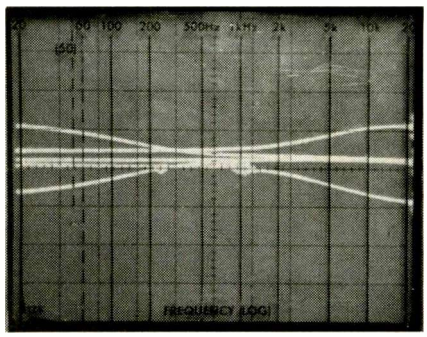


Fig. 8—Bass and treble control range. Note bass shelving caused by use of treble control (see text).

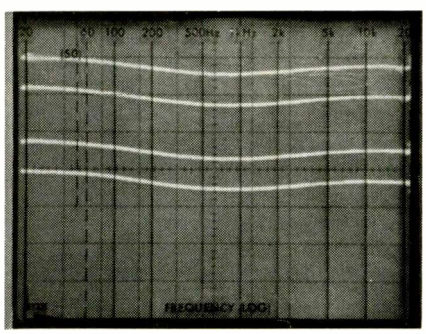


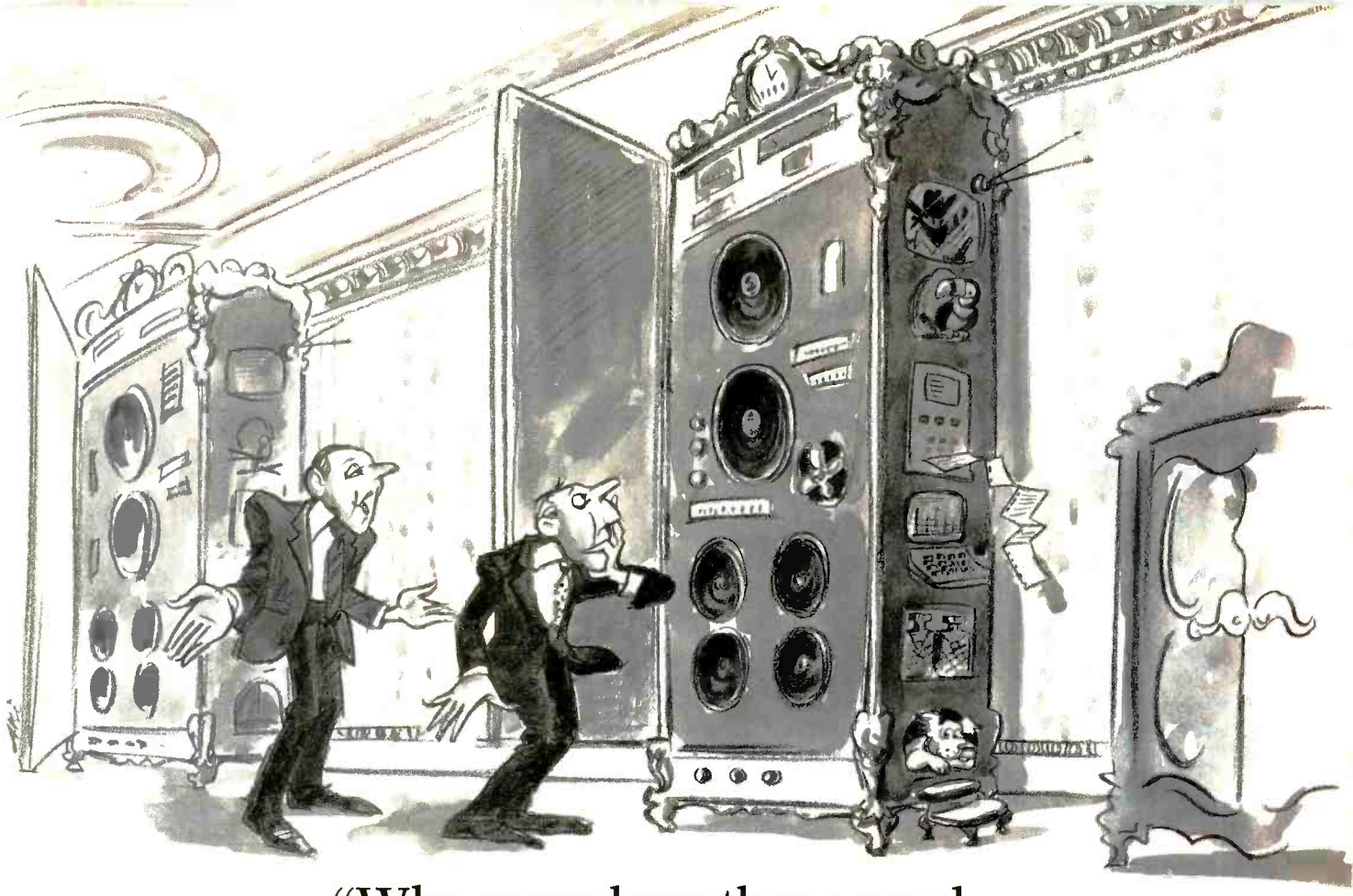
Fig. 9—Loudness compensation. Note that curve does not change shape with volume level.

Use and Listening Tests

Notwithstanding the FM tuner section's poor subcarrier rejection, FM reception was quite good. I struggled for a time while learning the complex process of memorizing call letters or other alphabetic notations along with station frequencies. Once that was mastered, it was rather nice to be able to call up those four-letter words (the ones I had associated with the various FM stations, that is). I hooked up a pair of high-efficiency extra speakers to try out the surround-sound. It worked well, but I felt that a bit more level out of the rear channels was needed. When I attempted to get it, I encountered noticeable distortion. The higher level from the front speakers tended to mask this distortion, but when I turned them off, the distortion from the rear channels was clearly evident. What was interesting, though, was that the surround sound worked nearly as well with randomly selected stereo material (such as FM broadcasts) as it did with videocassettes that had been encoded for it.

The front amplifier was more than adequate for my admittedly low-efficiency reference speakers for most types of program material. Clearly, the unusually high dynamic headroom was doing some good in what might otherwise have been an amplifier with inadequate power output for my needs.

I have to award kudos to Pioneer for being able to cram so much circuitry and so many functions into a package that only a few years ago would have been barely large enough to accommodate a low-powered receiver or an integrated amplifier. In accomplishing this feat, though, I wonder if Pioneer hasn't gone a bit too far. I know of many consumers who have a great deal of trouble programming a VCR for timer recording. I regularly get letters from people who ask questions about how to hook up and operate the most basic audio and video components. It would be one thing if Pioneer had built an all-out audio/video receiver for the real audio aficionado, but judging from its specs and price, the VSX-5000 was intended for middle-of-the-road music lovers who also own some video equipment. I just hope such users have the perseverance to plow through the owner's manual with sufficient care. Only then will they be able to enjoy all of the functions and switching capabilities that this unusually complex receiver offers. *Leonard Feldman*



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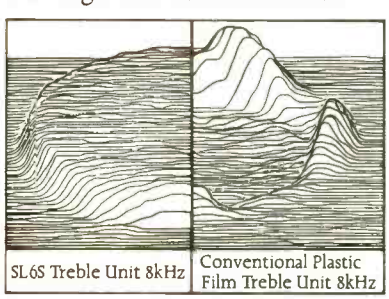

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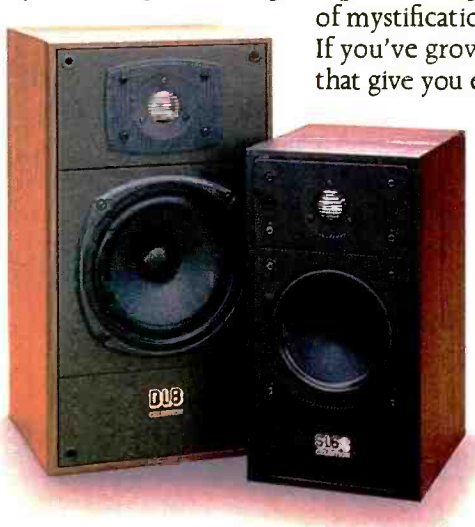

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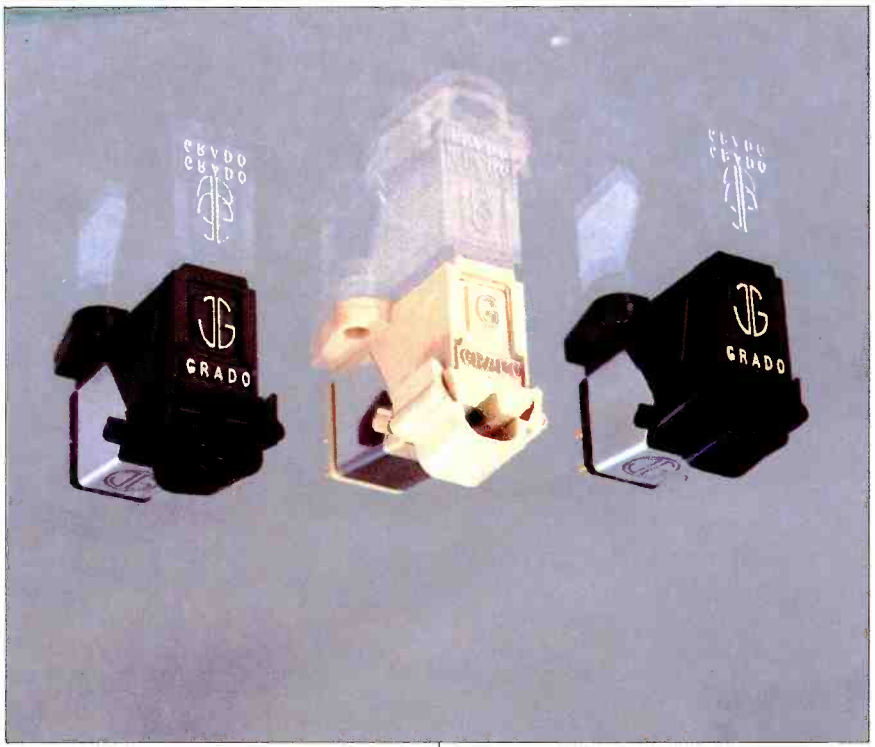

Joe Grado is one of the true legends of American audio. In the early 1950s—though it seems like several hundred years ago—he shifted from watchmaking to making phono cartridges, and has kept at it ever since. He also branched out into designing turntables and tonearms, became an operatic tenor, and even learned to cook. But he has devoted much of his life to making the best possible cartridges, and he has had amazing success with them.

It was Grado, in fact, who helped create the current wave of high-priced cartridges. First, in an era where $100 seemed far too much to spend, he priced his own hand-tuned Signature model at $275, starting cartridges on the path that has led to top prices of more than $4,000. Second, he developed some of the original patents on moving-coil cartridges, helping to trigger the moving-coil boom that now solidly dominates high-end audio.

What Joe Grado is most famous for, however, is his "moving iron" design. Having developed several successful moving-coil cartridges, Grado came to the conclusion that the moving coil had high inherent flux distortion, and that it had to have so heavy an armature and so much mass that stylus contact accuracy was reduced, resulting in a hard and edgy sound. At the same time, he concluded that most moving-magnet cartridges had high and irregular impedance curves and introduced considerable electrical distortion. His solution was a moving-iron pickup with carefully controlled impedance, minimal flux distortion, and a magnetic gap with most of the properties of a moving-coil magnetic system.

Other cartridge designers might take issue with Joe Grado's theories, but few audiophiles would question the sonic results. Since the mid-1970s, Grado Signature cartridges have been so famous for their midrange that word-of-mouth has been virtually the only advertising needed. Further, Grado has turned away from trying to lead the pack in terms of price. His top-of-the-line cartridge now costs $300, and he also makes the least expensive "high-end" cartridges around. One of these, priced around $20, has been the ideal audiophile "starter."

This brings us to the three cartridges under review. They are the XTE + 1, at $20; the Signature 8MX, at $200, and the Signature MCX, at $300. Ironically, even the MCX seems almost cheap by today's high-end standards.

The XTE + 1

The Grado XTE + 1 is not a great cartridge, but for all of $20, it is a darn good buy. It has high output and a good 7-by-3-micron elliptical stylus with a nude diamond tip. It is not a great tracker, but it does reasonably well at 1.5 grams and should ensure long record life. The XTE + 1's strengths are a good sound stage and good midrange with reasonable bass and treble. However, it does not have great transparency or detail, and its sound stage is limited in size. Dynamics are only good, not very good.

If this were all, the XTE + 1 would simply be one more low-cost cartridge. What makes it stand out, however, is its ability to provide a musically convincing timbre and to preserve the emotional impact of music in spite of the compromises it makes in performance. Most inexpensive cartridges involve compromises that make their sound fatiguing and remove much of the pleasure from music. This is particularly true when they are edgy, striving for a false illusion of detail which is never apparent in live music and which rapidly tires the soul and the ear. This Grado is obviously made by someone who knows and loves music, and it errs on the side of a forgiving and musically natural sound.

The XTE + 1 preserves much of the sound character of the expensive Signature series. If you have to operate on a really tight budget, it is probably the cartridge for you. If you are on a tight budget and you love strings, woodwinds, and male voice, it is definitely the cartridge for you.

The Signature 8MX

The Signature 8MX is the latest evolution of Grado's classic Signature series, and has a number of major design

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The 8MX has a superbly natural midrange, and it beats its predecessors at the frequency extremes.

improvements. The generator mass has been reduced by 75%, and the stylus has considerably more resolving power. Like all previous Grado Signatures, it uses a twin-tip elliptical diamond stylus. The magnet and wire used in the cartridge have been upgraded, however, and the electrical system has a smoother impedance. The resistance is rated at 475 ohms, the inductance is 45 mH, and the output is 3.5 mV. This is an exceptionally good load for virtually any standard preamp phono input.

Like all of the previous Grado Signatures, the 8MX has a superbly natural midrange. Because of this, it does a remarkably good job of surviving the test of being compared to live music. You can return from a concert, put on a good recording of the same program, and hear much of the same overall balance of midrange and timbre you heard live. Few cartridges can meet this test. Most seem relatively hard or edgy by comparison, and most recent designs provide too much upper-midrange information. Further, only a few cartridges have the high amount of lower-midrange energy common in live music, and few of these provide as much natural detail as the 8MX.

At the same time, the Signature 8MX is better than its predecessors—the Signature 8MR and 10MR—at the frequency extremes and in virtually every other respect. The upper octaves have previously been the weakest aspect of the Signature line. But the 8MX has smoother and more extended highs than its forebears, with a great deal more life and energy. The 8MX is not an overly "live" or forward-sounding cartridge; its treble balance is more mid-hall than front row. There also is some loss of fine detail compared to the best moving coils, and there may be just slightly too much forgiveness with strings and brass. The Signature 8MX does, however, provide all the treble data and energy you expect in a live performance. While this cartridge isn't perfect, no one looking for natural musical sound is going to complain about its highs.

The bass is also better defined than in previous Grado Signatures. The 8MX now combines power and deep bass extension with excellent control. This control removes most of the slight tendency towards warmth common in previous Grados, and also seems to improve the ability to track in any decent arm of medium to low mass. The Signature 8MX is less tonearm-sensitive than previous Signatures, and while this lack of tonearm sensitivity is most apparent in the bass, it also improves performance in the rest of the frequency spectrum.

Dynamics are improved over previous Grados, and there is more apparent contrast between very low-level and very high-level passages. This gives the Signature 8MX more of a moving-coil character, although with-

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The Signature MCX is great if you want to listen to orchestral and operatic dynamics in a musically natural form.

out an exaggeration of the upper midrange. Only a few moving-coil cartridges—such as the better Koetsus and Kisekis—have the Grado's combination of dynamic energy and midrange smoothness.

The sound stage is very good; width and height are excellent without being exaggerated, and there is no "hole in the middle." Depth is very good. In fact, only a few moving coils (which cost at least twice as much as the 8MX) create a more natural illusion of a large sound stage—when the music justifies such an illusion. The imaging and placement of instruments are excellent and very natural. Musicians and singers have a natural and stable location, without the spotlighting and artificial etching of the image common in some moving coils.

The Signature MCX

The Signature MCX is a major departure for Grado. In many ways, it is an attempt to combine all of the advantages of moving-magnet and moving-coil designs. The cartridge's high-frequency resonance has been raised to 25 kHz, and it uses a very low-mass generator system. It also has a very low rated impedance of 70 ohms and an inductance of only 9 mH. This gives the Signature MCX many of the superior electrical characteristics of a low-output moving coil, though it delivers 1.5 mV into a 47-kilohm load. The Signature MCX can be thus used with the standard magnetic input on any good preamplifier; no pre-preamplifier is required.

Like the Signature 8MX, the Signature MCX has a superb, natural midrange. The MCX, however, does an even better job than the 8MX of surviving the test of live music. You do not hear dramatic differences between the two Signatures, but the MCX clearly has more harmonic detail or air. To my ears, the music seems cleaner and less "hi-fi." Furthermore, it carries more conviction in the midrange and has more impact. The timbre is remarkably musically correct without being forgiving, and complex string and choral passages seem to be tracked more cleanly.

The 8MX has smooth and extended highs. The MCX, however, has still *more* life and energy. It is more "live" and slightly more forward-sounding; its treble balance and overall timbre and dynamics give it the character of a sound about one-third of the way back in a concert hall. Like the Signature 8MX, this is not a cartridge with more treble energy than a live performance. If you are a moving-coil buff, you will have to listen for some time before you realize that all the highs are there, with the proper energy and detail, but without the upper-midrange/lower-treble rise common in many moving coils.

While the Signature MCX does not rival the moving coils with van den Hul or complex long-contact-area styli in the ability to extract every bit of treble detail, it is relatively forgiving of setup,

This latest round of very musical and pleasurable cartridges clearly shows that Joe Grado continues to improve upon his legend.

and it provides a significant improvement in resolution relative to the 8MX. If there is any real weakness in the MCX's treble or upper midrange, it is that it sometimes seems to lack the natural bite or harshness of brass and strings. This, however, is hard to determine. (Many moving-coil phono cartridges exaggerate this harshness, and there are very few musically natural recordings.) Few listeners will regret this failing, since it comes as a trade-off for an absence of the grain and hardness of many competing high-end cartridges.

The MCX's bass performance is very similar to that of the Signature 8MX, but seems to have slightly more detail and resolving power. The bass dynamics are also better, as is every other aspect of dynamic performance. This is a great cartridge if you want to hear orchestral and operatic dynamics in a musically natural form; in both very low and very loud passages, there is an exceptional lack of grain and no other loss of detail. The MCX will, however, run into some difficulty with over-cut records or problem passages. You do not get the "track everything" capability that is characteristic of the best Shure cartridges.

The Signature MCX's sound stage is excellent. As is the case with the Signature 8MX, width and height are outstanding without leaving a hole in the middle. Depth is also exceptional. The MCX does even better with imaging and placement of instruments than the 8MX. There is more feeling of air and location in three-dimensional space, and those few recordings with real depth have this depth revealed in full. Oddly enough, recordings also generally seem quieter in terms of surface noise and other sonic garbage, and you can hear more chair movement, score rustling, and other original activity on the sound stage.

The latest round of Grado cartridges clearly demonstrates that Joe Grado continues to improve upon his own legend. More important, these are very musical and pleasurable cartridges. They all have the common characteristic of sounding exceptionally good if you have just heard live music and are not expecting some kind of special "hi-fi" character, life, or detail.

The choice of a cartridge is highly personal and should always be done on the basis of careful and extended listening. Cartridges vary more in sound character than any other component except speakers, and they must be carefully chosen to blend into a given system. Nevertheless, the Signature 8MX and the Signature MCX are really outstanding. They compete in sonic terms with such superb moving-coil cartridges as the Talisman Virtuoso DTi, the van den Hul Model One, and the Koetsu Red Signature—all of which are far more expensive. They also offer a uniquely natural midrange and sound character that may well be just what you are looking for.

Anthony H. Cordesman

FAB FOUR, FINALLY

Please Please Me, With The Beatles, A Hard Day's Night, Beatles for Sale: The Beatles
Capitol CDP 46435, CDP 46436, CDP 46437, CDP 46438.

The Beatles albums on most of our shelves are well-worn mementos that haven't received much attention lately. The reissue of The Beatles' repertoire on Compact Disc allows us to replace those albums with the state of the art. Even better, it encourages us to take a fresh look at the group.

For those dismayed that the first four discs have been reissued in mono, it should be noted that this is exactly what The Beatles and their producer, George Martin, intended. Subsequent attempts to impose simulated stereo on the material were made without their approval or appreciation and, like the computer colorization of black-and-white films, seem to this reviewer totally unnecessary.

These first four discs match up with the original Parlophone LPs issued in the U.K. In the United States, seven albums of Beatles material were issued in roughly the same time period, but only 14 songs found on the U.S. LPs are missing from the CDs, most notably "She Loves You" and "I Want to Hold Your Hand."

Amazingly, the 56 songs these CDs contain were recorded within a hectic two years the group largely spent touring and making their first film. They were allowed very little time in the studio, yet managed to arrange, rehearse, and record more classics than most supergroups produce in a lifetime. Despite Lennon/McCartney's prolific composing, 18 of the songs are covers. It's hard to imagine why they recorded most of the non-rockers, which include the outlandish "A Taste of Honey," Bacharach/David/Williams' syrupy "Baby It's You," and "Till There Was You" from *The Music Man*.

The best thing about the CD versions of these earliest albums is the new-found clarity of the vocals. Obviously, the nuances of McCartney's crooning and Lennon's sexy growl become more accessible, but the CD also reveals the kind of mastery the pair exercised when blending their unique voices in those incomparable harmonies. George Martin's liberal use of double-tracking the vocals becomes more apparent as well.

Please Please Me is basically a live album, with all but the title track recorded in one session. Martin had wanted to capture the tone of the group's live act; the energy level is very high and seems to come from a combination of exuberance, nervousness, and desire to succeed. The title song was originally much more sedate, and Martin had not wanted to use it. Under scrutiny it's apparent that The Beatles sped us their performance in the studio; the band is a bit shaky in its accompaniment, and the singers seem unused to rushing the phrasing. If you are looking for clean perfection, it won't be found here. By today's standards, the guitars are often harsh and gritty, the bass muffled and boomy, and the drums a muddy mess. The voices are not consistently balanced. But along with the imperfections comes a priceless intimacy; you feel that you are in the studio, eavesdropping.

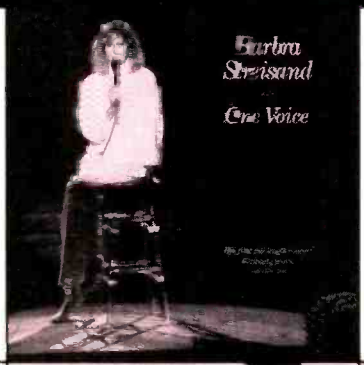
On *With The Beatles*, more care was taken with sound quality, and instrumental tone and separation improved. The energy level of the performances remained high. As on all the early albums, Lennon dominated the vocals, shining especially on the feisty "It Won't Be Long" and "Please Mister Postman."

A Hard Day's Night was the first album with all original material. It comprised the seven songs from the film, plus six others written for it but not used. Its classics include "I Should Have Known Better" and "If I Fell," whose astute harmonies are still routinely analyzed alongside Bach's by students of "serious" music.

By the time of *Beatles for Sale*, Martin had pushed twin-track technology to its limits, achieving remarkable clarity for nearly every element. The band was progressing beyond being a "beat" group; the sophistication and creativity that would soon bloom was foreshadowed in songs such as "No Reply" and "I'm a Loser."

Listening to the early Beatles on CD brings an appreciation of just how great they really were. Transcending the technology at their disposal, they had began to expand popular music in every direction. If your personal Beatlemania has died down or if you missed out the first time, these CDs may rev up your excitement with more authority than any Beatles documentary or history book. *Susan Borey*

JUNE



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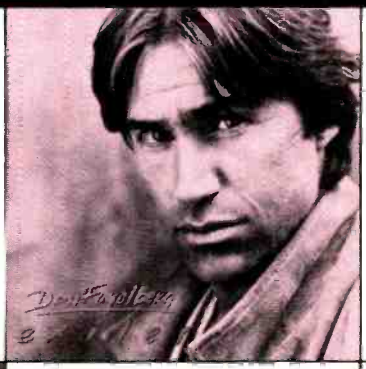

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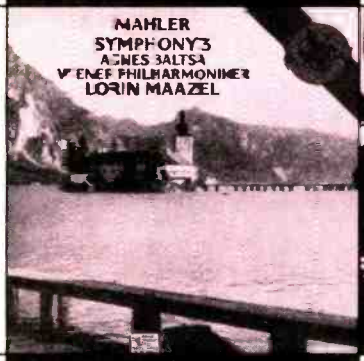

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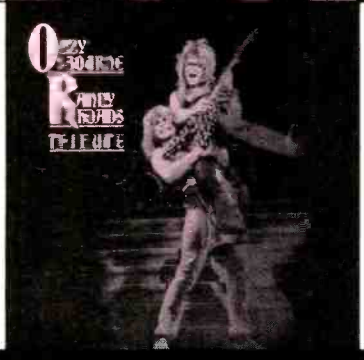

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Round Midnight: Various Artists
Columbia CK 40464.

Sound: B Performance: B

Like the film from which this soundtrack is taken, *Round Midnight* has a smoldering, languid quality. It reflects the waning and wasted years of a legendary saxophonist, played with some veracity by Dexter Gordon, himself a tenor giant in his autumn years. This is a curious soundtrack in that most of the music was recorded live on the set during filming, rather than dubbed in later. So it's often difficult to tell whether Dexter Gordon is interpreting the mood of his character, who at the film's beginning is a besotted wreck, or if he's truly in that groove himself.

His "Body and Soul" is certainly desolate enough, filled with a diffuse sort of pain. On the other hand, on the high-energy cuts like "Una Noche Con Francis" and "Rhythm-A-Ning," which occur during the character's brief renaissance, Gordon bops out toe-to-toe with saxophonist Wayne Shorter and trumpeter Freddie Hubbard. "Rhythm-A-Ning" in particular is a spontaneous outburst of ragged energy. Hubbard thrusts through with upper-register squeals against Gordon's straight-ahead resolve. The Ron Carter/Tony Williams rhythm section manages to hold it all together.

If Gordon presents a giant in decline, what can be said for Chet Baker's painful reading of "Fair Weather," on which he sings and plays trumpet? His voice and instrument are frail and scratchy, aching with a pathos that's embarrassing in its nakedness.

A real threat on *Round Midnight* is vocalist Bobby McFerrin, who makes two appearances. He's not an actor in the film, but his voice opens "Round Midnight," imitating a trumpet lead to Thelonious Monk's masterpiece. McFerrin gets so close to Miles Davis' trumpet sound that it's frightening.

Musically organized by Herbie Hancock, who plays piano throughout (and

A superb balance is struck between the soprano and the Academy of Ancient Music, led by the ever-reliable Christopher Hogwood.

who wrote three songs). *Round Midnight* maintains a fidelity to the mid-'50s era it portrays while investing its songs with new energy. But it's not a definitive bop record by a long shot; you'd be better off checking out Dexter Gordon's *One Flight Up* or his other Blue Note recordings for evidence of his real mastery.

The CD retains some of the live, of-the-moment quality of the movie, although the quick fades at the ends of many songs diminish the ambience, especially when Gordon is holding those breathy tones. Also, the disc originates from an analog master, and the resultant tape hiss is audible.

John Diliberto

Handel: Italian Cantatas. The Academy of Ancient Music, Christopher Hogwood; Emma Kirkby, soprano. **L'Oiseau-Lyre 414 473-2.**

This is a fabulous recording engineered by Decca's redoubtable John Dunkerley. He strikes a superb balance between soprano Emma Kirkby and the orchestra, with her voice always well projected, always articulate, and never swamped by the players. Dunkerley places the performers in an acoustic perspective which provides a warm, spacious ambience without sacrificing instrumental definition.

If you haven't heard Emma Kirkby, this will be a treat. She has one of the loveliest of soprano voices, with an unbelievably smooth top register and a lambent purity that is a joy to the ear. In addition, her singing skills are formidable. This is evident when you hear how effortlessly she handles the difficult florid vocal ornamentation so typical of much of Handel's music.

In these four delightful Italian cantatas, Kirkby is in glorious voice. With the very polished playing of the Academy, under the direction of the ever-reliable Christopher Hogwood, this is inspired music-making of very high order.

Bert Whyte

MICHAEL TEARSON
JON & SALLY TIVEN

THREE-PART INVENTIONS

Trio: Dolly Parton, Linda Ronstadt, Emmylou Harris
Warner Bros. 25491.

Sound: A– Performance: A+

For over a decade, Dolly Parton, Linda Ronstadt, and Emmylou Harris have been getting together from time to time to sing on each other's albums. Again and again they attempted to do a whole album of their own, but things never worked out. Only on the occasional tracks on one or another of their solo projects could we hear what amazing sounds they make when they sing together.

Finally comes *Trio*, exactly the record I'd always hoped it would be—mostly acoustic/folky and with spectacular singing, as the three sound relaxed and loose as only the best of friends can.

On *Trio* we have three very disparate vocal sounds: Dolly's high, clear trill; Linda's full-throated, deeper sound, and Emmylou's dry, reedy quality. Yet they merge into something amazing, something far more than the considerable sum of the parts. Crediting the lead singer is somewhat misleading, as the voices blend into such an organic whole that it is often difficult to figure exactly who is singing what. The whole takes on a life of its own, much the way the voices of Stephen Stills, David Crosby, and Graham Nash did back in '69.

Linda, Dolly, and Emmylou have opted to keep the instrumental support as simple and graceful as possible, and they have used musicians they have known and worked with for years. These include fiddler Mark O'Connor, who also takes turns on guitar and mandolin; guitarist Albert Lee; multithreat David Lindley for assorted guitars, autoharp, dulcimer, and mandolin; acoustic bassist Kenny Edwards, who goes back to The Stone Poneys with Linda; steel guitarist Steve Fishell from Emmylou's band; Russ Kunkel for the occasional drum part, and keyboardist Bill Payne. Guitarist John Starling, who splits his time between The Seldom Scene and a career as a surgeon, is invaluable as "musical consultant," as is banjoist and harmony wizard Herb Pedersen, who helped with the vocal arrangements. Throughout, the band is superlative. They never overplay or distract from the voices, which are the focus. Even so, the soloing is wonderful, at once vividly expressive and succinct.

The songs are the kinds one can imagine these ladies singing for fun in their living rooms. "The Pain of Loving You" is an early-'70s song by Dolly and Porter Wagoner, in which Emmylou sings the lead; "Making Plans" is an early-'60s country chestnut. "Hobo's Meditation" dates back to Jimmie Rodgers, the Singing Brakeman, and the trio's delicious version of "To Know Him Is To Love Him" feels ever so much more heartfelt than the 1958 Teddy Bears original. Linda is featured up front on Linda Thompson's "Telling Me Lies" and Kate McGarrigle's "I've Had Enough." Emmylou takes lead on Jean Ritchie's "My Dear Companion." The album closes fittingly with a pair of traditional songs, including the great old hymn "Farther Along."

Only two songs depart from simple arrangements, and even these have a real emotional impact. The forlorn "I've Had Enough" adds flute, clarinet, and three string players to Payne's piano. The even more bitter "Telling Me Lies" gets the biggest treatment as Edwards switches to electric bass and a beautiful David Campbell string arrangement swells and ebbs to effectively heighten the tragedy in the song.

George Massenburg's engineering and production are gorgeous. The instruments sound true and warm and close, and the voices are spectacular. In fact, this LP has some of the best vinyl sound I've heard in ages.

I imagine that Emmylou, Dolly, and Linda are pleased with *Trio*. It is a stone killer album, and one can only hope that it will prove to be the first of many they will do together.

Two last notes: Linda Ronstadt might consider suing her hair stylist for malpractice for that awful bubble cut she sports on the cover. On the other hand, the paper dolls on the inner sleeve are a great touch.

Michael Tearson

The Lace: Benjamin Orr
Elektra 60460.

Sound: B Performance: B

Anyone familiar with the musical style and sound of The Cars should have no problem identifying that style and sound on *The Lace*, the debut solo album from The Cars' vocalist/bassist Benjamin Orr. All the musical signatures are there: Layered keyboards, multiple guitar parts, Fairlight CMI drum and keyboard programming, and, of course, those lush, layered background vocals that sound as if they have been processed through the noise generator of an analog synthesizer. However, what *isn't* there is the strong material found on Cars releases. Certain tracks—specifically, the album's single, "Stay the Night," and the opening cut, "Too Hot to Stop"—offer most of the proper pop ingredients. But the remaining tracks are lyrically and melodically weak, denying Orr the chance to show his vocal talents. And as we all know from his singing on past Cars albums—especially "Drive" from *Heartbeat City*—if

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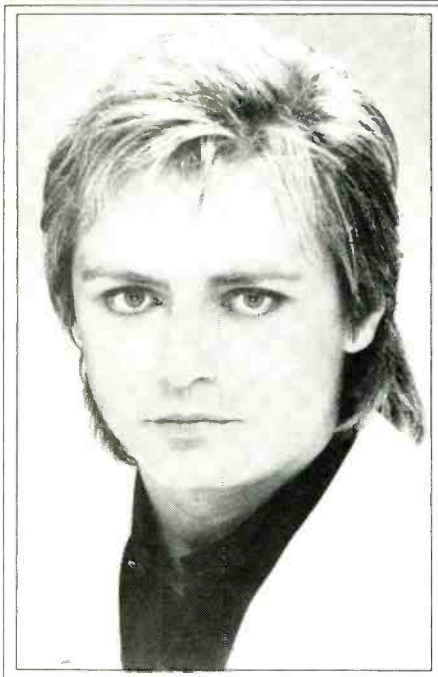
Benjamin Orr's songs have been very well recorded, but when material is weak, even the best engineer can do only so much.



the material is right. Orr can be a very capable and convincing vocalist.

All the songs are excellently recorded by engineers Mike Shipley (who also coproduced, with Orr and keyboardist Larry Klein) and Thom Moore. Shipley also mixed the two most musically cohesive tunes, "Stay the Night" and "Too Hot to Stop." This is not to imply that Moore didn't do as good a job. It just seems that the songs he worked on were not as well arranged as the two lead tracks. And when a song is weak, even the best of engineers can do only so much.

The recordings were made at The Wool Hall in Beckington, England and at Blue Jay Studios in Carlisle, Mass. The final pressing was made using the DMM process, and the LP is very quiet and dynamic.

Any time a musician steps outside of a group to record a solo album, he or she runs the risk of having the solo effort compared to the music made by the group. This can be unfair. However, in the case of Benjamin Orr's *The Lace*, there are such similarities to The Cars that comparison is unavoidable. And when the comparison is made, *The Lace* runs a poor second. Orr is a talented vocalist and bassist; one hopes that on his next solo recording, the material will be equal to his talents.

Hector G. La Torre

Skylarking: XTC
Geffen GHS 24117.

Sound: B+ Performance: A+

XTC's latest album is a return to form not only for them but for their producer Todd Rundgren as well. *Skylarking* is simply one of the most creative and well-made records of the year, an aural delight that should re-establish both the group and the producer as major forces in the marketplace.

Andy Partridge and Colin Moulding are two of the most engaging singer/songwriters to come out of Britain's post-punk pop scene. They haven't been more successful in this country only because of business problems (they've been on five different labels already), personal difficulties (Partridge got ill on the first date of his last tour and subsequently retired from the road), and lack of luck. Their music was not to be faulted—it could easily have been them in The Police's or Joe Jackson's shoes if the timing had been better.

Todd Rundgren has taken XTC into a fine musical place, giving them the clarity and production values that in the past have brought fame and fortune to The Beatles and Queen. The sound of the record is quite remarkable—it might even make you question whether you're listening to an LP or a CD! (We would have given it an A+, but our editor refuses to allow big-corporation vinyl to get sound grades above a B+.)

Skylarking has a variety of instruments that aren't normally heard on rock records, and an emphasis on string arrangements the likes of which haven't been explored since The Beatles got George Martin loaded. There are a few songs with no drums at all; XTC's regular drummer left a while ago and they now operate as a three-piece corporation, with a hired hand (Prairie Prince) tapping the skins when called upon. And a great job he does, too.

But this album isn't just about unusual arrangements—it rocks as well. Rundgren is obviously well aware of XTC's previous work, and "Earn Enough for Us" is a driving return to

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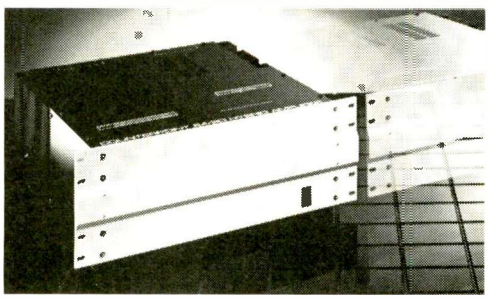

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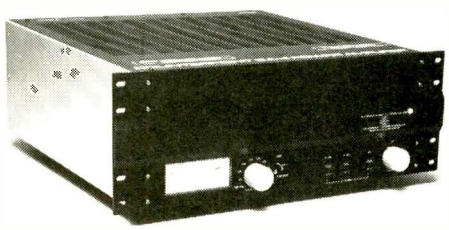

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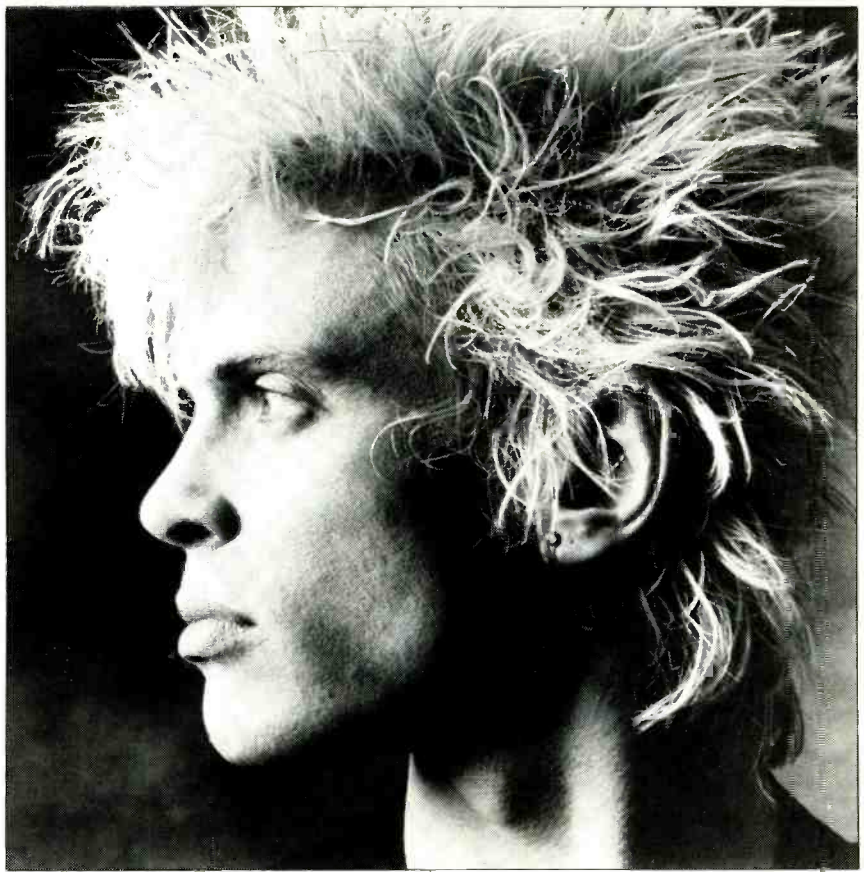
Billy Idol's very solid record has a cool, modern air and some unbelievable playing by his guitarist.



the territory the group made its own with songs like "Towers of London" and "Senses Working Overtime." Todd has brought out the best elements of XTC's provincialism and added the big sound of multi-tracked vocals to give it just that wee bit of accessibility that their last few records have needed.

Greatness, intelligence, and humor have all met on one record, and it's *Skylarking*. *Jon & Sally Tiven*

The Return of Bruno: Bruce Willis
Motown 6222ML.

Sound: B Performance: D

Bruce Willis is network TV's hottest property as fingerpoppin', jive-talkin' David Addison on *Moonlighting*. Naturally, after all those Motown songs he groaned out on the show, the opportunity came to do an album—and on Motown Records, yet.

So how's *The Return of Bruno*? Glad you asked. Let's be kind and say that Bruce clearly had a lot of fun doing it. His enthusiasm is his strongest suit; as a singer he's pretty limited. His best vocals are on a nice version of "Under the Boardwalk," but he's not going to make anyone forget The Drifters. Heck, he'll never make anyone forget The Blues Brothers.

The production is splashy and engaging. It should be, with half of L.A. working on the project. Some of the songs are oldies, like "Boardwa'k," "Young Blood," and "Secret Agent Man." Some are just very hip choices, like Ry Cooder's "Down in Hollywood" and Allen Toussaint's "Fun Time." It adds up to a loosey-goosey frat-party kind of record. But Bruce can't carry the load on fun alone. *Michael Tearson*

Looking for Jack: Colin James Hay
Columbia BFC 40611.

Sound: B– Performance: C

Colin James Hay was the best part of Australia's Men at Work. Here, on his first solo album, he can't manage to fire up the same charismatic flash. His songs are sound enough but lack sizzle, that mysterious element that could have made them fly.

Looking for Jack begins promisingly enough with the African chorus that opens "Hold Me," but the flight never goes past low altitudes, thanks to leaden horn charts which add weight rather than elevate. As the album unfolded, I kept listening for the equivalent of "Who Can It Be Now," but it never showed up. It's not the fault of engineer Tim Kramer or producer Robin Millar; sound and design are each more than adequate. It's the songs themselves that leave the album flat. *Michael Tearson*

Whiplash Smile: Billy Idol
Chrysalis OV 41514.

Sound: B+ Performance: A–

In 1976 who would have believed that the frontman from Generation X would be a worldwide megastar in 10 years' time, while Johnny Rotten would languish in some cult-hero limbo? Granted, Billy Idol's platinum aspirations were obvious enough, but whether he had the goods or not was very much an open question. At this point, the answer is pretty well clear. With the aid of guitarist Steve Stevens, Billy has put together a very solid record in which he plays the cartoon version of Jim Morrison (or Iggy Pop, depending on your decade of reference) to the hilt. Keith Forsey's production is slick without undercutting the basic thrust, and works particularly well on "Don't Need a Gun," "Soul Standing By," and the cover of the reggae hit "To Be a Lover."

For those of you who look upon Idol as just another obnoxious lead singer, try to endure in order to savor Steve Stevens' unbelievable guitar work; you won't be disappointed. Steve continues to wail and groan throughout the album, and he shines particularly on "A Man for All Seasons." Keith Forsey continues to give the act a cool, modern air that allows one to savor the technology rather than be drowned in it. The only complaint is that the drums are all machines, and it tends to sound the same after a while—but then, that's where the live show will provide surprises. This is an album capable of converting detractors.

Jon & Sally Tiven

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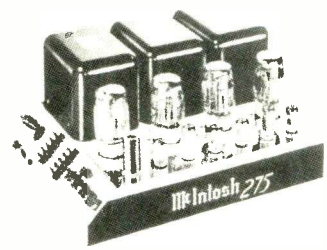

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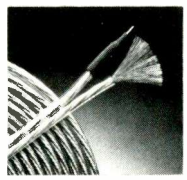

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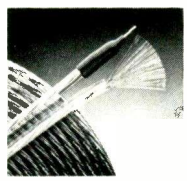

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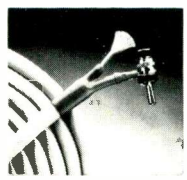

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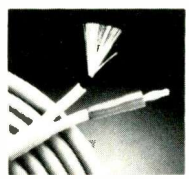

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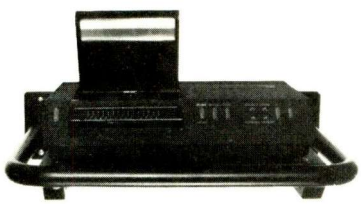

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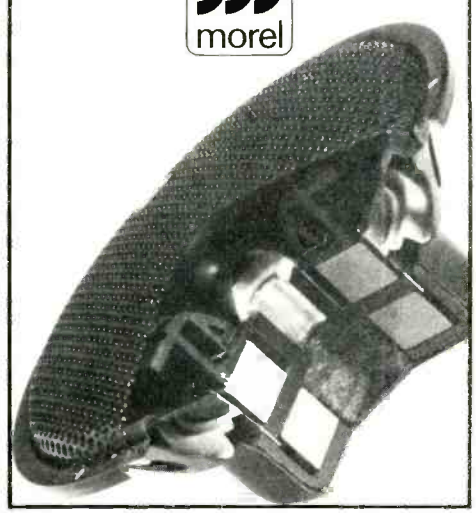

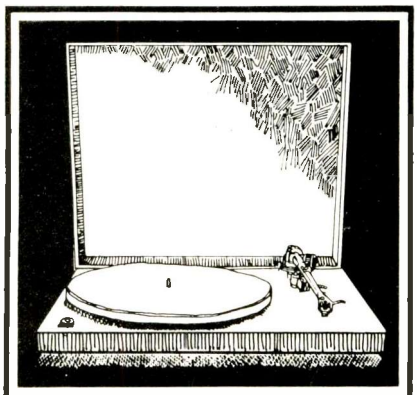

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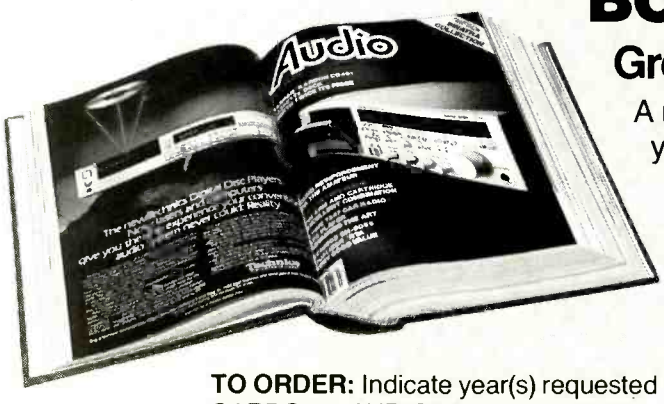

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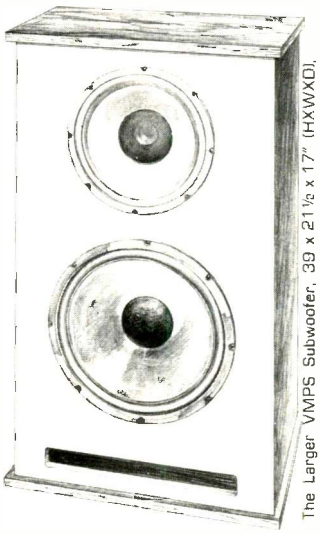

The Larger VMPS Subwoofer, 39 x 21½ x 17" (HXWXD), 140lbs available in oak or walnut

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Also new for 1987 is the Special Edition of our highly acclaimed VMPS **Super Tower IIa/R** system, incorporating four of the most requested luxury options—IAR Wondercap crossovers, high power Superdome tweeters, the single amp conversion kit, and Powerline II internal wiring—at only a small premium in price. The STIIa/R Special Edition kit is $1399ea in black, $1499ea in oak or walnut; factory assembled is $1838ea black, $1938ea oak or walnut finish. Write for reviews and test reports, plus brochures on all VMPS speakers including the **MiniTower II** ($329ea kit, $439ea assem), **Tower II** (439ea kit, $599ea assem), **Super Tower/R** ($699ea kit, $969ea assem), and the **QSO Series** on bookshelf systems. Kits are suplied with fully assembled cabinets and all prices include free shipping in USA.

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AD INDEX

Out of the rubble...a new technology

The collision of audio and video technologies dealt the home entertainment revolution a mixed hand.

There's the promise; quality home entertainment. Then, there's the reality; lots of components that just don't deliver.

Audio/video receivers, for example: Most are merely audio receivers with VCR inputs at best.

Suddenly, out of the rubble, a new technology is emerging; Nikko Video Technology.

Our AVR-65 Remote Audio/Video Stereo Receiver has built-in MTS/SAP, and delivers direct remote access to 139 channels, in audio and video, in stereo and second language programming; even if your TV doesn't itself have remote.

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*SL-P720 recommended for higher vibration applications

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