Audio

SEPTEMBER 1987 • $2.25

DESIGNING A LISTENING ROOM

LUXMAN LV-109 INTEGRATED AMP
IN A CLASS BY ITSELF

THE CASE FOR ACTIVE SPEAKERS

TESTED
KYOCERA DA-710 CD PLAYER

SOUNDCRAFTSMEN PRO-POWER FOUR AMP

0 270301 3 09
06030

Real Friends

Real people want real taste.

Winston

SURGEON GENERAL'S WARNING: Cigarette Smoke Contains Carbon Monoxide.

16 mg. "tar", 1.2 mg. nicotine av. per cigarette by FTC method.

....remarkable!

par.a.digm [par'adim] *noun: serving as an example or model of how something should be done.*

Every once in a great while a product comes along that offers performance which rises above the current variety of clever designs and marketing hype. When this occurs the new level of performance achieved can be readily heard by both the ardent audiophile and the novice listener.

Paradigm is a breakthrough loudspeaker that provides a level of musical truth that simply must be heard.

Oh yes, the price for such glorious performance? Well . . . that's even more remarkable.

Paradigm®

music . . . above all.

In the U.S.: ***AudioStream Corporation,*** *Box 1099, Buffalo, NY 14210*
In Canada: ***Paradigm Electronics Inc.*** *4141 Weston Rd #5, Weston, ON M9L 2S8*

Enter No. 36 on Reader Service Card

Audio

SEPTEMBER 1987 VOL. 71, NO. 9

Active Speakers, page 64

Whitney Houston, page 126

FEATURES

EQUIPMENT PROFILES

MUSIC REVIEWS

DEPARTMENTS

The Cover Equipment: Luxman LV-109 integrated amp.
The Cover Photographer: ©1987, Bill Kouirinis.

Audio Publishing, Editorial, and Advertising Offices,
1515 Broadway, New York, N.Y. 10036

Subscription Inquiries, (800) 525-0643; in Colorado, (303) 447-9330

ABC

MPA

Luxman Amp, page 72

Audio ETC, page 37

DIMENSION REDEFINED.

Cerwin-Vega's new Select Edition Series.

Sonic realism that creates a new dimension.

These stunning speakers give you high-tech outside, and *inside*—where it counts most. We've combined exacting engineering standards with superior innovation to deliver defined, dimensional performance. All six models offer expertly matched componentry for clear linear response and electrifying depth.

Advances in consumer electronics demand progressive loudspeakers. With its unsurpassed efficiency (as high as 102dB 1W @ 1M) and power handling (up to 405 watts continuous), the SE Series delivers incomparable dynamic range (exceeding 92dB). Even at extraordinary output levels, reproduction remains remarkably defined and distortion free.

Finally, speakers that do justice to everything you've got—from compact discs to 8mm digital video playback.

For those who know a great thing when they hear it. And see it.

Cerwin-Vega's SE Series.

A new classic.

Cerwin-Vega!

For more information please write or call:
Cerwin-Vega: 12250 Montague St./Arleta, CA 91331 (818) 896-0777
Cerwin-Vega Canada: 2360 Midland Av., Unit 21/Scarborough, Ontario M1S 4A9
Cerwin-Vega Europe: Skanderborgvej 71/DK-8680 Ry, Denmark

Enter No. 10 on Reader Service Card

Audio

Eugene Pitts III
Editor

Art Director: Cathy Cacchione

Technical Editor: Ivan Berger
Managing Editor: Kay Blumenthal
Copy Chief: Elise J. Marton
Associate Art Director: Linda Zerella
Assistant Editor: Karen Clark

Associate Editors:
Edward Tatnall Canby, Bert Whyte, B. V. Pisha
Senior Editors:
Leonard Feldman, Howard A. Roberson
Senior Editor/Music Features: Ted Fox
Editor-At-Large: David Lander

Contributing Editors/Artist:
Susan Borey, Herman Burstein, David L. Clark, Anthony H. Cordesman, Ted Costa, John Diliberto, John M. Eargle, Joseph Giovanelli, Laurence L. Greenhill, Bascom H. King, Gary Krakow, Edward M. Long, Jon R. Sank, George Shellenberger, Donald Spoto, Michael Tearson, Jon & Sally Tiven, Paulette Weiss

Business Services Director: Catherine Hennessey
Circulation Director: Brian T. Beckwith
Production Director: David Rose
Production Manager: Michele Lee
Research Manager: Neil Karlin
Special Projects Coordinator: Phyllis K. Brady
Ad Coordinator: Susan Oppenheimer

Stephen Goldberg
Publisher

ADVERTISING
Associate Publisher: Stephen W. Witthoft (212) 719-6335
Sales Manager: Nick Matarazzo (212) 719-6291
Account Manager: R. Scott Constantine (212) 719-6346

Western Manager: William J. Curtis
Regional Manager: Bob Meth (818) 784-0700

Classified Manager: Laura J. LoVecchio (212) 719-6338
Classified Assistant: Mary Jane M. Adams (212) 719-6345

CBS MAGAZINES EXECUTIVE STAFF
President: Peter G. Diamandis
V.P., Editorial Director: Carey Winfrey
Sr. V.P., Publishing: Robert F. Spillane
Sr. V.P., Circulation: Robert E. Alexander
Sr. V.P., Operations: Robert J. Granata
Sr. V.P., Mfg. & Distribution: Murray M. Romer
V.P., Finance: Arthur Sukel
V.P., Subscription Circulation: Bernard B. Lacy
Pres., CBS Magazine Marketing: Carl Kopf

AUDIO (ISSN 0004-752X, Dewey Decimal Number 621.381 or 778.5) is published monthly by CBS Magazines, A Division of CBS Inc., at 1515 Broadway, New York, N.Y. 10036. Printed in U.S.A. at Dyersburg, Tenn. Distributed by CBS Magazine Marketing. Second class postage paid at New York, N.Y. 10001 and additional mailing offices. Subscriptions in the U.S., $19.94 for one year, $35.94 for two years, $49.94 for three years; other countries, add $6.00 per year.

Subscription Service: Forms 3579 and all subscription correspondence must be addressed to AUDIO, P.O. Box 5316, Boulder, Colo. 80302. Please allow at least eight weeks for the change of address to become effective. Include both your old and your new address and enclose, if possible, an address label from a recent issue. If you have a subscription problem, please write to the above address or call (800) 525-0643; in Colorado, (303) 447-9330.

SONY

ES Series

Closing the gap between music and technology

A promise fulfilled

Digital audio has ushered in a new era in sound reproduction. It holds the promise of dramatically improved sonic quality—a listening experience that convincingly recreates the live musical event in your home.

The Sony ES Series is an exclusive, limited series of matched components. They are engineered without compromise to bring you all the benefits of Sony's many years of experience and technological leadership in audio. They, furthermore, incorporate refinements specifically designed to meet the demands of modern digital audio reproduction. In fact, when it comes to digital audio, ES Series components are in a class by themselves. They fulfill the promise of digital performance as no other components before.

No matter what the music source, Sony ES Series components assure you the best possible sound quality. They deliver superior sonic purity, clarity, and accuracy—a difference you'll hear the very first time you audition them and a difference you'll appreciate and enjoy for years to come.

Sony has led the way in digital audio.
No other manufacturer can claim more "firsts" in digital audio than Sony.

The digital revolution began to take shape in the early 1970's when Sony developed a PCM (Pulse Code Modulation) digital recorder for professional use. Since the beginning, Sony has played a significant role in the development of professional digital audio products. And today, Sony digital audio equipment is in use at prestigious music recording and production facilities around the world.

Sony PCM-3324 Multitrack Recorder for professional use.

In 1977 Sony introduced the PCM-1, a processor which permitted digital recording with any conventional VCR. The PCM-1 first made it possible for serious recording enthusiasts to take advantage of Sony's impressive digital technology.

Digital recording took another leap forward in 1981, when Sony unveiled the world's first portable PCM processor, the PCM-F1. Applauded by professional and amateur recording engineers alike, the PCM-F1 brought the staggering clarity and accuracy of digital sound to thousands of music lovers the world over.

Then in 1982, Sony announced a product that made a profound and permanent impact on the high-fidelity industry—the first Compact Disc player. The CDP-101 Compact Disc player was acknowledged as an important breakthrough, opening the door to vastly improved sound quality and convenience in consumer audio.

Other Sony CD innovations soon followed. It was Sony that first produced portable and car CD players. Innovative concepts, such as the DiscMan® and DiscJockey® CD players, have put Sony at the leading edge of digital audio technology and have played major roles in making the CD format a marketing reality.

As the inventor of the CD format, Sony's experience in the design and construction of CD players is unsurpassed. From the 16-bit linear quantization system to the CD format's error correction methods... from extensive involvement in software production to the creation of the most highly regarded professional and consumer digital products... Sony is truly THE LEADER IN DIGITAL AUDIO.™

The ES Series—the quintessential expression of Sony's commitment to sonic accuracy.
Sony's remarkable digital audio technology has resulted in a new generation of music software and playback equipment that greatly increases the demands on associated hardware.

Connecting Sony's finest ES Series CD player to components of dated or less sophisticated design, for example, would result in a mismatch that could prevent you from realizing the full, dramatic capabilities of the CD format. To maximize your enjoyment of digital audio, you need the best possible components, designed specifically to elicit ultimate performance from the most demanding program source.

That's why Sony created the ES Series. Each ES Series component represents the state-of-the-art in its category. And collectively, they represent the highest achievement in Sony's continuing quest for perfection in audio reproduction.

ES Series components, moreover, are perfectly matched in engineering, quality, and styling. Nothing has been spared to make each component the perfect complement in a total system designed to deliver the utmost in listening satisfaction.

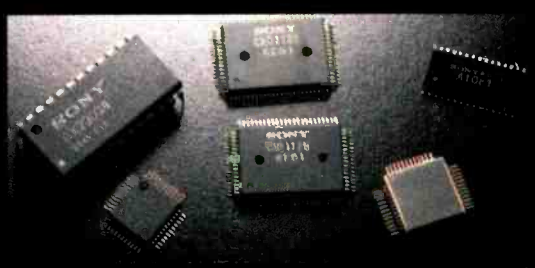
All CD players are not created equal.
Choosing a good CD player is of paramount importance if you wish to take full advantage of modern digital audio technology. But if you think that all CD players sound about the same because their specifications are similar, you're in for a surprise.

Sony's considerable research and experience in the design and manufacture of Compact Disc players has resulted in numerous engineering advances that make significant improvements in tracking and sonic performance.

Sony ES Series CD players incorporate a new generation of technologies that affect all critical areas of signal processing, including digital-to-analog conversion, filtering, and analog audio and power supply design. Further improvements in disc tracking and reliability have also been realized through the use of newly developed laser optic and mechanical assemblies.

New, exclusive Sony digital LSIs.
To implement many of these engineering refinements Sony had to develop its own large-scale integrated circuits (LSIs). The digital signal processing LSIs, for example, integrate up to 13 different digital functions into a single, miniature chip. The circuits employ C-MOS semiconductors for high thermal stability.

Separate Sony ICs handle other functions, such as optical system focusing, tracking, transport servo control, pulse width modulation, and digital-to-analog conversion.

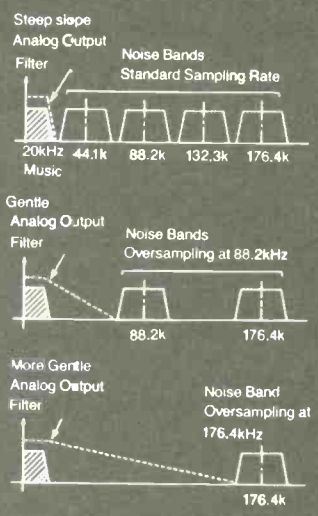


These proprietary chips greatly simplify the signal path, consume less power, and generate less heat... all of which results in improved reliability. And their advanced design is one of the primary reasons Sony ES Series CD players sound better and perform more dependably.

Compact Disc Players

UniLinear Converter™ with 4X Oversampling Digital Filter

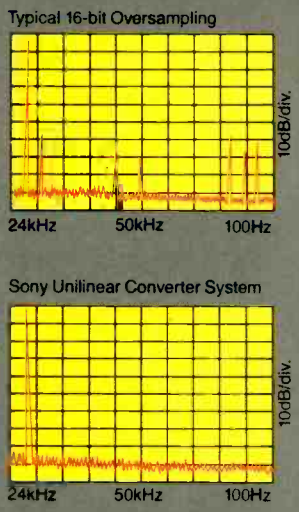
Sony ES Series CD players employ a sampling frequency that is 4 times higher than the standard 44.1 kHz rate for digital filtering. Decoding at this higher rate provides no additional music information, but it shifts the noise band to a much higher frequency so that a final stage filter with a gentle slope can be used. Compared to the steep "brick wall" analog filters used in conventional designs, this digital filtering technique results in vastly improved phase linearity and virtually no ripple (less than +/−0.001 dB) at the higher audio frequencies.



While digital filtering does solve the problems associated with steep analog filters, the interaction of multiple clock rates found in typical oversampling designs creates high-frequency spurious noise. ES Series CD players are free of such noise thanks to Sony's exclusive UniLinear Converter™, which utilizes a single "master clock" to synchronize all digital decoding functions.

It all adds up to smoother, cleaner, untiring sound reproduction from your favorite CDs.

Noise Spectrum Comparison



CDP-705ESD

A new reference standard for CD players.

A Compact Disc player incorporating Sony's most sophisticated digital audio technology and control features to let you fully appreciate the tremendous capabilities of the CD format.

- ☐ G-Chassis construction for total vibration absorption
- ☐ Optical Transfer System for superior analog/digital isolation
- ☐ 20-key Direct Access™ for instant track selection
- ☐ 20-selection Random Music Sensor (RMS), Automatic Music Sensor™ (AMS), High-Speed Manual Search, Index Search, and Shuffle Play provide extensive playback programming and track access capabilities
- ☐ 5 repeat modes (single, all, RMS, Shuffle, A-B) give you a variety of extended listening options
- ☐ Music Calendar & 6-mode Timekeeper for complete status display: track number, index number, track elapsed time, track remaining time, disc remaining time, and programmed remaining time
- ☐ Variable line output permits independent adjustment of volume level
- ☐ Full-function wireless RM-D502A Remote Commander® unit (supplied) provides total control of all operating and programming features, including line output level

Converter Deglitcher Circuit
Most CD players add a "sample-and-hold" circuit to eliminate occasional noise bursts, generated by even the best of D/A converters. Such circuits, however, tend to exhibit "memory" characteristics that preclude accurate response due to minute changes in signal level.

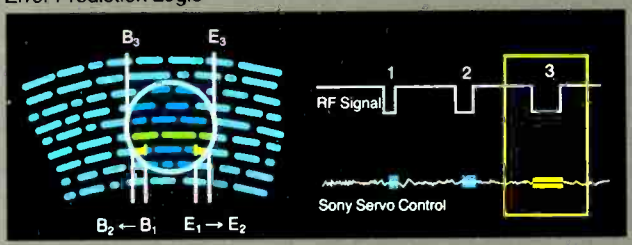
Sony's newly developed D/A converter, however, utilizes advanced current accumulation technology that corrects for "glitches" during the digital-to-analog process, thus eliminating the need for sample-and-hold circuitry. ES Series CD players, as a result, deliver dramatically improved sonic resolution at all listening levels.

Error Prediction Logic™
Conventional players rely only on a servo feedback circuit to correct for tracking errors caused by occasional disc defects. The amount of compensating current required varies in proportion to the size of the defect. The resulting fluctuations in servo current causes power supply instability and increased levels of magnetically induced noise.

Sony's Error Prediction Logic (EPL) system employs a microprocessor to determine the probable location to monitor the disc's rotation every 1/8000 second within the first three rotations after a defect is initially detected. The system then directs the servo circuit to respond with the precise amount of current required immediately prior to the predicted occurrence of the defect. The frequency and amount of servo compensation required to adjust for most errors is thus dramatically reduced.

EPL circuitry improves tracking response and servo stability in Sony ES Series CD players. And occasional disc defects won't cause excessive power supply fluctuations that can result in noise.

Error Prediction Logic™



1 Microcomputer compares error B_1 to B_2 and E_1 to E_2
2 Calculates where B_3 and E_3 will probably occur
3 Correct voltage supplied to servo before error (B_3 + E_3) is scanned

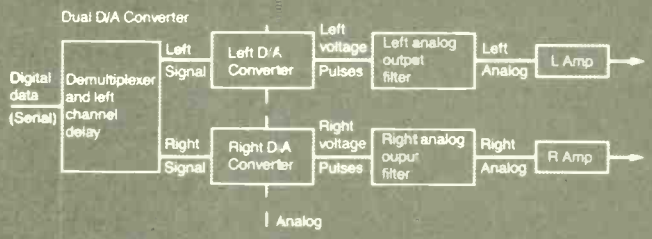
CDP-605ESD
A new level of Compact Disc performance.

Unprecedented playback versatility combined with awesome sonic capabilities. A CD player that truly represents the state of the digital audio art.

- ☐ Dual-Chassis construction for exceptional rigidity
- ☐ 20-key Direct Access™, for instant track selection
- ☐ 20-selection Random Music Sensor (RMS), Automatic Music Sensor™ (AMS), High-Speed Manual Search, Index Search, and Shuffle Play provide extensive playback programming and track access capabilities
- ☐ 5 repeat modes (single, all, RMS, Shuffle, A-B) give you a variety of extended listening options
- ☐ Music Calendar & 6-mode Timekeeper for complete status display: track number, index number, track elapsed time, track remaining time, disc remaining time, and programmed remaining time
- ☐ Full-function wireless RM-D550A Remote Commander® unit (supplied) provides total control of all operating and programming features

Compact Disc Players

Dual D/A Converters
Sony ES Series CD players feature full 16-bit dual D/A converter circuitry. Unlike typical players that must "time share" a single converter through data multiplexing, this design permits both channels to be decoded simultaneously. There is virtually no interchannel time delay. The lack of interchannel time delay ensures a more precise and stable stereo image. What's more, Sony uses two separate converters that are precisely matched for optimum linearity.



Linear Motor Tracking Mechanism
Conventional CD players utilize a DC motor to move the optical pickup through a complicated sytem of worm and reduction gears. Such systems suffer from mechanical "play," which makes smooth, precise motion difficult to achieve.

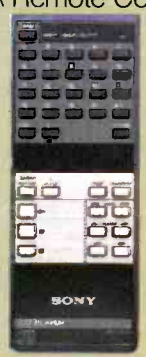
The advantage of Sony's Linear Motor Tracking Mechanism, featured on all Sony ES Series CD players lies in its simple construction—the linear motor's torque is applied directly to the pickup. The velocity sensor is also attached directly to the pickup, giving instant, accurate feedback to the servo system.

The low-mass laser pickup, linear motor, and velocity sensor are unitized to eliminate unwanted mechanical play and backlash. The entire compact assembly rides on oil-damped bearings to ensure durability. And, a low resonance Cerasin™ material is used to improve sound quality.

CDP-505ESD
An exceptional value among CD players.

The most affordable ES Series CD player with a degree of technical refinement and control flexibility uncommon at its price.

- ☐ Monocoque chassis construction for extra rigidity
- ☐ 20-key Direct Access™ for instant track selection
- ☐ 20-selection Random Music Sensor (RMS), Automatic Music Sensor™ (AMS), High-Speed Manual Search, Index Search, and Shuffle Play provide extensive playback programming and track access capabilities
- ☐ 5 repeat modes (single, all, RMS, Shuffle, A-B) give you a variety of extended listening options.
- ☐ Music Calendar & 6-mode Timekeeper for complete status display: track number, index number, track elapsed time, track remaining time, disc remaining time, and programmed remaining time
- ☐ Full-function wireless RM-D350A Remote Commander® unit (supplied) provides total control of all operating and programming features



Outboard Digital-to-Analog Converter

The Sony Linear Motor Tracking Mechanism ensures fast access speed, precise cueing, and smooth tracking. It produces far less mechanical noise than conventional gear-driven designs, and its simplicity results in unsurpassed reliability and long service life.

Multiple Power Supply Design

Sony has always recognized the need for highly stable, well-regulated power supplies in its CD players. Separate regulated power supplies for the digital and analog circuits provide the needed stability and help eliminate electrical interference and noise leakage between stages.

The CDP-605ESD and CDP-505ESD players have power supplies with separate windings on the power transformer for the digital and analog stages with dedicated regulation circuitry.

The CDP-705ESD delivers the ultimate in power supply stability with separate, large-capacity power transformers for the digital and analog sections, plus nine different power subregulators, in a completely independent, dual-monaural configuration.

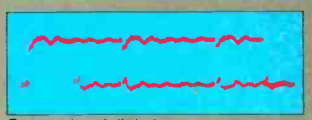
These steps ensure superior regulation and isolation of circuit stages for ultra-clean, noise-free audio performance.

Direct Digital Output

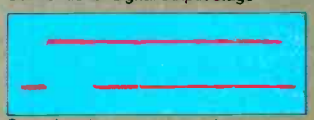
Sony pioneered the concept of transferring music information in digital form through standardized interface ports. All ES Series CD players now provide a direct digital output that fully conforms to industry format standards. This output makes Sony ES Series CD players ready for interface with future generations of digital audio components.

And with the Sony DAS-703ES outboard D/A converter, the future is now. The direct digital output of any ES Series CD player can be connected to the DAS-703ES to provide state-of-the-art digital decoding for the ultimate in Compact Disc playback.

The digital output stage in ES Series CD players is designed with special "latch" circuitry to correct for any time-based error caused by jitter. Furthermore, when the digital port is used, the player's analog stage is completely bypassed to eliminate any internal interference with the digital data stream.



Conventional digital output stage



Sony time-base corrected digital output stage

DAS-703ES
A step into the future of digital audio.

An outboard digital-to-analog (D/A) converter featuring automatic selection of four different sampling rates. Designed to decode digital audio signals with uncompromising accuracy for reproduction of stunning clarity and definition.

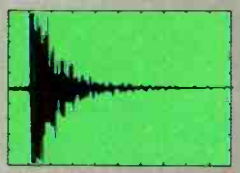
- ☐ Optical Transfer System for superior analog/digital isolation
- ☐ Dual D/A Converters eliminate interchannel time delay
- ☐ Separate large-capacity power transformers for digital and analog circuitry increase power supply stability and reduce interference and noise
- ☐ Double PLL Clock System for improved decoding accuracy
- ☐ Left/Right Dual Monaural construction for reduced interchannel interference
- ☐ Recommended for use with Sony ES Series CD players featuring direct digital output
- ☐ Capable of decoding 4 sampling rates—32 kHz, 44.056 kHz, 44.1 kHz, and 48 kHz; compatible with most digital audio sources, such as PCM processors and future PCM broadcasts and digital audio tape recorders (DAT)
- ☐ Digital Monitor Switch for future applications
- ☐ Ultra-high-grade, selected circuit components
- ☐ LC-OFC (Linear Crystal, Oxygen-Free Copper) wiring used for all analog signal paths

Amplifiers

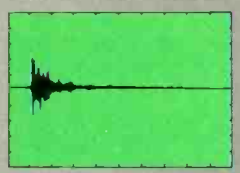
Superior amplifiers for superior program sources
Sony ES Series integrated amplifiers are the result of extensive research into ALL of the factors that affect sonic performance, including a few not previously recognized. Like other ES Series components, these amplifiers reflect no-compromise engineering. They incorporate technological advances that result in audibly superior reproduction with virtually any high-quality program source, especially a well-engineered, properly decoded Compact Disc.

G-Chassis (Gibraltar Chassis) Construction
Power transformers, power transistors, and other amplifier parts generate vibration during normal operation. There are also external sources of vibration, such as sound waves transmitted through the air and floor from the speakers. The transistors and capacitors that handle low-level signals in an amplifier can convert these vibrations into electrical signals that can modulate the audio signal and rob an amplifier of sonic purity.

The G-Chassis employed in Sony's ES Series amplifiers is made of a unique calcium carbonate polyester resin reinforced with glass fibers, similar in composition to natural marble. It is molded at high termperature into a single piece, onto which the power transformer, heat sink and PC board assemblies are mounted. The structure is approximately 3,000 times more rigid than a conventional steel chassis.



Standard chassis vibration



G-Chassis vibration suppression

Sony's G-Chassis is not only exceptionally immune to vibration, but also totally non-magnetic. Distortions and colorations caused by vibrational energies and magnetic fields are virtually eliminated. Sony ES Series amplifiers thus achieve a purity in sound that cannot be matched by amplifiers of conventional chassis design.

Spontaneous Twin-Drive Power Supply
Sony ES Series amplifiers incorporate a novel Spontaneous Twin Drive design, which utilizes separate power supplies for the voltage amplification and power output stages. Each power supply is independently rectified and filtered with large capacitors. This eliminates power supply fluctuations for the earlier volt-

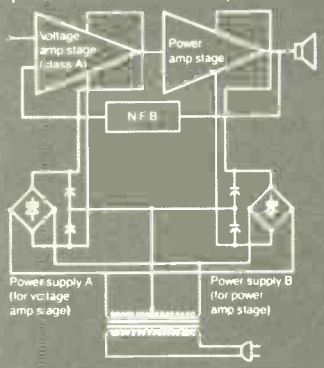
TA-F700ES
An amplifier of unparalleled sonic purity.

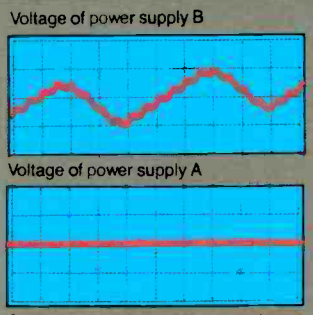
Capable of delivering astonishingly clean, solid power. Reproduces the fine detail and tremendous dynamics of digital audio with consummate transparency and ease.

- ☐ 140 Watts per channel continuous output at 4 ohms, 20 Hz-20 kHz, 0.008% THD
- ☐ 105 Watts per channel continuous output at 8 ohms, 20 Hz-20 kHz, 0.004% THD
- ☐ Spontaneous Twin-Drive assures consistent amplifier performance under a wide variety of signal loads for accurate reproduction of musical dynamics
- ☐ Phono input fully compatible with moving-magnet and moving-coil cartridges
- ☐ Passive tone control circuitry (with switch-selectable bass and treble turnover frequencies) maintains high signal integrity
- ☐ Independent record output selector lets you tape one signal source while listening to another
- ☐ Defeatable subsonic filter removes undesirable and potentially harmful ultra-low-frequency signals, such as those caused by turntable rumble or record warps
- ☐ Connections for 3 tape decks with dubbing capability
- ☐ Connections for 2 speaker pairs with A/B/A+B switching

age amplification circuitry even when the power output stage is drawing heavy current.

Spontaneous Twin Drive results in consistent amplifier performance under a wide variety of signal loads. The sound quality is always clear with accurate reproduction of musical dynamics.

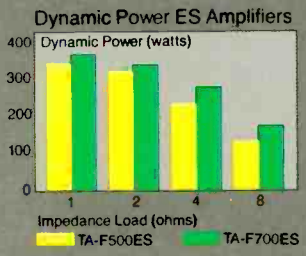




Oscilloscope photos shows stability of power supply A while power supply B draws heavy current.

Low-Impedance/High-Current Drive

Amplifier current requirement increases as a speaker's impedance decreases. And an amplifier must be able to stably deliver this current regardless of the fact that no speaker behaves like a purely resistive load. Sony ES Series amplifiers are capable of delivering high current with stable consistency to virtually any load, even at 1-ohm. Large amounts of clean, undistorted power are always available, even for speakers of low and/or complex impedances.



Source Direct Capability

Sony ES Series amplifiers include Source Direct capability. A touch of a button routes the input signal directly to the amplifier's volume attenuator, completely bypassing the filter, tone control, and balance circuitry.

Passive Tone Control Circuitry

Sony ES Series amplifiers employ sophisticated passive tone control circuitry consisting only of capacitive and resistive components. Tone control action is designed to be dependent on volume attenuator setting to provide a refined loudness compensation system.

The passive tone control circuitry in Sony ES Series amplifiers provides highly useful tonal adjustment capability without the signal degradation associated with conventional active-type controls.

TA-F500ES
An audibly superior integrated amplifier.

Generous power reserves and innovative Sony amplifier technology for performance that does justice to the finest digital and analog sources. Truly an amplifier for the audio purist.

- ☐ 100 Watts per channel continuous output at 4 ohms, 20 Hz-20 kHz, 0.01% THD
- ☐ 80 Watts per channel continuous output at 8 ohms, 20 Hz-20 kHz, 0.006% THD
- ☐ Spontaneous Twin-Drive assures consistent amplifier performance under a wide variety of signal loads for accurate reproduction of musical dynamics
- ☐ Phono input fully compatible with moving-magnet and moving-coil cartridges
- ☐ Passive tone control circuitry maintains high signal integrity
- ☐ Independent record output selector lets you tape one signal source while listening to another
- ☐ Defeatable subsonic filter removes undesirable and potentially harmful ultra-low-frequency signals, such as those caused by turntable rumble or record warps
- ☐ Connections for 2 speaker pairs with A/B/A + B switching

Tuners

New Tuner technology for improved FM reception
Many FM stations have invested in new equipment, including Compact Disc players and state-of-the-art transmitting systems, to take advantage of the inherently high quality of digital audio sources.

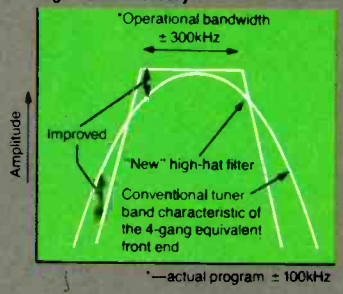
RF interference from strong adjacent stations, however, often prevents the listener from enjoying the fine signal quality of a more distant or weaker station.

To combat this problem, Sony has developed an impressive series of FM tuner circuits. These Wave Optimizer technologies have been incorporated for the first time in the ES Series tuners.

Super Sound Tracking Circuitry
To increase rejection of unwanted signals, a steeper, narrower front end filter must be used. But if a filter is made too narrow, phase and amplitude distortions will degrade signal quality. And with large signal modulations, the "shoulders" of a narrow filter can actually clip off components of the desired signal.

The Sony ST-S700ES tuner employs a unique Super Sound Tracking (SST) front end that continuously shifts the center of the bandpass filter in response to the frequency modulations. This effectively results in ideal "high-hat" filter characteristics, which provides the excellent selectivity of a narrow filter without the normally associated phase and amplitude distortions.

High-hat filter theory



The SST circuitry also solves the problem of front end tracking error, which occurs when the center of the bandpass filter is not at the exact frequency of the broadcast signal. SST eliminates such error by using separate control voltages for the front end and RF tuning sections with varying degrees of compensation across the FM reception band.

Sony's SST front end design assures high rejection of unwanted signals while maintaining low distortion. It enables the ST-S700ES tuner to provide superior signal clarity even in "crowded" reception areas.

Wave Optimized IF System
The Wave Optimized IF System (WOIS) used in the ST-S700ES tuner automatically selects optimum filter characteristics based on signal condition. Whether the signal is monaural or stereo, whether there are strong adjacent stations or not, WOIS will

ST-S700ES
Incomparable FM reception quality.

A tuner that ensures the best possible reception for full enjoyment of today's finest-quality FM broadcasts. Features the full complement of Sony's unique Wave Optimizer technologies for superb performance even in difficult reception areas.

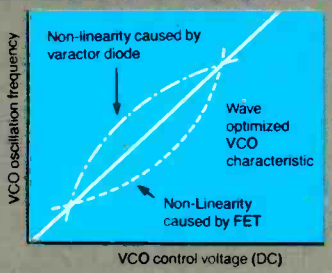
- ☐ Super Sound Tracking front end design
- ☐ Wave Optimized IF System
- ☐ Wave Optimized Direct Detector
- ☐ Wave Optimized Digital Stereo Decoder
- ☐ Exclusive Direct Comparator circuitry for the accuracy of quartz frequency-synthesis tuning without the commonly associated noise
- ☐ Timer program capability permits pre-selection of up to 4 stations for sequential unattended recording
- ☐ 10 station memory presets for instant, one-button recall of favorite stations
- ☐ Multi-process memory "remembers" various tuner settings for each preset station
- ☐ Memory Scan gives you a 4-second sample of each preset station
- ☐ Calibration tone facilitates presetting of record levels when taping off the air

always select the appropriate set of IF filter characteristics to give you the lowest possible distortion without interference.

Wave Optimized Direct Detector

Conventional PLL designs suffer from excessive distortion because varying the control voltage applied to the varactor diode cannot linearly change the VCO (voltage-controlled oscillator) frequency.

Sony has solved this problem in the ES Series tuners with the Wave Optimized Direct Detector (WODD). This circuit uses a special FET circuit to produce an intentionally non-linear characteristic that precisely compensates for the non-linearity of the VCO.



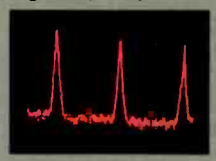
The result in Sony's ST-S700ES tuner is PLL detector that exhibits extremely low distortion and noise.

Wave Optimized Digital Stereo Decoder

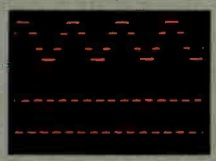
Sony ES Series tuners feature a Wave Optimized Digital Stereo Decoder (WODSD). It takes the composite signal from the IF stage and switches it at a rate of 38kHz. This switched signal is blended with another special waveform which is produced through balanced multiplication of 38kHz and 114kHz signals. The resulting audio frequency signal does not contain any harmonics of the switching signal. Thus any high-frequency interference components that may have been present in the original composite signal are not demodulated into the audible frequency range.

WODSD eliminates the need for the conventional beat-cut filters. It effectively suppresses high-frequency interference without introducing phase and amplitude distortions. Sony ES Series tuners are thus able to provide stereo FM reception of exceptional fidelity.

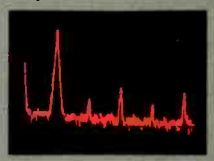
Oscilloscope photos show that WODSD effectively suppresses high-frequency interference for exceptional FM fidelity



Wave input spectrum analysis



WODSD signal switching



Wave output spectrum analysis

ST-S500ES
Advanced technology for improved FM performance.

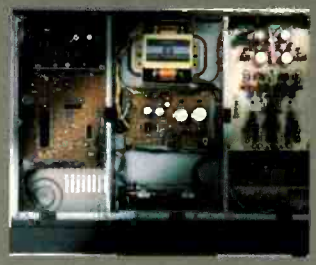
Superior FM reception under a wide variety of signal conditions. Features many of Sony's most advanced tuner technologies to ensure exceptional sonic quality with today's improving FM broadcasts.

- ☐ Wave Optimized Digital Stereo Decoder
- ☐ Exclusive Direct Comparator circuitry for the accuracy of quartz frequency-synthesis tuning without the commonly associated noise
- ☐ 10 station memory presets for instant, one-button recall of favorite stations
- ☐ Multi-process memory "remembers" various tuner settings for each preset station
- ☐ Calibration tone facilitates presetting of record levels when taping off the air

Cassette Deck

Cassette performance that meets the digital challenge
The Sony ES Series cassette deck is the result of an intensive effort to produce a recording instrument that would be capable of faithful reproduction with today's most demanding program sources.

Mid-ship Drive System
A lavishly constructed chassis separates the system control circuitry, in the left third of chass s, from the audio circuits, which occupy the right third. The cer-ter "mid-ship" portion of the unit houses the tape transport mechanism and power supply components in a separate inner chassis.



The physical separation of the system control section from the audio circuits eliminates electrical interference. It also eliminates excessive internal wiring and simplifies the signal path. The results are exceptionally low-noise audio performance.

The inner mid-ship chassis adds structural rigidity, which helps control vibrations and resonances that can adversely affect tape transport and audio circuitry performance.

Twin Monaural DC Amplifier Design
Entirely separate PC boards are used for the record and playback amplifiers, which are of an advanced DC design that reduces dependence on distortion-causing coupling capacitors.

Each PC board is, in addition, designed with physically separate sections for the left and right channels. This symmetrical twin monaural design significantly reduces interstage and interchannel interferences for unparalleled reproduction clarity and improved stereo separation.

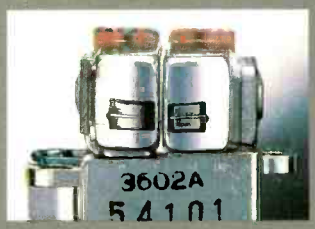
LC-OFC LaserAmorphous 3-head Design with Independent Suspension
Sony's extraordinary Laser-Amorphous head features laser-welded laminations made from an amorphous (non-crystalline) material that possesses nearly ideal magnetic characteristics. Coils are wound using linear-crystal, oxygen-free copper (LC-OFC) wire, known for its superb conductive characteristics.

TC-K700ES
For those who seriously record.

Features highly sophisticated design and construction, unsurpassed magnetic head technology, state-of-the-art tape transport, superb electronics, and advanced performance capabilities. Capable of accurately capturing the detail and dynamics of digital audio sources.

- ☐ Dolby® B/C noise reduction system uses Dual Symmetry IC for simplified, efficient circuitry
- ☐ Linear Counter for "real time" indication of tape position
- ☐ Memory stop/play halts the transport or begins playback when the counter reaches "0.00" during rewind
- ☐ Subtract function on counter for remaining time indication
- ☐ Automatic tape type selection makes it impossible to accidentally record or play with the wrong bias/equalization
- ☐ MPX filter swtich lets you remove the 19 kHz carrier signal that can cause errors in Dolby system tracking when taping FM stereo broadcasts
- ☐ Auto Play automatically puts transport into play mode after rewind
- ☐ AutoSpace Record Mute facilitates consistent spacing between recorded selections
- ☐ Timer Record/Play permits unattended record or playback—puts the deck in record or play when power is turned on, e.g., via an external program timer
- ☐ Headphone output with volume control

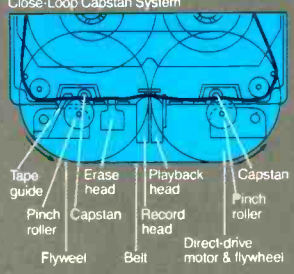
The LaserAmorphous head exhibits far superior linearity and lower noise when compared to conventional heads. It ensures wider dynamic range and extended frequency response. And its physical hardness makes it one of the longest-lasting heads available.



With typical "combination" heads, slight azimuth misalignment between the heads is virtually unavoidable and permanent. The sophisticated independent suspension system on the ES Series cassette deck, however, permits the erase and separate LaserAmorphous record and playback heads to be independently aligned at the factory. It assures perfect head alignment and, thus, the best possible high-frequency performance and signal-to-noise ratio.

Closed-Loop Dual Capstan Transport with Quartz-Lock Direct-Drive
Sony's advanced closed-loop dual capstan transport ensures perfect tape tension and optimal tape-to-head contact regardless of the vagaries of the plastic cassette housing.

Close-Loop Capstan System



The capstan and flywheel on the take-up side, furthermore, are integral parts of a sophisticated Sony 3-phase linear-torque BSL (brushless/slotless) direct-drive motor with quartz-lock digital servo. In the closed-loop dual capstan configuration, it delivers precise, steady tape travel with remarkably low wow-and-flutter: less than 0.025% (WRMS).

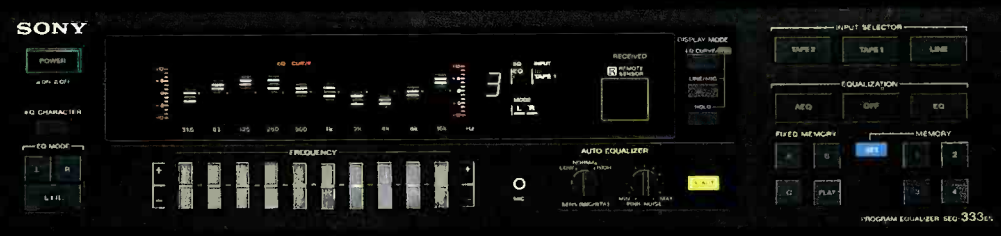
Record Level and Bias Calibration
Even the best of tape formulations can slightly vary in characteristics from batch to batch. That's why the Sony ES Series cassette deck includes a front-panel calibration system with built-in test tones that permits you to adjust record level and bias for the best possible performance with virtually any high-quality tape formulation.

Sound Processors

SEQ-333ES
The perfect equalizer for less-than-perfect listening environments.

An "intellligent", remote control equalizer that automatically adjusts for room acoustics. Features 10 bands of equalization with real-time spectrum analysis. A sophisticated component that greatly enhances your listening pleasure.

- ☐ Precision test microphone included for room acoustic equalization
- ☐ 3 inputs and outputs
- ☐ 8 acoustic memories with 4 pre-programmed curves for the most popular listening conditions
- ☐ Choice of automatic or manual equalization provides maximum versatility
- ☐ Battery backup holds programmed settings



SDP-505ES
The most convincing sonic illusions yet.

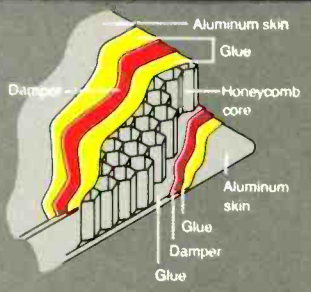
A digital surround processor featuring five different delay modes. Reproduces surround sound and ambience effects with the wide dynamic range, low distortion, and low noise demanded by digital audio.

- ☐ Includes Dolby® Surround Sound decoding
- ☐ Utilizes a 44.1kHz sampling rate and full 16-bit quantization (the same as the CD format)
- ☐ Independent left/right channel delay adjustment
- ☐ Built-in pink noise calibration generator
- ☐ 3 delay memory presets
- ☐ Built-in 14 watt per channel stereo amplifier

Speakers

Speakers ideally suited to digital audio reproduction
During Sony's developmental work on digital audio and the Compact Disc, it became increasingly clear that conventional speaker technology was simply inadequate for the reproduction of digital audio. Sony, therefore, took a radically different engineering approach. The result is the ES Series speakers, incorporating Sony's exclusive APM (Accurate Pistonic Motion) driver technology.

Light, Rigid, Flat Diaphragm Design
Sony's APM driver is constructed of an extremely light and rigid aluminum honeycomb material. It is nearly 1,000 times

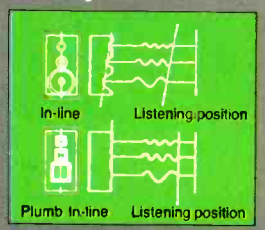


stiffer than ordinary diaphragms. This high rigidity makes it possible to design a flat driver that is free of "cavity effect." The APM driver diaphragm is also well damped and exhibits virtually no internal resonances that can alter reproduction accuracy.

The APM tweeter in the APM-66ES speaker features a proprietary Sony technology in which a thin layer of amorphous diamond is deposited onto the flat aluminum honeycomb diaphragm. This results in not only great stiffness, but also extremely high sound propagation speed. Phase cancellations are largely eliminated, enabling the APM tweeter to reproduce frequencies ranging to 40,000Hz and above with exceptionally uniform dispersion.

Multi-Point Direct Dual-Surface Drive
APM driver diaphragms are square-shaped and driven at multiple points to avoid the problem of sectional vibrations, one of the major causes of speaker distortion. The woofer in the APM-66ES speaker, for example, is driven at no less than 8 points. This ensures more efficient energy transfer and greatly reduces harmonic distortion for a cleaner, more transparent sound.

Plumb In-Line Configuration
The flat APM speakers' plumb in-line configuration assures that the sound arrives at the listener without frequency-dependent time delays. This results in more precise stereo imaging and the accurate reproduction of spatial relationships among the individual sound sources in a recording.



APM-66ES/APM-22ES
Digital audio the way it was meant to be heard.

Reference quality speakers with Sony's unique APM flat driver technology for sonic performance that fully meets the demands of digital audio.

- ☐ Extremely uniform, extended frequency response for superb tonal accuracy and smooth, untiring sound
- ☐ Exceptional power handling capability
- ☐ Low distortion and coloration not possible with conventional cone drivers
- ☐ Near-perfect linearity over a wide dynamic range
- ☐ Advanced crossover design for smooth response and stable stereo imaging over entire frequency range
- ☐ Built-in circuit breaker for tweeter protection
- ☐ Heavy-duty cabinet construction with rounded edges for reduced diffraction effects
- ☐ Optional speaker stands available

Specifications

CD Model:	CDP-505ESD	CDP-605ESD	CDP-705ESD
Frequency Response:	2-20K ± 0.3	2-20K ± 0.3	2-20K ± 0.3
Signal to Noise Ratio:	102 dB	106 dB	106 dB
Dynamic Range:	95dB	97dB	97dB
Harmonic Distortion:	0.003%	0.0025%	0.0025%
Stereo Separation:	98 dB	100 dB	100 dB
Wow & Flutter (below measurable limit):	Yes	Yes	Yes
Line Output/ Load Impedance:	2 V/10K ohm	2 V/10K ohm	2 V/10K ohm (Fixed) 2 V/50K ohm (Variable)
Headphone Output:	28 mW/32 ohm	28 mW/32 ohm	28 mW/32 ohm
Power Requirement:	120 V 60 Hz	120 V 60 Hz	120 V 60 Hz
Power Consumption:	13 W	18 W	19 W
Dimensions (WHD):	17 x 4 x 13¼ in. (430 x 100 x 335mm)	17 x 4⅜ x 13½ in. (430 x 110 x 335mm)	17 x 15 x 15⅝ in. (430 x 125 x 395mm)
Weight:	11 lbs. 4 oz. (5.1 kg)	18 lbs. 2 oz. (8.2 kg)	28 lbs. 4 oz. (12.8 kg)
Supplied Accessories:	RM-D350A Connecting Cable	RM-D550A Connecting Cable	RM-D502A Connecting Cable

Digital Converter Model:	DAS-703ES
System:	Digital-to-Analog (D/A) Converter
Format:	Sampling Rates: 32 kHz, 44.056 kHz, 44.1 kHz, 48 kHz
Channels:	Two Channels
Demodulation:	16 Bit Linear
Frequency Response:	5-20 kHz, ±0.5 dB (44.1 kHz sampling rate)
Harmonic Distortion:	Less than 0.004% (1 kHz; 44.1 kHz sampling rate)
Dynamic Range:	More than 95 dB (44.1 kHz sampling rate)
Stereo Separation:	More than 90 dB (1 kHz)
Line Output:	Fixed 2.5v/10k ohm Variable 0-2.5v/10k ohm
Headphone Output:	0-14 mW at 32 ohms
Digital Input:	0.5 V p-p, ±20% impedance 75 ohms
Digital Output:	0.5 V p-p, ±20% impedance 75 ohms
Power Requirements:	120 V, 60 Hz
Power Consumption:	25 W
Dimensions (WHD):	17 × 4⅛ × 16⅛ in. (430 × 110 × 435mm)
Weight:	33 lbs. (15 kg.)
Supplied Accesories:	Audio connecting cables (2) Digital connectlng cable (1)

Sound Processor Model:	SDP-505ES
System:	Digital Surround Processor
Sampling Frequency:	44.1 kHz
Format:	16 bit linear quantization (EIAJ)
Surround Mode:	Dolby Surround/Presence Delay/Matrix/Hall/Simulated
Memory Presets:	3
Delay Time:	0-90m/sec. (0.1m/sec steps, L/R channels independent)
Frequency Response:	Surround Out 20 Hz-20 kHz, ±0.3 dB, Center Out 10 Hz-100 kHz, +0-3 dB
Dynamic Range:	More than 90 dB (A network)
Harmonic Distortion:	Less than 0.008% (1 kHz, 3V, presence delay mode)
Power Output:	14 watts per channel, both channel driven continuously into 8 ohm from 40 Hz-20 kHz at no more than 0.2% total harmonic distortion
Input Level:	250 mV (Line In)
Input Impedance:	50 k ohms (Line In)
Output Level:	Front Out 250 mV Surround Out 250 mV Center Out 250 mV (Low) 1.7 V (High)
Power Requirement:	120 V 60 Hz
Power Consumption:	100 watts
Dimensions (WHD):	17 x 3⅜ x 13⅞ in. (430 x 86 x 350mm)
Weight:	17 lbs. (7.7 kg)

Graphic Equalizer Model:	SEQ-333ES
Frequency Response Line:	10 Hz-100 kHz +0 −1 dB
Total Harmonic Distortion Line:	Less than 0.0015% (1 V output, 1 kHz, flat)
Signal-to-Noise Ratio Line:	More than 116 dB (A network, 2 V output, flat)
Center Frequencies:	31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, 8 kHz, 16 kHz.
Adjustable Range:	L, R or L + R ±12 dB (2 dB step)
Gain:	0 dB
Automatic Acoustic Equalizer:	Yes
Measuring Level:	About 74 dB ± 10 dB SPL (at microphone position) (at ±10dB by SENSE control)
Measuring Time:	About 2 seconds for each channel after level reaches the measurable level.
Number of measurements:	Max 8 times (averaged)
Fixed memories:	A for rhythm music B for female vocal C Loudness D Flat
Inputs (0 dBs = 0.775 V):	
Reference input level:	Line in: − 10 dBs (245 mV) Tape 1, 2: − 10 dBs (245 mV)
Input Impedance:	MIC: Low Impedance Line in: 50 k ohms Tape 1, 2: 50 k ohms
Connector:	MIC: Mini jack
Line Out Rec Out 1, 2:	
Reference out level:	− 10 dBs (245 mV)
Max. output level:	+ 20 dBs (7.75V)
Output Impedance:	1 k ohm
General Power Requirements:	120 V 60 Hz
Power Consumption:	14 Watts
AC Outlet:	1 unswitched, 600 watts max.
Dimensions (WHD):	17 x 4¼ x 10⅞ in. (430 x 105 x 275mm)
Weight:	10 lb. 13 oz. (4.9 kg)

Cassette Deck Model:	TC-K700ES
Frequency Response:	
Dolby NR Off, Type 4 (Sony Metal ES)	20 Hz-20 kHz ±3 dB
Wow & Flutter:	0.025% (W RMS) ±0.04% (W. Peak)
S/N Ratio:	
Dolby NR Off Type 4 (Sony Metal ES)	60 dB
Dolby C NR On Type 4 (Sony Metal ES)	73 dB
Input Sensitivity:	77.5 mV (−20dB)
Input Impedance:	50 K ohm
Power Requirement:	120 V 60 Hz
Power Consumption:	30 W
Dimensions (WHD):	17 x 5 x 13¾ in. (430 x 125 x 350mm)
Weight:	18 lbs. 9 oz. (8.4 kg)

Amplifier Model:	TA-F500ES	TA-F700ES
Continuous RMS Power Output:		
(both channels driven simultaneously)	100 W + 100 W 4 ohm 20 Hz-20 kHz 0.01% THD	140 W + 140 W 4 ohm 20 Hz-20 kHz 0.008% THD
	90 W + 90 W 6 ohm 20 Hz-20 kHz 0.008% THD	120 W + 120 W 6 ohm 20 Hz-20 kHz 0.006% THD
	80 W + 80 W 8 ohm 20 Hz-20 kHz 0.006% THD	105 W + 105 W 8 ohm 20 Hz-20 kHz 0.004% THD
Power Band Width (IHF):	10 Hz-100 kHz (0.02% 4/8 ohm)	10 Hz-100 kHz (0.02% 4/8 ohm)
Dynamic Headroom:	2 dB 4 ohm 1.2 dB 8 ohm	3 dB 4 ohm 2 dB 8 ohm
Slew Rate:		
(inside)	250 V/u sec	250 V/u sec
(total)	125 V/u sec	125 V/u sec
Damping Factor:	50	100
Frequency Response:		
Phono MM	RIAA ± 0.2 dB	RIAA ± 0.2 dB
Tuner, CD Tape	2 H-200 kHz +0, −3	2 H-200 kHz +0, −3
Input Sensitivity:		
Phono MC	0.17 mV 1 K ohm	0.17 mV 100 ohm, 1 K ohm
MM	2.5 mV 50 K ohm	2.5 mV 50 K ohm
Tuner, CD Tape	150 mV 50 K ohm	150 mV 50 K ohm
S/N Ratio:		
Phono MC	76 dB ('78 IHF) 68 db (A Network)	76 dB ('78 IHF) 68 db (A Network)
Phono MM	80 dB ('78 IHF) 86 dB (A Network)	80 dB ('78 IHF) 87 dB (A Network)
Tuner, CD, Tape	84 dB ('78 IHF) 105 dB (A Network)	84 dB ('78 IHF) 105 dB (A Network)
Tone Control:	Turnover Frequency	Turnover Frequency
Bass at 100 Hz	±6 dB 400 Hz	+6, −5 dB 400 Hz +4, −3.5 dB 200 Hz
Treble at 10 kHz	±6 dB 3 kHz	+7, −8 dB 3 kHz +4, −5 dB 5 kHz
Subsonic Filter:	6 dB/oct below 15 Hz	6 dB/oct below 15 Hz
Power Requirement:	120 V 60 Hz	120 V 60 Hz
Power Consumption:	210 W	330 W
Dimensions (WHD):	17 x 5¾ x 14¾ in. (430 x 148 x 373mm)	17 x 6⅜ x 17¼ in. (430 x 160 x 436mm)
Weight:	29 lbs. 1 oz. (13.2 kg)	40 lbs. 6 oz. (18.3 kg)

Tuner Model:	ST-S500ES	ST-S700ES
Sensitivity (75 ohm):		
IHF	10.3 dBf/0.9 uV	10.3 dBf/0.9 uV
S/N 50 dB Mono	16.8 dBf/1.8 uV	16.8 dBf/1.8 uV
S/N 50 dB Stereo	37.9 dBf/22.5 uV	37.9 dBf/22.5 uV
Total Harmonic Distortion:		
Mono (1 kHz wide)	0.06%	0.005%
Stereo (1 kHz wide)	0.08%	0.0095%
S/N Ratio:		
Mono	88 dB	96 dB
Stereo	84 dB	91 dB
Frequency Response:	15 Hz-15 kHz +0.2 − 0.5 dB	15 Hz-15 kHz +0.2 − 0.5 dB
Stereo Separation (1 kHz Wide):	60 dB	65 dB
Selectivity:		
300 kHz:	55 dB	65 dB (Narrow)
400 kHz	90 dB	65 db (Wide)
Power Requirement:	120 V 60 Hz	120 V 60 Hz
Power Consumption:	12 W	17 W
Dimensions (WHD):	17 x 3⅜ x 13⅝ in. (430 x 85 x 345mm)	17 x 3⅜ x 13⅝ in. (430 x 85 x 345mm)
Weight:	9 lbs. 5 oz. (4.3 kg)	9 lbs. 15 oz. (4.5 kg)

Speakers Model:	APM-22ES	APM-66ES
Drivers:		
Woofer:	45 square in APM	66 square in APM
Mid-Range:	—	7.4 square in APM
Tweeter:	1.4 square in APM	1.4 square in APM
Crossover Frequency:	2.0 kHz	600 Hz, 4.5 kHz
Enclosure Type:	Bass Reflex	Bass Reflex
Frequency Response:	40 Hz-20 kHz	30 Hz-30 kHz
Sensitivity:	88 dB SPL, 1 Watt, at 1 meter	89 dB SPL, 1 watt at 1 meter
Power Handling Capacity:	80 watts nominal, 160 watts maximum	100 watts nominal, 200 watts maximum
Nominal Impedance:	6 ohms	6 ohms
Dimensions (WHD):	11½ × 20⅜ × 12⅝ in. (290 × 515 × 320mm)	15 x 26 x 14⅜ in. (380 x 660 x 365mm)
Weight:	30 lbs., 15 oz.; (14 kg)	57 lbs., 6 oz.; (26 kg)
Supplied Accessories:	2.5M speaker cord	2.5M speaker cord
Optional Accessories:	WS-220 speaker stand	WS-660 speaker stand

Features and specifications subject to change without notice.
Non-metric weights and measurements are approximate.

For a free detailed "White Paper" on Sony ES Compact Disc Players, write to the Sony Consumer Audio Division at the address below.

SONY.

THE LEADER IN DIGITAL AUDIO.

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

Removing Transient Clicks

You occasionally write about the causes of transient clicks in audio equipment. I'd like to relate my own experience with the problem.

I lived with annoying clicks for several months after purchasing new equipment. Every time the refrigerator cycled or a light switch was thrown, a loud click was heard in my loudspeakers. Elaborate grounding schemes and even the use of an expensive a.c. line-interference filter were to no avail.

Finally I borrowed an oscilloscope and examined various points in the signal path. A very large high-frequency signal corresponding to the clicks was apparent at the outputs of the preamplifier. Further investigation revealed that the preamplifier had nearly a 1-MHz bandwidth! Installation of capacitors across the circuit's feedback resistors to reduce the bandwidth to a more reasonable 40 kHz completely eliminated the clicks.—G. Ramian, Santa Barbara, Cal.

Weak FM Reception

Q. I live between New York and Philadelphia. Though I have a rooftop FM antenna on a 12-foot mast, my FM reception is poor. Yet my TV antenna, on a shorter mast, brings in excellent video and stereo sound, with virtually no noise!

Is the distance between my home and the desired stations too great for my antenna and tuner? Could my poor FM reception be the result of using 300-ohm lead-in instead of the 75-ohm coaxial cable used with my TV's antenna? The antenna installer elected to use 300-ohm twin-lead ribbon for the FM, explaining that less signal loss would occur because there would be no need for the usual transformers.

Can anything be done to improve my reception?—Joseph W. McGuire, address withheld

A. As an experiment, connect your TV antenna to your FM tuner (using a matching transformer if the tuner has no provisions for coaxial cable). If your FM antenna system is working properly, there should be little change in reception; if there's a noticeable improvement, your FM system needs attention.

First, make sure the FM antenna's leads are connected to the proper antenna terminals and that there are no strands of wire bridging the terminals together. If you have an ohmmeter, disconnect the leads from the tuner and measure the resistance across them. A low resistance reading or a dead short indication are usually okay, an infinite resistance probably signifies a break in the lead-in, and a high resistance probably indicates a poor connection somewhere.

Next, inspect the FM antenna installation. Check that there are no shorts caused by strands of wire bridging the antenna terminals or by improper antenna assembly. Check all connections for corrosion too.

Examine the twin-lead to be sure it does not run along ducts, gutters, or other metal structures. Remove any staples holding the twin-lead in place, and use the appropriate stand-offs and tacks. Staples can short the conductors together, either by direct contact or capacitively.

If the FM antenna system checks out, and the TV antenna gives no significant improvement, try another tuner. If the second tuner performs properly with your FM antenna, you will know that something is wrong with your present tuner.

The main advantage of 75-ohm over 300-ohm systems is greater immunity to noise pickup from local sources, largely because the 75-ohm cable's coaxial construction shields the center conductor.

Stereo Imaging

Q. What is "imaging"?—Jerome Swabb, Erie, Pa.

A. Imaging refers to the ability of a stereo sound system (especially its loudspeakers) to convey the sense that music is being performed in a perceptible space (the "sound stage"), and to accurately convey the locations of instruments and other sound sources within that space.

Excess Sibilance

Q. My problem is that of vocal sibilance, sometimes appearing on an entire record and sometimes in just one or two cuts. I checked my tonearm balance and stylus pressure, made sure that the anti-skating force was set correctly, and finally brought the turntable to my dealer to have all of this re-examined. After checking the turntable's performance with a test record, he increased the stylus tracking force from 1 to 1.2 grams and said that all was well. He also told me that the vocals on most discs are typically recorded "hot" to compensate for the inadequacies of less elaborate playback systems. Therefore, the sibilance I am hearing is the result of this recording procedure. My dealer also said that sibilance can result from a bad record pressing. Admittedly, sibilance is not present on every record that I buy, but when it is, this knowledge doesn't make listening a pleasure.—James O'Malley, Gillette, N.J.

A. I have been in the sound-recording field for many years. In a few instances I have noticed sibilance as a result of electroplating difficulties, but I believe this is rare.

I do agree that many LPs are recorded with either too much treble or too much signal level, or both. Therefore, the stylus has difficulty tracing the fine undulations of the grooves. This leads to the distortion heard on "s" sounds, usually referred to as sibilance.

Some styli and cartridges have more trouble in this regard than others. It all has to do with tip geometry, tip mass, and stylus assembly compliance.

If you can borrow a friend's cartridge, install it into your tonearm and see if some of your "problem" discs play with less sibilance. If you find an improvement, it may be time for you to switch to a different cartridge. Alternatively, you might add a bit more tracking pressure (still using your present cartridge), to see if some of the problem disappears.

Amp-to-Amp Connection

In the September 1986 "Audioclinic," you neglected to mention to Keith Ling that one possible way of connecting an integrated amplifier to a second power amplifier is via the headphone jack on the integrated amp (with the addition of attenuating resistors, if needed).—Ralph Gonzalez, Philadelphia, Pa.

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.

ATHENA. The preamplifier is in many ways the most telling component in the audio chain. All too often technical absolutism results in sound quality that is sterile, unappealing, or aggressive. Yet bad lab performance almost always indicates poor sonic integrity. With Athena, Sumo demonstrates a new balance. A preamplifier that is both a stunning performer in the areas of quickness, linearity, and freedom from overload. Yet a warm, faithful, and exciting reproducer of music.

Athena represents the culmination of a major effort at Sumo. As such, it sets new standards for dynamic headroom and freedom from overload. Utilizing high voltage power supply rails, passively linearized circuitry, and a high current toroidal transformer, Athena can faithfully reproduce music at levels far in excess of the peak output of signal sources. As a result, compact discs display dynamic range without high end pain. And complex passages come through intact and unstrained.

Sonic purity in Athena is enhanced both by careful component selection and the exclusive use of pure Class A circuitry. Low noise 1% metal film resistors and metalized polypropylene capacitors are used throughout. Components are mounted on a military grade glass epoxy printed circuit board. And all external connections are made via gold plated input and output jacks. Further, a bypass function allows the user to totally remove the high level section of the preamp from the signal path. When selected, this provides both direct line-drive for high level sources (such as a CD player), as well as direct phone out.

At various times and for various products, we hear the words powerful, impactful, detailed, delicate, accurate, transparent, smooth, natural and a variety of other flattering adjectives. But one word is repeated more frequently than all the rest, and it is that for which we have strived above all. Musical. Athena is above all gloriously musical.

As with all Sumo products, Athena is designed and manufactured in the United States. Among those select dealers stocking our products are:

THE SOUND SHOP
528 South Tejon
Colorado Springs, CO 80903
303/636-1684

DESIGNATRON
4679A Route 347
Pt. Jefferson Station
New York 11776
516/473-4242

THE NEW BALANCE.

SUMO

SUMO PRODUCTS GROUP, 21300 Superior St., Chatsworth, CA 91311 818/407-2427
SUMO CORP CANADA, 1305 Odium Dr., Vancouver, B.C. V5L 3M1 604/254-5148

KEN POHLMANN

REBORN IN THE U.S.A.

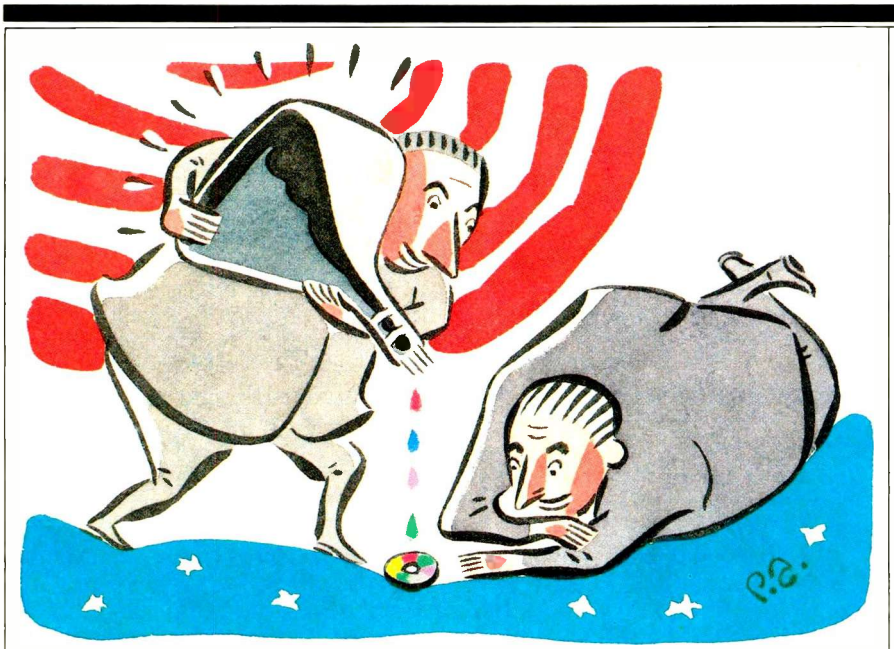


Illustration: Philip Anderson

Just when you thought the American audio giants had gone to rest, never to do combat again, two of the oldest and formerly mightiest have sprung to life. The occasion is no less than the development of one of the most innovative audio/video technologies ever devised.

GE and RCA have announced DVI—Digital Video Interactive—a system which stores up to an hour of full-motion video and audio on a Compact Disc, with a fantastic combination of resolution, quality, and playing time. The DVI system manages to cram the video and audio into a CD-ROM format. What's more, the all-digital system is interactive, allowing user control of foreground video objects, text, dynamic graphics, and audio. (At present, DVI hardware must be linked to a personal computer for interactivity, but it's hoped that all-in-one units will be developed eventually.) The demonstration at the second annual Microsoft CD-ROM conference was so surprising, and impressive, that those in attendance rose in a standing ovation.

Working in secret for three years in the David Sarnoff Research Center of General Electric's RCA Laboratories in Princeton, N.J., researchers attacked the essential problems of storing video information on CD: Too much data, too little space, and a too-slow data-readout rate. A screen of analog video measuring 512 by 400 pixels (a pixel is the smallest basic unit of a TV picture) requires about 600 kilobytes of data per frame for digital storage (assuming 24 bits per pixel). With the NTSC Standard, 30 frames are displayed each second; this means the standard CD format has room for only about 30 seconds of digital video per disc. Furthermore, because the data-readout rate of the CD is only about 150 kilobytes per second, it would take over an hour for that 30 seconds of video to be read off the disc. In other words, the normal disc playing time limits the transfer rate.

Clearly, storage of raw video data was not the answer. RCA searched for a method of compressing data prior to storage, then decompressing it upon playback. At the Sarnoff Center, Larry Ryan conceived the idea of performing non-real-time compression of video frames, with custom VLSI (very large-scale integrated) chips for real-time decompression. Serious number-crunching using serious (VAX) computers is done before mastering; the digital video and audio data is compressed so that fewer bits are required for storage. The compression scheme devised by RCA is impressive indeed: Through pyramid delta encoding, a video frame is compressed to only 5 kilobytes (except for the first frame of each new scene, which requires 15 kilobytes). The result is an hour of storage and a data rate supporting 30 frames per second.

Each time the CD is played, the compressed data must be decompressed—in real time. Two VLSI chips form the VDP (video display processor). The first chip, VDP1, is the pixel processor; it runs the decompression algorithm in software and is designed to scoot along at the healthy rate of 12.5 MIPS (million instructions per second). Its instruction set contains several proprietary video/graphic instructions which permit simultaneous operations; this increases processing power. A new program can be loaded in 120 μS for rapid updates, a requirement for interactivity.

The second chip, VDP2, handles output display processing. It determines the resolution modes and pixel formats. Its resolution ranges from 256 to 768 pixels horizontally and up to 512 pixels vertically. The VDP2 pixel formats use 8, 16, or 24 bits per pixel; with the latter, any one of 16 million colors are available in each pixel. Audio chores are handled with ADPCM (adaptive delta pulse code modulation), the same method used in CD-I technology. As is the case with CD-I, DVI offers various audio bandwidths and dynamic ranges.

One DVI CD could hold about 74 minutes of video playing time. With an hour of video, the remaining disc space could be used for ADPCM audio, perhaps using its 4-bit mode (which sounds a lot better than you might think). Of course, a higher audio quality level could be traded for less video playing time or reduced video quality.

The DVI is designed with a computer bus interface compatible with several computer architectures. The first commercial incarnation of the DVI, which will reportedly be available later this year, will be two plug-in boards designed to fit into an IBM PC AT. As with CD-ROM and CD-I products, a microprocessor-based player (with disc drive) is required.

The personal computer becomes a system which integrates software programs, text, graphics, sound, and full-motion video. It is the latter which differentiates DVI from CD-ROM and CD-I systems; lacking DVI's data compres-

Introducing the Bose® 401™ Direct/Reflecting® speaker system: Our most affordable floorstanding speaker

What separates the 401 system from other speakers? *Direct/Reflecting® speaker technology.* Taking their cue from a live performance, Direct/Reflecting® speakers deliver a precise combination of direct and reflected sound. The result is a sense of musical realism and impact usually experienced only during a live performance.

Only Bose makes Direct/Reflecting® speakers. To the listener, the benefits are immediately obvious:

- **Full stereo**—so you enjoy natural, balanced stereo throughout the listening area, no matter where you stand or sit.
- **Even sound distribution**—so you hear the correct blend of instruments and vocals everywhere in the room, not just between the speakers.
- **Lifelike spaciousness**—your music sounds life-sized, instead of being confined to the speakers.

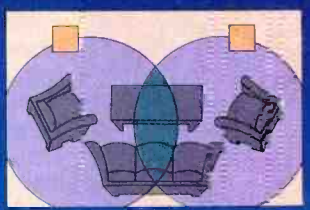
The 401 system draws on the design heritage of the world-acclaimed Bose 901® Direct/Reflecting® speaker system. A result of years of ongoing research, the 401 system is built around the *Stereo Space™ array,* an innovative way to achieve a sense of musical realism usually heard only during a live performance.

What separates the 401 system from all other Direct/Reflecting® systems is that it's Bose's most affordable floorstanding loudspeaker. It gives you true musical realism at less than half the price of a 901 system.

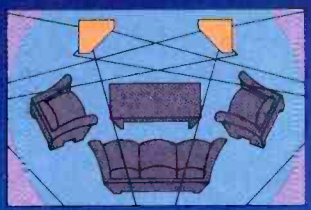
The 401 system's spaciousness, lifelike performance and high power handling capability combine to bring out the best in today's source material—especially digital compact discs and hi-fi video. And like all Bose products, it's subjected to the Syncom®computer comprehensive quality assurance program.

Experience the results of the latest acoustic technology.

Audition the new Bose 401 system soon at your nearest Bose dealer. For more information, write Bose Corporation, Dept. AM, The Mountain, Framingham, MA 01701.



Since conventional speakers radiate primarily *direct* sound, stereo is heard in only part of the room.



The 401 system projects both *direct and reflected* sound, providing full stereo everywhere.

Each speaker has two long-excursion 3½" woofers that operate in a computer-designed ported enclosure for *deep, powerful bass* with low *distortion.* The 2" tweeter delivers *crisp, clean highs.*

The 401 system consists of two slim, mirror-image speakers that require less than one square foot of floorspace each.

Enter No. 6 on Reader Service Card

BOSE
Better sound through research.

DVI doesn't aim to be a new standard; developers hope to incorporate it into existing CD-ROM and CD-I formats.

sion techniques, the video storage of CD-ROM and CD-I is limited in playing time and quality. Even CD-V, a format designed with video in mind, offers only a few minutes of full-motion video on a CD-sized disc.

Just how good is DVI? Well, it's pretty darn good, but not perfect. Its video is indeed full-screen and full-motion, but the data-compression methods do have drawbacks. Not all scenes are encoded as well as others and particularly busy ones suffer picture deterioration. On the other hand, simpler or slower-moving scenes are very good.

DVI opens up several opportunities for product development. For example, the educational market sorely needs an affordable interactive video system (videotape is cumbersome, and videodiscs are expensive). Training systems must provide realism in their simulations; often the poor quality of graphics-based pictures makes them inadequate for applications such as medical, aviation, and maintenance training. DVI could remedy this.

In another application, some retail establishments are turning to in-store marketing, with video systems that allow buyers to preview their purchases.

Of course, the biggest market is the home user. GE and RCA expect that DVI prices should hit consumer affordability by 1990. Interactive games and personal-education packages are two potential uses. If nothing else, DVI could greatly enhance the video applications of many emerging consumer products and perhaps spawn some new products of its own. I can't yet foresee what those will be, but who foresaw the laser's uses when it first appeared?

There you have it. DVI brings digital video and audio to the personal computer, with enhanced interactivity, via the CD. It's a great step forward for video storage and processing and could stimulate existing CD formats.

Of course, the appearance of yet another type of CD will alarm those troubled by format overpopulation. And that's a cause for concern. To address the issue—and recognizing that any format's success hinges on its universality and its acceptance by the manufacturing community—GE and RCA have invited companies and individuals to join them in developing DVI technology. DVI is not intended to compete with existing formats or to be a new standard. Rather, it is hoped that the existing CD-ROM and CD-I standards could be stretched to allow for players incorporating DVI chips. Then this great data algorithm could gain the acceptance it deserves.

Meanwhile, it is comforting to know that technological innovation is not really dead in American audio. It's just been taking a very long nap. After CD, CD-ROM, CD-I, and CD-V with their red, yellow, green, and blue book standards, let's put DVI in a red, white, and blue book.

T H E P O W E R

There is power in the sound of an approaching alpine storm. There is power in the awesome silence that follows.

There is power also in music as it swells from a delicate passage to a thundering crescendo that excites and moves the spirit. This is the essence of the Alpine Sound, that level of sonic virtuosity which is attained by Alpine's newest ensemble of CD and cassette players, amplifiers and speakers.

Out of recent technologies developed by Alpine come autosound components, each taking fullest advantage of the new digital medium, handling with ease CD's broader dynamic range and greater musical energy.

Assembled as a system, the result is staggering.

Experience the emotional power of the Alpine Sound. Because music was meant to be felt as well as heard.

ALPINE

Enter No. 2 on Reader Service Card

BERT WHYTE

CLONE OF CONTENTION

Illustration: David Reau Johnson

The 1987 Summer Consumer Electronics Show in Chicago will linger in memory as a strange and amorphous affair, where the pervasive mood was one of uncertainty.

There was no better case in point than the situation involving Digital Audio Tape (DAT) recorders. In spite of the legislative battles in Congress with respect to the inclusion of a so-called copycode chip in DAT recorders sold in the U.S., Japanese manufacturers at the show decided the time had come to openly display and demonstrate these products. However, as they have done at the last two shows, none of the DAT manufacturers would furnish a retail price for the units nor say when they would begin to deliver them. On the second day of the show, Marantz decided it was time to stop "pussyfooting"; they announced they would begin to sell their DT84 DAT recorder in October of this year at a retail price of $2,000. This resulted in hurried conferences by the other DAT manufacturers, but after consulting their home offices, none of them jumped aboard the Marantz bandwagon. Big and small, all the DAT companies said that if they started to sell DAT recorders in this country and *then* Congress decided to make an anti-copy chip mandatory, they would face a technically difficult and extremely costly retrofitting of chips in all the DAT recorders they had sold. Executives of several of the smaller DAT manufacturers stated that if the copy chip became mandatory, they would not bring any DAT recorders into the U.S. In spite of these pronouncements, however, the feeling is that several more DAT producers will soon follow Marantz and market their units at a price of $1,800 to $2,000.

Just to keep the DAT pot boiling, 3M, TDK, and Fuji announced they would begin selling blank DAT recording tapes, which are a special cobalt-doped ferric oxide type. 3M indicated that a C120 would sell for about $13, a C90 for $11, and a C60 for $8. Obviously, with $13 tapes and $2,000 recorders, the DAT system is hardly a "cheapie" mass-market product.

The record companies contend that they (and those who own the copyrights on recorded music) are losing millions of dollars because of rampant, unauthorized home taping. They are very fearful of the DAT recorder because its advanced digital technology makes possible perfect "clones" of any source. It is estimated that pop music accounts for 95% of the total record market in this country; it is equally understood that teenagers are the dominant factor in the pop music market. The record companies envision a scenario in which a group of teenagers buy one $15 CD and then have great fun making copies on their DAT machines. This is why the record companies are urging Congress to make mandatory the inclusion of a copycode chip in all DAT recorders sold in this country. Then, they could encode their CD recordings with a 3,838-Hz anti-copy notch and thus thwart the dastardly practice of the home taping of CDs.

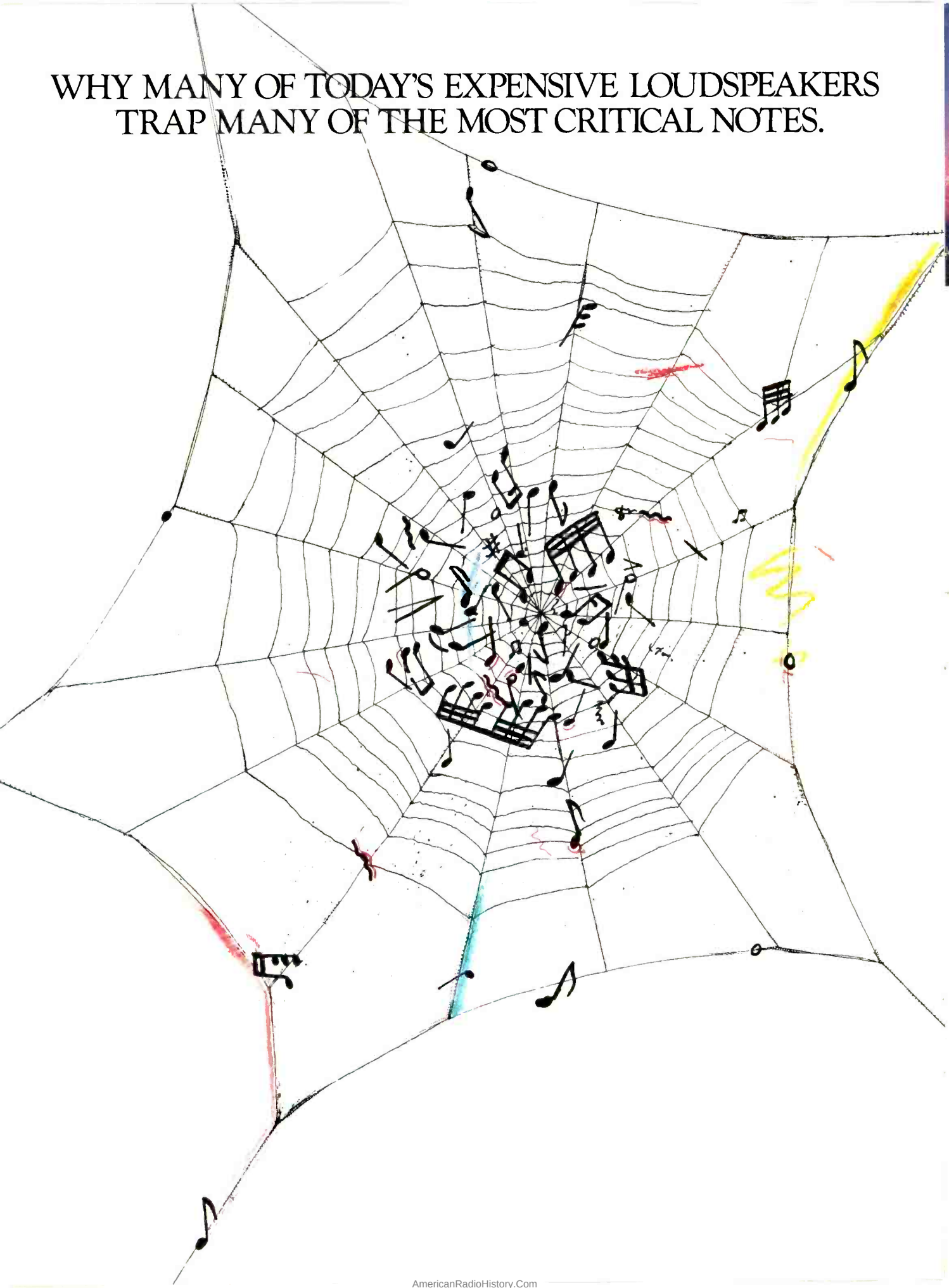
It is common knowledge that teenagers and adults alike have been buying CDs and copying them onto analog cassette tapes, mostly for use in their portables and their cars. Teenagers are active participants in this copying because it is economically feasible within their generally limited resources. They have to shell out $14 or $15 for a CD, but they can buy a CD player for as little as $129 and an analog cassette deck with Dolby B NR for $159. Blank C90 cassettes of reasonably good quality cost just a few dollars.

Teenagers have a number of reasons for copying CDs onto cassettes. First, many of them cannot afford CD players for their cars. Second, many CDs contain "bonus" selections that are not available on any prerecorded cassette. Third, it is common practice among both teenagers and adults to record specific selections from a number of CDs onto one cassette, going through an involving and time-consuming process to create a personalized program of music.

It would seem to me that there are parallels between this practice and the infamous Disney/Sony videotaping case. The Supreme Court ruled that videotaping was overwhelmingly a time-shifting convenience, and said that such videotaping activities did not constitute copyright infringement. The taping of CDs is in the same category as a "convenience" for personal use. The process involves musical selectivity and format-shifting to enable playback in an automobile.

Surely it is fantasy on the part of the record companies to support the notion that hordes of teenagers would be taping CDs on their $2,000 DAT recorders, and that they would give (or

WHY MANY OF TODAY'S EXPENSIVE LOUDSPEAKERS TRAP MANY OF THE MOST CRITICAL NOTES.



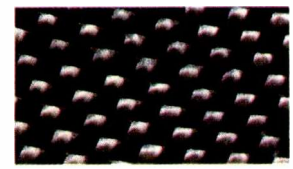
The music that goes into many of today's highly priced loudspeakers isn't always the same music that comes out. Many of the finer notes and nuances are often trapped or lost. Why? Because advanced recording techniques and digital processing demand a dynamic range of over 90 dB and an extended frequency response. Demands that are often beyond the limits of ordinary loudspeakers.

The truth is, most people can't hear what's missing from their music—like a broad frequency range—or what's been added—like coloring or distortion. But there are a few who can.

For that select group, listeners with well trained ears, Altec Lansing has engineered a new line of loudspeakers to recreate every subtlety of recorded music with a clear open sound and without coloring or distortion. Even the accuracy of CD recordings can be more fully appreciated on these Altec Lansing loudspeakers, prompting Stereo Review to remark "...the bass distortion was among the lowest we have measured. The speakers have...very good bass, and a warm, extended and unstrained character."

Polyimide/Titanium Mid-range

The secret to Altec Lansing's consummate performance? Remarkably sophisticated technology. Like woofers of a woven carbon fiber material (instead of paper or polypropylene) that is extremely rigid yet sufficiently light for maximum transient response and extraordinary low frequency definition. The result is a pure, clean, deep bass that beautifully complements the performance of our mid and high frequency polyimide/titanium domed drivers. Virtues like these compelled Stereo Review to also comment on Altec Lansing's "...high sensitivity and ability to absorb large power inputs...a speaker that can develop high sound pressure levels in any environment." Even the hand crafted walnut veneered cabinets utilize the latest computer aided design techniques, thick walls and extra bracing to eliminate resonance.



Carbon Fibers in Woofer Cone

So come hear Altec Lansing loudspeakers. And discover just how much of your music has been trapped by less than extraordinary loudspeakers. Call 1-800-ALTEC 88 for information and the Altec dealer nearest you. (In PA 717-296 HIFI.) In Canada call 416-496-0587 or write 265 Hood Road, Markham, Ontario L3R 4N3.

ALTEC LANSING
LOUDSPEAKERS FOR
THE WELL-TRAINED EAR

Enter No. 32 on Reader Service Card

I think anti-copy encoding not only is unwarranted, but is a subversion of a tortuous 100-year ascent to higher fidelity levels.

sell) these tapes to friends—who, of course, would also need $2,000 DAT machines in order to play them. Some say that DAT recorders will undergo the same rapid price erosion as CD players, but there are good reasons why this is unlikely to happen. DAT recorders have high-precision tape transports whose mechanisms are made to very close tolerances. Add the A/D and D/A converters and other advanced digital circuitry, and even after two years, DAT recorders will not be priced any lower than $500 to $600. Products at this level are hardly mass-market toys for teenagers.

There are other aspects to this DAT situation which might raise a few eyebrows. I have several friends, recording engineers, who are already using DAT recorders. They think they are great and enthusiastically endorse them. As a recording engineer, I feel sure that a DAT recorder will be a great convenience for me and very much worthwhile. However, what would the average audiophile do with a DAT recorder? These days, there is really nothing worth recording "off the air." He would probably have neither the requisite skills nor the proper equipment necessary for live recording. What could he record . . . his child's birthday party, the church choir? Some might suggest CDs. But assuming he has no DAT recorder in his car, why would he want to transfer his CDs to DAT? A CD is forever free from wear, while after a certain number of passes a DAT cassette will begin to deteriorate, with edge frilling and oxide wear. Moreover, the DAT copy would not have the access speed of the original CD. At present, there are no prerecorded DAT cassettes on the market. To duplicate them economically will require a special process. One has been developed by Sony but it currently exists only on paper.

I am not putting DAT technology down. Certainly, for automotive use it is superior to CD players, thanks to its relative freedom from the effects of vibration. The point I am making is that it probably will take a fair amount of time before there is a large population of DAT recorders in place. I am saying that the present DAT controversy in Congress is an overreaction to the format's recording capabilities. I think the anti-copy encoding of CDs not only is unwarranted, but is a subversion of 100 years of a tortuous ascent to ever-higher levels of fidelity in the reproduction of music. High fidelity, faithfulness to the original, is an unending quest. We have reached a very high degree of refinement in the art and science of audio. Let us hope reason prevails and that our music remains unsullied by notches or signal artifacts of any kind.

While DAT got a lot of attention, there were indeed other things going on at the show. A consortium of more than 30 hardware and software companies launched another new technology, CD-V (CD-Video). CDV-Single discs, measuring 5 inches in diameter, provide 5 minutes of analog video and 20 minutes of digital audio. Longer-playing CD-V discs are also available. Two types of CD-V players will be marketed. One, a so-called dedicated CD-V player, handles standard CDs and the CDV-Single; the other, called a combi-player, accommodates standard CDs, all CD-V discs, and 8- and 12-inch laser videodiscs. Such manufacturers as Sony, Denon, Hitachi, Magnavox, Pioneer, Technics, and Yamaha were showing both types of players, with a general price level of $500 for the dedicated players and $800 for the combi units. The anticipated price of a CDV-Single is $8, and companies like Warner/Elektra/Atlantic, Capitol/EMI, RCA, CBS, and Polygram expect to have more than 200 titles available by the fall.

Despite the jazzy launch of CD-V and the united front of its supporters, many people questioned the thrust of this product, which again is squarely targeted to the teenage market. As its backers envision it, the CDV-Single is supposed to be a modern replacement for the 45-rpm pop single, with the added attraction of 5 minutes' worth of music video. Perhaps the CD-V people have forgotten that 45-rpm discs sell for $1.79 to $2.49 each, and that record players can be as cheap as $49! Many people at the show thought that $8 CD-Vs and $500 dedicated CD-V players will be just a bit too rich for today's teenagers. I agree.

In my opinion, the only salutary thing about CD-V is that it has sparked new interest in the laser videodisc, which for many of us has been *the* high-resolution video source for many years. Pioneer has kept the faith, and at the show they introduced their most versatile, technologically advanced videodisc player ever, the LD-S1.

The LD-S1, dedicated solely to 8- and 12-inch LaserDiscs, is loaded with new features. There is a new floating drive system and a new servo "Accu-Focus" system for the laser beam. The unit has a digital memory, employing a RAM chip with a megabit of memory capacity and an 8-bit sampling rate. Thanks to this chip, the LD-S1 can produce freeze-frame stills, scan play, and multi-speed play on CLV extended-play LaserDiscs; previously, Pioneer says, this was possible only on standard-play CAV discs. The digital audio section has a D/A converter for each channel, quadruple oversampling, and digital filtering. Video resolution is a remarkable 420 lines and video S/N ratio is an impressive 48 dB. The LD-S1 will be available by the time you read this at a price of $2,000.

Another hot product at the CES was also in the video field. JVC and many of its licensees introduced Super VHS, a new generation of VCR units which, with special S-VHS tape, affords 430 lines of picture resolution. JVC will import its HRS-7000 by early fall or sooner at a price of $1,200. Similarly priced units will be available from Panasonic, Toshiba, Hitachi, Mitsubishi, and others. Normal VHS tapes will play on the Super VHS units, but Super VHS tapes can be played only on the new VCRs. 3M, Fuji, and TDK all have Super VHS cassettes ready for market. While recording a TV broadcast with the Super VHS will yield only the 330-line resolution of the NTSC signal, the 430 lines of resolution will be forthcoming through Super VHS prerecorded cassettes. Duplicators, among them CBS/Fox, claim transition to the new format will be neither overly expensive nor difficult. When these videocassettes are available, to realize the full potential of Super VHS in respect to color stability and saturation, a TV monitor with Y (luminance) and C (chrominance) signal inputs will be necessary. The 430-line resolution of prerecorded Super VHS will be apparent on good-quality TV sets as well as on monitors.

Next month, a look-see at a number of innovative new audio products.

FOR WANT OF A SPLICE

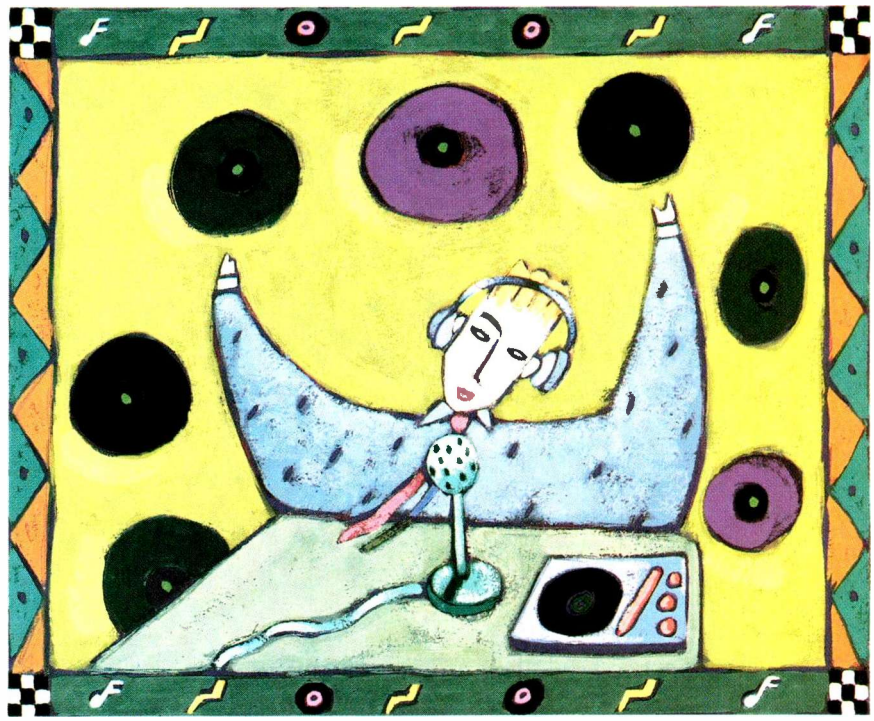


Illustration: Betsy Everitt

Was it some psychic impulse that led me to write my most recent segment of audiobiography about that chancy period of ultra-change in our media, the years immediately after World War II? My March 1987 column took me right up to the threshold of consumer hi-fi and the first wide usage of the term *audio*, as embodied in this magazine's name and that of the then-new Audio Engineering Society. And so I was all set for *Audio*'s 40th anniversary, a fitting time, I thought, to recount the beginning of my involvement with the magazine. No matter that, when the anniversary came, I forgot.

That was a tough period for all of us. Even the new colossus, TV, was momentarily floundering just as precariously as FM radio and, indeed, AM itself. I survived those postwar years intact—but barely.

In 1947, after quitting old-band FM forever, I moved into an upper room in an unused stone church on Manhattan's Park Avenue, barely heated and totally shabby, for an economical rental of $9 per month. That helped. And I was able to transfer my FM radio program to "public radio," then known in New York as the Municipal Broadcasting System. That helped a lot too—more than you could imagine. My new AM program, sacrificing all the benefits of high-quality FM sound for the moment, brought me, of course, a much vaster audience than FM. Perhaps it was 100 times larger, maybe 1,000 times—who knows? A lot, let me tell you, and soon I began, in that great population, to be *heard*. Even without a national network.

There was, of course, no audio or video tape in those years. I forget when Bing Crosby inaugurated his taped radio show, via Ampex, but certainly very few lesser or greater programs were recorded on anything but the celebrated and usually dreadful "air checks." So I did my show live, with records, all at 78 rpm and all but a few on very breakable shellac. After one disastrous try at sonic trickery using local station personnel, I saw the handwriting on the station wall. (It said, "We ride gain and watch seconds. Period.") So I brought in my own highly intelligent but unpaid assistants to juggle the discs in jockey fashion, cross-fading the most unthinkable combinations, playing two records at once, and so on. It was fun, and disasters often happened. Then again, there were also miracles of perfect timing, after endless rehearsing—so perfect that the changeover from one disc to another was largely undetectable, and I would have to comment in words as to what had just happened.

These assistants were lucky finds, as mentioned in an earlier account. John McClure went on to become a CBS Records big shot and then recording assistant to Leonard Bernstein. Jac Holzman founded Elektra, and later Nonesuch, while still doing tricks for me on good old WNYC. He was 19 when we started to work together.

The upshot of this, to make the story short at this point, was an audience on AM (later AM-FM simultaneous mono) that included an audio specialist and magazine editor by the name of C. G. McProud, who at the time was helping to launch *Audio Engineering*, the forebear of this magazine. I came on every Sunday at 1 p.m., and McProud was there in his Greenwich Village apartment, with his wife, Betty, and a brace of Siamese cats. While the cats leapt and yowled and did their Siamese tricks, Mac and Betty listened to Canby orating about music with a batch of audio tricks.

This was early in 1947, probably just before *Audio Engineering*, Vol. 1, No. 1, went to press. I was to make the second issue. I do not remember how McProud contacted me, but in any case, I found myself very shortly in his apartment, with Betty managing the cats while we gents talked.

No—I was *not* hired as an audio engineer! Ever so simply, I wasn't one. What McProud wanted was a column of classical record reviews, which he figured might take on at least a bit of an audio flavor, thanks to my already extensive experience in the working end of reproduced music. He may also have known of my record department in *The Saturday Review*; it was done in tabular form, with sections not only for the musical performance but for the engineering as well. I must have been one of the first to venture into such territory.

McProud was an indefatigable worker, but he also had a very, very strong fondness for all forms of amiable relaxation. I had splendid times in his apartment home and over lunch with him at

Not Evolutionary,

Introducing the Visionary New CLD-1010 LaserVision Discs, Compact Discs, Plus 5-inch CD Videos

Our new CLD-1010 is the first invention on earth capable of playing every audio and video laser format in existence.

Which means the CLD-1010 opens up your home to a vast array of entertainment software. Select from a huge library of over 2000 LaserVision™ titles, from the latest movies to opera, many with breath-taking digital soundtracks. The new 5-inch CD Videos. Compact discs. And the growing catalog of 8-inch music LaserDiscs™ as well.

The CLD-1010's remarkable capabilities are made possible by Pioneer innovations like our super-fine half-micron laser optical reader and advanced high-precision servomechanisms and electronics. You get brilliant, high-resolution, 400-line true-color pictures, 60% sharper than any VHS-HQ on the market.

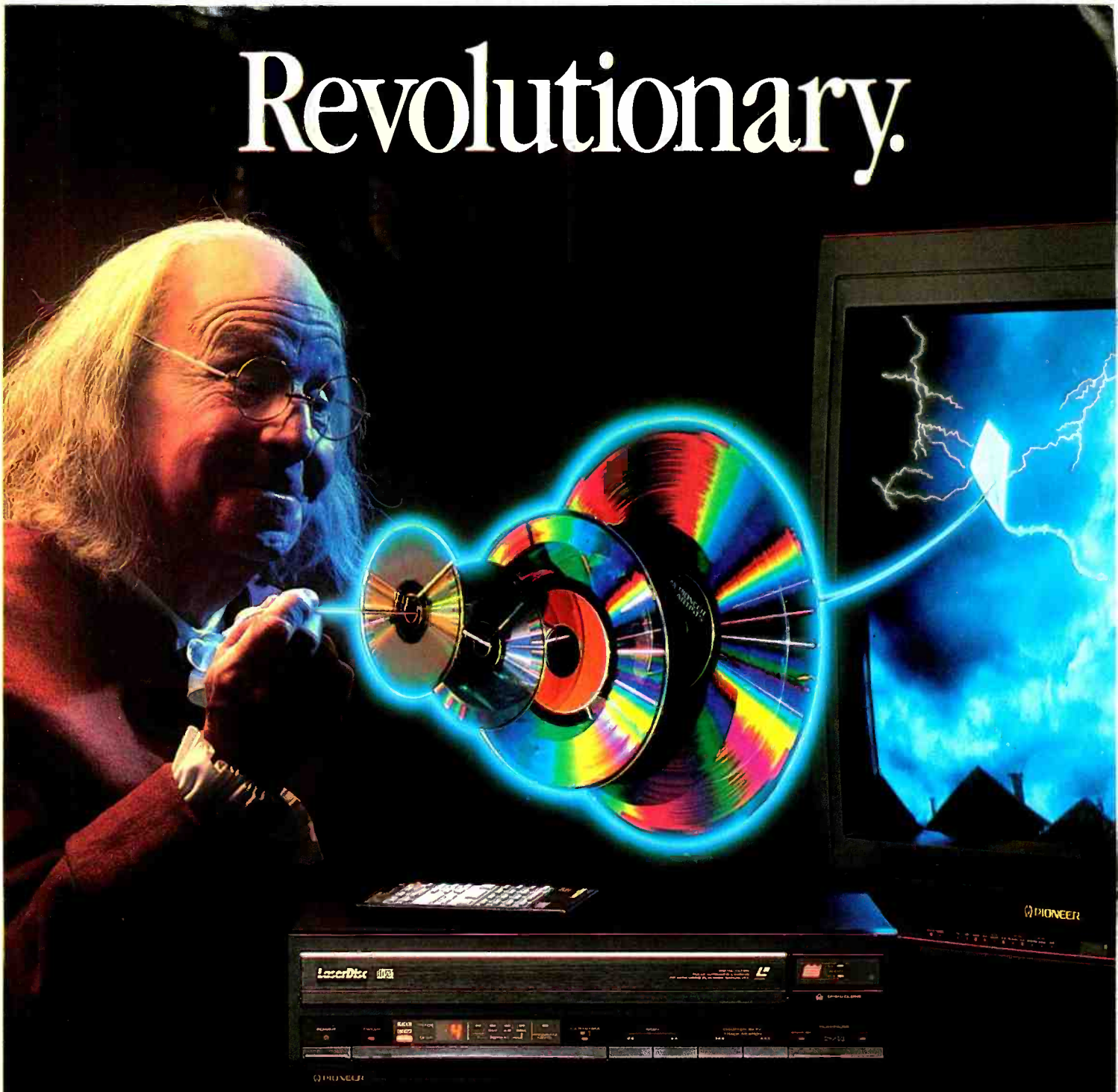
The CLD-1010 markedly reduces picture noise by "piggy-backing" the RF video amplifier on the laser pickup assembly to shorten the signal path. Color "jitter" is eliminated with a CCD time-base corrector and spindle servo system. A new Feed-Forward Color Corrector maintains color accuracy, and an IC Video Detector along with Pioneer's exclusive Noise Canceller further reduces picture distortion and video noise.

Digital source materials are decoded by a 2x Oversampling Digital Filter to reduce phase distortion and deliver crisp, clear dynamic sound. And our three-spot beam linear servo system ignores dust, dirt and scratches on CD's for improved reproduction.

The front-loading CLD-1010 comes complete with extensive programming capabilities, between-track pausing, backward/forward scanning, skip, search, still/step, and more. A full-function remote complements front panel operation of basic controls. And unlike videotape, you can access any point on a LaserVision disc as fast as lightning.

The Pioneer CLD-1010 is years ahead of its time. But why wait till the 21st Century to enjoy 21st Century home entertainment? It's all here, right now, at your Pioneer Dealer today. For more information, call 1-800-421-1404.

Revolutionary.



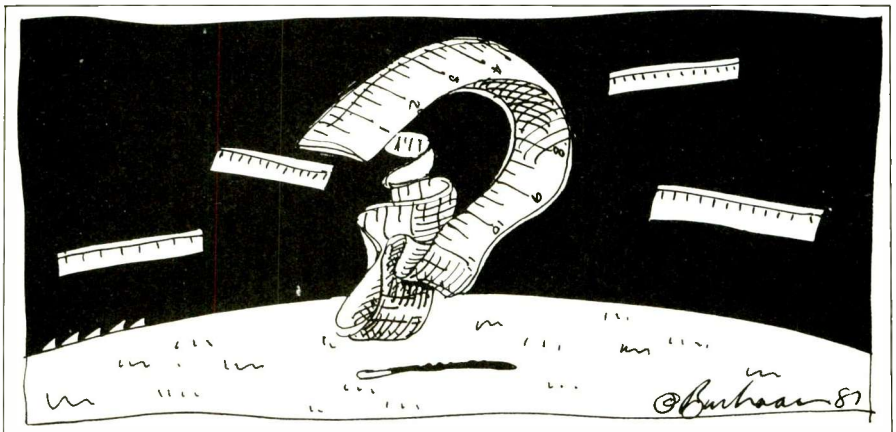
PIONEER®

CATCH THE SPIRIT OF A TRUE PIONEER.

Enter No. 25 on Reader Service Card

IVAN BERGER

SUBJECTIVE SEDUCTIONS



Real and Rubber Rulers

Ultimately, what matters about audio equipment is not how it measures but how it sounds, what we hear when listening through it. This is not an argument against measuring its performance, however.

A sharp, trained ear can detect differences that test instruments miss—not because the instruments are defective, but because they can measure only those differences we have designed them to detect. We still do not know completely which electronic or acoustical effects correspond to certain subtleties of listening, such as depth of imaging. If we did know, we could and would design instruments to measure them.

The ear can also detect differences that aren't there. By this I don't mean simple disagreement between listeners: I might well be able to hear nuances which you can't, and vice versa. There are, however, occasions on which well-trained listeners, making A/B comparisons between two closely matched components, detect definite differences not just between A and B but also between A and A.

Though the ear can make subtle distinctions, it measures them with a rubber ruler. Components sound better on a nice day, after a pleasant lunch, when we don't have headaches, and when the music being played is to our liking. They also sound better when we expect them to—a principle common to all human perceptions and one subconsciously exploited by most good salespeople. It takes a fresh mind to see that the Emperor is naked—and an equally fresh mind, once everyone believes he's naked, to note that he's wearing royal purple tweeds with golden piping.

Furthermore, subjective sensations are hard to communicate. My perceptions may be analogous to yours, but they are probably not identical. The soup I find too salty you may find too bland; the faint edge on a speaker's treble that I dislike may seem a desirable touch of crispness to you.

So we balance subjective perceptions with measurements. If that speaker's "edgy treble" measures flat, then my reaction is either wrong or based on something other than treble amplitude (distortion, perhaps); if it measures peaky, then my reaction is more probably correct—though this still won't necessarily keep you from liking that speaker's "crispness."

In the real world, we have to balance the objective with the subjective. No speaker is completely free from peaks and dips in its response curve; when comparing speakers whose response curves are of equal irregularity, we have only our tastes and perceptions to fall back on. It's a question of which among equal evils bothers me and which bothers you.

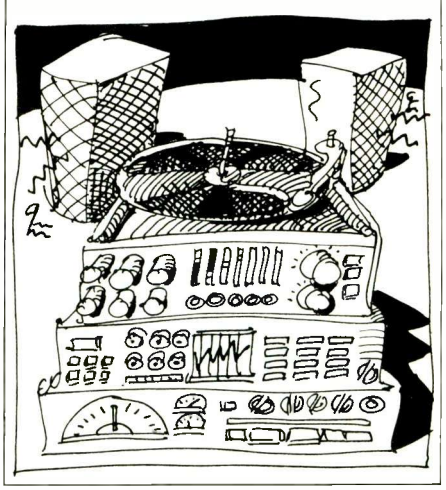
Objective measurements don't tell the entire story. But what they do tell is relatively reliable, and their deviations from reliability reasonably predictable and well known. They don't really tell us what we hear, but they provide a good baseline against which to check our perceptions of a component's performance.

Purity, Body, Flavor

There's a running debate in audio: Should a system be absolutely neutral, making perfect recordings sound perfect (and imperfect ones sound imperfect)? Or should it be designed to make average recordings—mostly imperfect ones—sound as good as possible?

The answer, in my view, is yes. A system should be able to help you get the most from any record you own, which means neutrally reproducing those which need no help and softening the imperfections of those which need all the help they can get. That's what controls—tone controls, spatial enhancers, filters, noise reducers, equalizers, and all the rest—are for. They're fine to have, as long as you can switch them off when they're not needed. Better yet, since every extra circuit adds a little haze of imprecision, you should be able to switch these enhancers *out* as well as off, so they'll have absolutely no impact at all.

The purist approach, buying equipment without tone controls, means that recordings which need no such aid will sound a little better than if tone controls were present. But recordings which do need help will sound considerably worse. Since many of the best musical performances are on just such recordings, this strikes me as cutting off your nose to spite your face, unless sound means more to you than music does. The best compromise is probably tone controls which can be switched out of the circuit.



Illustrations: Yvonne Buchanan

BEYOND CONVENTIONAL SYSTEM CONTROL

THE ONKYO TX-84 AND RC-AV1—Capable of operating any manufacturer's audio or video components with a single remote control

Today's audio/video home entertainment systems typically incorporate a variety of audio and video components, all operating with their own separate remote controls.

Introducing.... The ONKYO TX-84—the first receiver ever offered with a "Universal" Programmable Remote Control that can operate any wireless remote controlled components from any manufacturer. For total control of the TX-84 and everything else in your audio/video system, ONKYO introduces the "Unifier"—Universal Programmable Remote Control. With the RC-AV1, the functions of many brands of infrared remotes can be memorized into one master unit, eliminating inter brand remote incompatability forever. The RC-AV1 can be easily programmed to operate over 100 functions, with function keys conveniently grouped in three modes—audio, video, and auxiliary. The RC-AV1 "Universal" Remote Control is available for sale separately or included as an option with the TX-84.

Designed for the audio/video enthusiast, the ONKYO TX-84 offers outstanding sonic performance in addition to full A/V capability. The TX-84 delivers 60 watts of FTC rated power per channel into 8 ohms with no more than .04% THD. Features such as low impedance drive capability, discrete output stages, Automatic Precision Reception, and Dynamic Bass Expander make the TX-84 the equal of any comparable audio-only receiver. Its seven inputs (5 audio, 2 video) offer total system versatility, while the Stereo Image Expander and Simulated Stereo can optimize any video or audio soundtrack.

Together, the TX-84 and RC-AV1M can form the heart of your audio/video system. Audition them today at your ONKYO dealer!

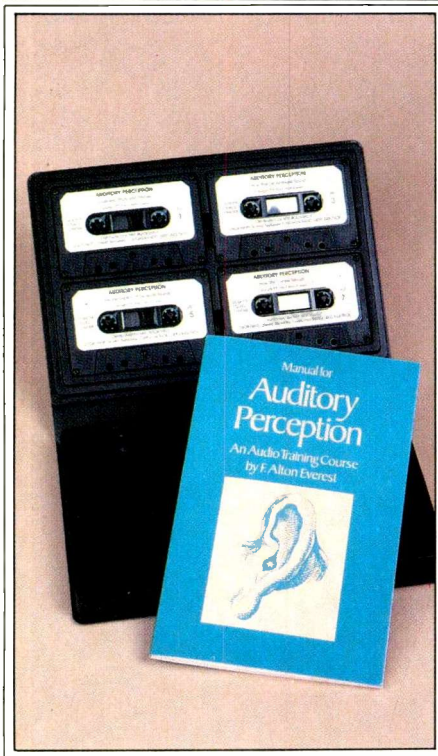
Artistry In Sound

ONKYO

200 Williams Drive, Ramsey, N.J. 07446

Enter No. 21 on Reader Service Card

TRAINING REELS



Auditory Perception by F. Alton Everest. Published privately; 104-page manual and four audio cassettes, $160. (Available from Mix Bookshelf, 2608 Ninth St., Berkeley, Cal. 94710; (800) 641-3349 in California, (800) 233-9604 elsewhere.)

Have you ever listened to the curious phenomenon called "low pitch," in which complex tones seem to have a slightly lower subjective pitch than pure tones of the same frequency? Have you ever heard a Mobius sequence, such as a progression of ascending tones starting at middle C and eventually winding up back at middle C? Have you ever experienced "difference tones"?

Can you explain how masking works? Have you ever used probe tones to explore your auditory system's network of critical bands? When you hear a violin tone, are your ears sufficiently trained to distinguish the third harmonic from the fundamental? How about the fifth harmonic? Not easy to hear!

How's your pitch discrimination, and how good are you at hearing distortion in loud and soft signals?

Have you ever tried the famous experiment performed by Joseph Henry in 1849? (I know you have.) How about the experiment Helmut Haas did in 1949, to demonstrate the amazing Precedence Effect? Why are some sounds more pleasant than others, and how do consonance, dissonance, and critical bands relate to provide the answer?

If any of these questions pique your interest, you can explore all of them, and more, in the audio training course *Auditory Perception* by F. Alton Everest. The course contains a 104-page manual and four audio cassettes, each of which includes two one-hour lessons. The book contains an introduction on the physiology of the human hearing system and eight chapters of information on select topics; its text duplicates the narrative on the tapes. The book also supplies visual representations and graphs, while the tapes provide the listening tests themselves. The tapes are chrome and are recorded in stereo with Dolby B noise reduction; their quality level is good enough to rarely interfere with the lesson at hand.

Author Everest, a veteran audio consultant and writer, has once again succeeded admirably in conveying difficult or intangible information in an understandable manner. His experiments, text, and sequence of presentation communicate a great deal of information in a short time. In addition, a bibliography and glossary invite one to further study.

While the course is not inexpensive, it is a small investment compared to that which many of us make in audio hardware and software. Surely it is worth the price to learn more about our most important audio component, our ears. As an educator, I am pleased that copies of the manual alone are available for $14.95. Now, if only Mr. Everest would try one more experiment: Publishing this course on CD-I. That would be a revelation indeed.

Ken Pohlmann

Introduction to Magnetic Recording edited by Robert M. White. IEEE Press, 309 pp., $47.50; $28.50 to IEEE members.

This volume gives an overview of the technical side of magnetic recording. The first section of 60 pages has seven newly written chapters: An introduction, and then chapters covering magnetic media, the recording head, the writing process, readback voltage, the air bearing, and the recording channel. The text is fundamental in character, with college-level mathematics and excellent illustrations throughout.

The second section of 240 pages is a collection of 38 reprints of articles that have appeared elsewhere. They are categorized in nine parts: General (2 papers), media (5), head fields (6), thin-film heads (6), written magnetization (8), readback (3), noise (3), codes (3), and equalization (2). The reprints are reproduced in the format in which they originally appeared, which is an understandable choice to keep production costs down. As would be expected, some of the text is slightly hard to read because of faintness and small type size. But most of the papers are good in this regard, and the illustrations are generally very good.

Although there is emphasis on the non-audio topic of mass storage, the text does stand as a very good general introduction for those wishing to gain a deeper technical understanding of magnetic recording and its fundamental nature. The tutorial approach in the first section will aid the serious reader, and the reprints include a number of valuable sources that would be hard for most individuals to locate.

Howard A. Roberson

I Remember—Eighty Years of Black Entertainment, Big Bands, and the Blues by Clyde E. B. Bernhardt as told to Sheldon Harris. University of Pennsylvania Press, 270 pp.; hardback, $30, paperback, $17.95.

Clyde Bernhardt passed away shortly after his 81st birthday, only a few weeks before this book was published. Being the subject of a book was quite an accomplishment for a player like Bernhardt, one of the legions of what I call jazz soldati, men of solid professional accomplishment who filled out the sections of dozens of bands, large and small, but whose names remain known mainly to jazz scholars.

During layoffs due to illness or just stretches of unemployment, Bernhardt took to his typewriter. He began putting down on paper his sharp memo-

BEYOND CONVENTIONAL AUDIO

THE ONKYO INTEGRA TX-108
THE FIRST RECEIVER WITH SEPARATES PERFORMANCE

In the past, buying a receiver over costly separate components meant sacrificing sound quality for the sake of convenience and economy. The ONKYO Integra TX-108 sets a new standard for receiver performance by providing sound quality normally associated with separates with maximum audio and video system control flexibility, all operated by 25 key wireless remote control.

The heart of the TX-108 is ONKYO's patented Real Phase power supply system. Real Phase insures phase accuracy in the audio signal by placing a second power transformer between the main power transformer and the filter/storage capacitors, duplicating the theoretical perfect charging current, pure DC. The TX-108 provides an RMS power of 100 watts per channel into 8 ohms and an IHF dynamic power of 295 watts into 2 ohms, along with precisely focused imaging and deep, tight bass.

Full audio/video flexibility is provided by 5 audio and 2 video inputs facilitating easy dubbing between video and audio sources. A unique Sound Control system incorporates a dual band Dynamic Bass Expander for superior deep bass impact and definition, a Dynamic Transient Expander to restore impact and dynamics to compressed music sources, and a Simulated Stereo function for monophonic video soundtracks.

Now, there's a new standard for receiver convenience and separates performance. The ONKYO Integra TX-108.

Artistry In Sound

ONKYO

200 Williams Drive, Ramsey, N.J. 07446

Enter No. 22 on Reader Service Card

Matthew Polk's Magnificent Sounding New SDA 2A

SDA 2A
$549.00 ea.

Digital Disc Ready

Matthew Polk stands proudly alongside the latest version of his Audio Video Grand Prix Award Winning SDA 2A

The Magnificent Sound of Matthew Polk's Extraordinary New SDA 2A Puts the Competition to Shame!

"It has the ability to make your previous favorite speaker sound almost second rate"

Stereo Review Magazine

Matthew Polk's magnificent sounding new 3rd generation SDA 2A incorporates many new advances pioneered in his top-of-the-line Signature Edition SRSs. It achieves stunningly lifelike musical reproduction which would be remarkable at any price but is simply extraordinary at $549. each. Stereo Review said, "listen at your own risk." Once you hear them you'll never be satisfied with anything else!

Polk's Revolutionary True Stereo SDA Breakthrough

The magnificent sounding new SDA 2A incorporates Polk's revolutionary True Stereo SDA technology. This patented, critically acclaimed, Audio Video Grand Prix Award winning breakthrough is the most important fundamental advance in loudspeaker technology since stereo itself. In fact, the design principles embodied in the SDAs make them the world's first and only True Stereo speakers.

Why do Polk SDAs always sound better than conventional speakers? When conventional loudspeakers are used to reproduce stereo both speakers are heard by both ears causing a form of acoustic distortion called interaural crosstalk which cuts down stereo separation, obscures detail and interferes with the proper reproduction and perception of imaging, and spaciousness. Polk SDAs are designed to eliminate interaural crosstalk so that each speaker is only heard by the one correct ear (i.e. left channel/left ear, right channel/right ear), like headphones. The result is dramatically improved stereo separation, detail and three-dimensional imaging. In order to accomplish this each SDA incorporates a separate set of drivers which radiates a special dimensional (difference) signal which cancels the undesirable interaural crosstalk coming from the wrong speaker to the wrong ear. High Fidelity called the results "Mind Boggling".

The Most Extraordinary Value in High End Audio Today

The new SDA 2As, like all the current SDAs, incorporate the latest 3rd generation SDA technology developed for Matthew Polk's Signature Edition SRS and SRS-2 including ***1:*** full complement sub-bass drive for deeper, fuller, tighter and more dynamic bass response; ***2:*** phase coherent time-compensated driver alignment for better focus, lower-coloration smoother, clearer, more coherent midrange and improved front-to-back depth and; ***3:*** bandwidth-optimized dimensional signal for smoother high-end and even better soundstage and image. The new SDA 2A is the finest sounding and most technologically advanced speaker ever produced at its extraordinarily modest price. It sounds dramatically better than speakers from other manufacturers that cost 4 times as much and more and is, at $549 ea., truly the speaker of your dreams at a price you can afford.

"Breathtaking...a new world of hi fi listening." *Stereo Buyers Guide*

The spectacular sonic benefits of SDA technology are dramatic and easily heard by virtually anyone. Reviewers, critical listeners and novices alike are overwhelmed by the magnitude of the sonic improvement achieved by Polk's SDA technology. Stereo Review said, "These speakers ***always*** sounded different from conventional speakers — and, in our view, better — as a result of their SDA design."

All Polk's SDAs, including the new 2As produce a huge lifelike three dimensional sonic image which will amaze you. You will hear for the first time instruments, ambience and subtle musical nuances which are present on your recordings but masked by the interaural crosstalk distortion produced by conventional speakers. Stereo Review said, "Spectacular...literally a new dimension in the sound...the result is always better than would be achieved by conventional speakers". High Fidelity said, "Mind Boggling...Astounding ... Flabbergasting...we have yet to hear any stereo program that doesn't benefit". With SDAs every instrument, vocalist and sound becomes distinct, tangible and alive; allowing you to experience the spine tingling excitement, majesty and pleasure of live music in your own home.

"Mindboggling, Astounding, Flabbergasting"

High Fidelity Magazine

Other Superb Sounding Polks From $85. to $1495. each

No matter what your budget is there is a superb sounding Polk speaker perfect for you. Polk's incredible sounding/affordably priced Monitor Series loudspeakers utilize the same basic components as the SDAs and begin as low as $85. each. The breathtaking sonic benefits of Matthew Polk's revolutionary True Stereo SDA technology are available in 5 SDA models priced from $395. to $1495 ea.

"You owe it to yourself to audition them" *High Fidelity*

The experts agree: Polk speakers sound better. Use the reader's service card or write to us for more information. Better yet, visit your nearest Polk dealer today. Your ears will thank you.

polkaudio
The Speaker Specialists ®

5601 Metro Drive, Baltimore, Md. 21215

Where to buy Polk Speakers? For your nearest dealer, see page 124.

This rambling book served to verify my ideas about why audio engineers and musicians seem to be wary of philosophers.

ries, going back to his North Carolina childhood and including all the events he had witnessed and taken part in during a rich life full of music and entertainment. He sought out author Sheldon Harris, whose *Blues Who's Who* (Da Capo Press) is a standard reference work in the field, and together they spent two years producing this remarkable autobiography.

As one who has interviewed hundreds of players of Bernhardt's generation, the second generation of jazz pioneers, I can attest to his most formidable memory. I knew him well and spoke with him often over a period of 15 years; never once was he not right on the money with names, dates, and places. He truly had total recall. It is all here in *I Remember*, easily one of the most valuable books on jazz that one is likely to encounter. Bernhardt's amazing memory and acute observations bring to life dozens of major and minor figures in the world of jazz and show business, many of whom had been totally ignored until now.

As a boy, Bernhardt did errands for Ma Rainey, long before he had any idea of becoming a professional musician. He worked steadily from the early '20s until the bottom fell out for jazz men of his generation in the '50s. Then he just took weekend gigs while working a steady day job which enabled him to retire with a pension in the mid-'60s. His career was revitalized in the last decade of his life with regular club and concert dates and recordings here and abroad.

Never an outstanding soloist, Bernhardt nonetheless was hired by King Oliver, who preferred his reliable, sober style—and the fact that he read well and worked hard to make the band sound good—to that of the big contemporary names like J. C. Higginbotham. The chapter which discusses Oliver is particularly good, telling how well the New Orleans giant was still doing on tour as late as 1931.

Like many of his generation, Bernhardt had a high sense of honor. He often turned down offers from leaders like Cab Calloway, Louis Armstrong, and others because he preferred the situation he was in, even if it paid less money. He also turned down offers in order to maintain his health after a particularly gruelling tour of one-nighters, when he played with Jay McShann and had to double on two different books of trombone parts.

It was King Oliver who started him off as a blues singer in 1931. After that and throughout Bernhardt's career, his blues singing led to good jobs and to the formation of his own bands, particularly his 1946 Blues Blowers. This band started off well, packing them in at Harlem's famed Smalls' Paradise, until the boss asked Bernhardt to cut down the band's size so the club could bring back its chorus line. Bernhardt refused. Soon he gave up his band in frustration, because of unscrupulous recording managers, booking agents, and club owners who contrived to take a good deal more than their fair share of his earnings.

Later, in the '60s, I personally witnessed the formation of the Harlem Blues and Jazz Band, with Bernhardt as its leader, in Dr. Albert Vollmer's Larchmont, N.Y. living room. From there the band went on to various jazz festivals in Europe and to an extended engagement at New York's Ginger Man restaurant. All this without the benefit of an agent or "star" value, just good, solid jazz and blues.

Clyde Bernhardt left a rich legacy of music and he tells his story in a unique down-home manner. This book deserves to enjoy a wide sale.

Frank Driggs

The Recording Angel: Explorations in Phonography by Evan Eisenberg. McGraw-Hill, 272 pp., $17.95.

Although one might infer from its title that *The Recording Angel: Explorations in Phonography* deals with the recording industry, it is, in fact, a philosophy book which falls between a dozen—if not more—stools of thought relating to the arts and sciences. Unfortunately, it never comes close to the audio field in the process.

The book, which is a rambling exploration into a thousand quotes on the nature of art, science, and music from Plato to Schopenhauer and Nietzsche to Hanslick and Paul Ros, verified my suspicions as to why audio engineers and professional musicians seem to be wary of philosophers. They are too airy and vague, never getting down to the nitty-gritty facts.

In a magazine devoted to audio—art, science, whatever—it seems to me that these words must be said. Our author, who studied philosophy (of course) at Harvard and Princeton, is an enthusiast and communicates his enthusiasm on every page; his database (card file?), out of most of the big names in philosophy and aesthetics, is enormous. But it is all *ideas*—and so little substance. Ideas, of course, are powerful, but in our day, in our civilization, they simply have to be tied to techniques, to the substratum of technology that is all-important in our life.

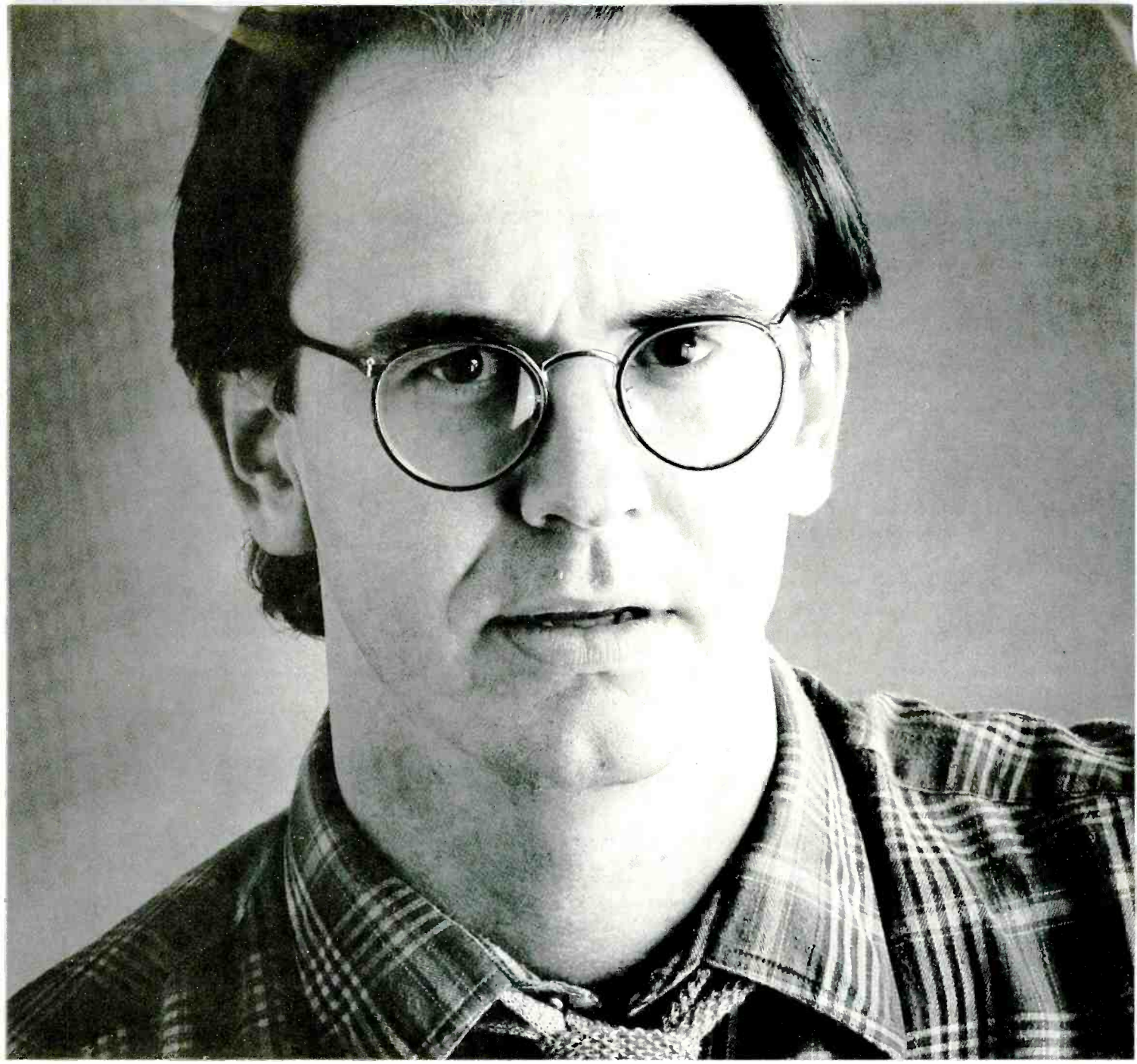
For instance, Schopenhauer announces to us that the deep bass is analogous to the lowest grade of Ideas, the brute mass of the planet from which everything else is generated. Ah yes, and the intermediate parts, the *ripieno*, represent the intermediate grade of the will's objectification. As for melody, it is man. By the next page, we are into Charlie Mingus and a bass-fiddle solo.

Eisenberg uses a common theme to tie the quotes together—namely, that phonograph music is different from live music. Some of us have been contributing thoughts on this subject for a half-century or so already—I was giving "phonoconcerts," with no great success, in the late '30s at Princeton and have often used the term "phonography" when appropriate.

Eisenberg's choices of musical selections to bear out his theories are all too predictable, whether they be from the standard-bearers of jazz, or from Bach himself. I almost cringed when I saw the "Toccata and Fugue in D Minor." What else? Of course: The "Air for the G String," as it used to be called, much to my music students' delectation. There is, in fact, quite a bit of Bach outside of these two works. Hundreds of hours' worth, if you really want to get into the details.

As Mahler once said of his Eighth Symphony, "These are not human voices any more, but planets and suns circling." But how does one record planets circling? Ask Denon: One way is to use B & K microphones. *The Recording Angel* says very little about microphones, or any other technical devices, for that matter. They do not belong in the realm of philosophical ideas.

Edward Tatnall Canby



"How Come So Much?"

It's easy to spend a lot of money on speakers. So make sure you get a lot of value and performance in return.

Start with the cabinet. Don't settle for wood grained plastic. Look for *real wood* in a time-honored design.

Then peel back the grille cloth. If you find some ho-hum handful of cheap cones and domes, keep shopping. If you're staring down the throat of a horn and into the eye of a compression driver, you may be on to a speaker worth your money.

Oh, and the listening test. That's the most important. Compare several models with the hottest licks on your favorite CD. You'll know when you've turned on the speakers that deliver *real* dynamic range.

Check that brand again. We bet it reads KLIPSCH.®

KLIPSCH. Now that's value.

KLIPSCH. Now that's performance.

For your nearest KLIPSCH dealer, look in the Yellow Pages. Or call toll free, 1-800-223-3527.

KLIPSCH HERESY II® PICTURED ABOVE

klipsch®

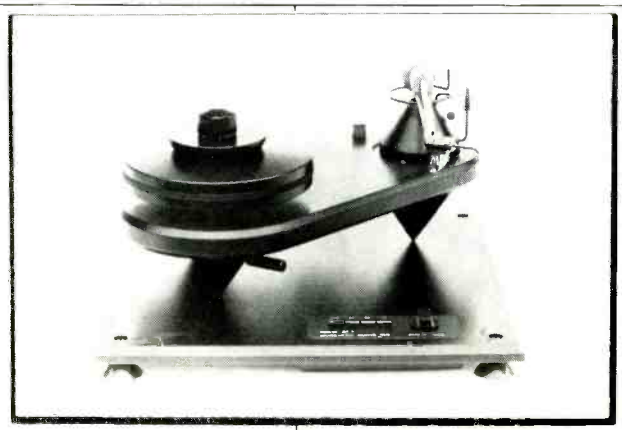
A LEGEND IN SOUND.™

P.O. BOX 688 • HOPE, ARKANSAS USA 71801

Enter No. 17 on Reader Service Card

Boston Acoustics Speaker

Newly redesigned, the A70 Series II is a two-way system using an 8-inch woofer with copolymer diaphragm and the same 1-inch ferrofluid-cooled dome tweeter used in the most expensive Boston Acoustics speaker systems. To smooth the frequency response and enhance imaging (by reducing diffraction), the tweeter is flush-mounted and placed asymmetrically, and the grille is thin and precisely tapered at its inner perimeter. Frequency response of this 8-ohm system is 45 Hz to 20 kHz, ±3 dB, and sensitivity is 90 dB for 1 watt at 1 meter. The cabinet is finished in wood-grain vinyl. Price: $300 per pair.
For literature, circle No. 100



Meitner Arm and Turntable

Instead of using a conventional platter or mat, the three-speed AT-2 turntable supports discs at their label areas by elevated knife edges and a special double-edged clamp. According to Meitner, this allows vibrations set up in the record to be dissipated into the surrounding air rather than reflected back to the disc. The subchassis rests on three aluminum cones and is made of an inert synthetic marble to provide isolation. Vertical tracking angle is adjustable during play by a control which raises and lowers the disc. The TA-2 tonearm, included with the AT-2, is a unipivot type. To eliminate standing waves, it uses three pre-stressed rods in a triangular array instead of a conventional arm tube. Price: $1,450.
For literature, circle No. 102

Carry Disc CD Holder

Fourteen CDs can be carried in the compact Carry Disc, a multi-pocket black nylon wallet. Each pocket has a soft velour lining to protect the disc's playing surface and a transparent plastic face that allows the labels to be read. Price: $15.95.
For literature, circle No. 101

Pioneer Combi-Player

The first CD-V player on the U.S. market, Pioneer's CLD-1010 can be used with the new CDV-Single discs, audio CDs, and 8-inch and 12-inch CD-V or LaserVision videodiscs. The audio section, which uses a digital filter with two-times oversampling, has a rated S/N of 98 dB and dynamic range of 95 dB, with frequency response from 4 Hz to 20 kHz. Price: $800.
For literature, circle No. 103

BUILD YOUR COMPACT DISC COLLECTION.

Join the CBS Compact Disc Club and TAKE ANY 3 COMPACT DISCS FOR $1.00 with membership.

348458. Dvorak: Cello Concerto—Yo-Yo Ma; Maazel, Berlin Philhar. (*Digital*—CBS Masterworks)

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

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

348979. Tina Turner—Break Every Rule (Capitol)

352633. Dolly Parton/Linda Ronstadt/Emmylou Harris—Trio (Warner Bros.)

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

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

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

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

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

346478. Madonna—True Blue. (Sire)

343319. Janet Jackson—Control (A&M)

349571. Boston—Third Stage (MCA)

290916. The Best Of Earth, Wind & Fire, Vol. I (Columbia/Arc)

343715. Vivaldi: Four Seasons—Maazel cond. (*Digital*—CBS Masterworks)

319541. Elton John—Greatest Hits. (MCA)

342105. Bangles—Different Light. (Columbia)

356279. Gloria Estefan And Miami Sound Machine—Let It Loose. (Epic)

339044. Mozart: Symphonies 40 & 41 (Jupiter)—Kubelik, Bavarian Radio Or. (*Digital*—CBS Masterworks)

339226. Gershwin: Rhapsody In Blue; more. Thomas, Los Angeles Phil. (*Digital*—CBS Masterworks)

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

287003. Eagles Greatest Hits 1971-1975 (Asylum)

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

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

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

138586. Bob Dylan's Greatest Hits (Columbia)

346957. Steve Winwood—Back In The High Life. (Island)

344622. Anita Baker—Rapture. (Elektra)

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

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

345777. Peter Gabriel—So. (Geffen)

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

334391. Whitney Houston. (Arista)

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

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

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

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

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

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

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

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

348649. Pachelbel Canon & Other Digital Delights—Toronto Chamber Orch. (*Digital*—Fanfare)

260638. Chicago's Greatest Hits (Columbia)

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

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

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

349373. Beethoven: Symphony No. 9 (Choral) Bernstein, N.Y. Phil. (*Digitally Remastered*—CBS Masterworks)

314997-394999. Stevie Wonder's Original Musiquarium 1. (Tomla)

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

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

351122. Europe—The Final Countdown. (Epic)

346544. Kenny G—Duotones. (Arista)

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

355156. Vladimir Horowitz Plays Favorite Chopin (*Digitally Remastered*—CBS Masterworks)

354985. Billie Holiday—From The Original Decca Masters. (*Digitally Remastered*—MCA)

353037. Miles Davis—Sketches of Spain. (Digitally Remastered—Cl. Jazz Masterpieces)

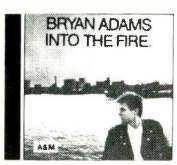
349613. Original Soundtrack—Round Midnight. (Columbia)

355115-395111. Prince—Sign 'O' The Times. (Paisley Park)

357186. Hooters—One Way Home. (Columbia)

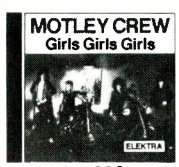
356873. The Outfield—Bangin'. (Columbia)

354100. Crowded House. (Capitol)

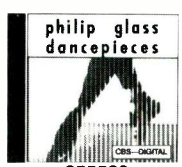


353946

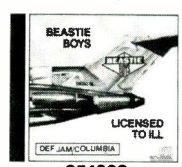
353771



355990



355529



351692

356675

COMPACT disc DIGITAL AUDIO

We've built-in a wide range of choices. You can select from a wide variety of current hits and classical favorites. Our great introductory offer lets you choose any 3 CDs listed in this ad for just $1.00. Fill in and mail the application—we'll send your CDs and bill you for $1. You simply agree to buy 2 more CDs (at regular Club prices) in the next year—and you may then cancel your membership anytime after doing so.

How the Club works. About every four weeks (13 times a year) you'll receive the Club's music magazine, which describes the Selection of the Month for your musical interest...plus many exciting alternates. In addition, up to six times a year, you may receive offers of Special Selections, usually at a discount off regular Club prices, for a total of up to 19 buying opportunities.

If you wish to receive the Selection of the Month, you need do nothing—it will be shipped automatically. If you prefer an alternate selection, or none at all, fill in the response card always provided and mail it by the date specified. You will always have at least 10 days in which to make your decision. If you ever receive any Selection without having 10 days to decide, you may return it at our expense.

The CDs you order during your membership will be billed at regular Club prices, which currently are $14.98 to $15.98—plus shipping and handling, and sales tax where applicable. (Multiple-unit sets may be higher.) There will be special sales throughout your membership. After completing your enrollment agreement you may cancel membership at any time.

Special Bonus Plan: After you buy 2 CDs at regular Club prices, you can build your collection quickly with our money-saving bonus plan. It lets you buy one CD at half price for each CD you buy at regular Club prices.

10-Day Free Trial: We'll send details of the Club's operation with your introductory shipment. If you are not satisfied for any reason whatsoever, just return everything within 10 days and you will have no further obligation. So why not choose 3 CDs for $1 right now?

ADVANCE BONUS OFFER: As a special offer to new members, take one additional Compact Disc right now and pay *only* $6.95. It's a chance to get a fourth selection at a super low price!

Selections with two numbers contain 2 CDs and count as 2—so write in both numbers.

CBS COMPACT DISC CLUB: Terre Haute, IN 47811

CBS COMPACT DISC CLUB, 1400 N. Fruitridge
P.O. Box 1129, Terre Haute, Indiana 47811-1129

Please accept my membership application under the terms outlined in this advertisement. Send me the 3 Compact Discs listed here and bill me only $1.00 for all three. I agree to buy two more selections at regular Club prices in the coming year—and may cancel my membership at any time after doing so.

SEND ME THESE 3 CDS:

My main musical interest is (check one): *(But I may always choose from any category)*

☐ ROCK/POP ☐ CLASSICAL

Mr.
Mrs.
Miss _____
Print First Name Initial Last Name

Address _____ Apt. _____

City _____

State _____ Zip _____

Do you have a VCR? (Check one.) ☐ Yes ☐ No
Do you have a credit card? (Check one.) ☐ Yes ☐ No

474/F87

ADVANCE BONUS OFFER: Also send me a fourth CD right now at the super low price of just $6.95, which will be billed to me.

This offer is not available in APO, FPO, Alaska, Hawaii, Puerto Rico; Please write for details of alternative offer. Canadian residents will be serviced from Toronto. 3TA/C2

Note: We reserve the right to reject any application or cancel any membership. 3TC/C3

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 8k and 9k 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 Cray Ltd., 14 Laidlaw Blvd., Markham, Ontario, Canada L3P1W7 (416) 294-4833

A Harman International Company.

TIVE PERFORMANCE

DESIGNING A HOME

It's not surprising that a room can dramatically affect what we hear when listening to music. Sound from even the most electronically sophisticated playback system must eventually travel the acoustic paths from the loudspeakers to the listener's ears, making the room, in effect, an extension of the speakers. This delicate acoustical component is a vital link in the electro-acoustic chain and plays a large part in determining the ultimate accuracy and quality of the stereophonic listening experience. This listening experience should be an active process, generating musicality, emotionality, sonic images (which enhance the music) and a sense of immersion or envelopment in the performance. In this article, we describe a listening-room design approach which accomplishes these objectives by employing the concept of a Reflection Free Zone (RFZ) and by creating a dense, diffuse sound field, with significant lateral components, using Reflection Phase Grating (RPG) acoustical diffusors [1]. (RFZ and RPG are trademarks of RPG Diffusor Systems, Inc.) This design approach has evolved from psychoacoustical observations, Time Delay Spectrometry measurements, theoretical calculations, and the success of many full-scale models.

The science of psychoacoustics, which examines the perceptual effect sound has on the auditory system (the ear/brain combination), has provided us with many observations, particularly over the past 20 years, about the effects of reflections on three important listening-room parameters: Stereo imaging, frequency coloration, and envelopment (the spatial impression). Research suggests that, to accurately perceive stereo images and enjoy a heightened spatial impression with a sense of immersion or envelopment in the music, one must control the interference of early reflections from speaker boundaries and create a uniform, diffuse sound field, with significant lateral components, in the room.

Many clues have been provided about the mechanism the auditory system uses to binaurally perceive music in a room. Paramount is the effect of very early reflections (arriving less than 10 mS after the direct sound). Barron [2] found that reflections which are too early and/or too strong (with respect to the direct sound) cause false localization and frequency coloration. He also observed a time and intensity range in which the lack of early reflections in small rooms created an RFZ listening area and allowed an initial time delay gap (ITD) to be introduced. Figure 1 shows how very early reflections cause image shifting and corruption of spatial information. Consequently, to process spatial information, the auditory system demands that the direct sound be isolated by at least 10 mS from the indirect reflected sounds of the room. The

B.V. PISHA AND CHARLES BILELLO

LISTENING ROOM

arrival time of the indirect energy might then be sequenced to fall within the useful reflection zone, thus increasing the apparent acoustic size of the room. Rodgers [3] also showed that very early reflections confuse the auditory system and result in image shifting, because they cause comb-filter patterns which are similar to the interference resulting from coherent reflections from the folds of the outer ear and upper body.

Other researchers, most notably Haas [4], have described the ability of the auditory system to temporally fuse similar sounds within a time window which depends on the nature of the source (approximately 20 mS for program material). It is this temporal fusion that allows us to blend the direct sound, early reflections, and reverberation into one louder and fuller event.

In addition to amplitude and temporal distribution, the directionality of early reflections is an important parameter affecting the spatial perception of music. Music with lots of lateral reflections that results in a sonic dissimilarity (or lack of interaural coherence) between the left and right ears is preferred by more listeners. Specular reflections, when too intense and too isolated with respect to the direct sound, can convey a very directional impression and destroy spatiality, whereas diffuse lateral reflections lead to greater binaural dissimilarity and an increased sense of space or envelopment, which is preferred by more listeners.

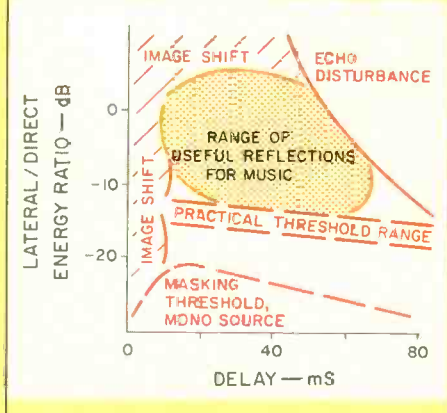
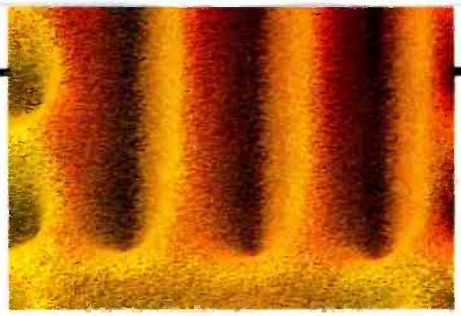


Fig. 1—The effect of delayed reflections of various intensities on the perception of music. (After Barron.)

The objective, then, is to eliminate common acoustical problems such as slap and flutter echoes, resonances, and frequency coloration, without creating the adverse acoustical side effect of a "dead" or lifeless-sounding space. In fact, *we would like to psychoacoustically allow the openness and natural ambience of a larger space to be perceived in a physically smaller room.*

The design of a critical listening room requires an appropriate balance among three acoustical ingredients—absorption, reflection/diffusion, and room geometry. In Fig. 2, the temporal (time) and spatial (angular) properties

Photograph: David Hamsley



of the three basic surface types are shown.

An ideal absorptive surface absorbs all the sound striking it, over a wide range of frequencies (which is very important). Consequently, only the direct sound is observed in the temporal distribution plot. Since no sound is reflected, no polar plot is shown.

A reflective surface, whose properties are shown in the middle row of Fig. 2, scatters the incident sound in a specular direction, as a mirror would reflect light. Hence, the first and second intense spikes in the temporal distribution refer to the direct and reflected sound, respectively. The reflected sound's time of arrival is related to the difference between the direct distance from the source to the listening position and the total distance from the source to the reflecting surface to the listener. The polar pattern for a reflective surface shows a peak in the direction of the reflection, which in this example is approximately 45° to the surface. In this discussion, we will refer to path-length differences in milliseconds or thousandths of a second. This can easily be translated into distance by recognizing that sound travels approximately 1.13 feet every millisecond. For example, the path-length difference between the direct sound from a loudspeaker and a reflection from a back wall 10 feet behind the listener is 20 feet or 17.7 mS.

The diffusive surface of Fig. 2, representing an RPG diffusor, scatters incident sound over an appreciable time period and uniformly over a wide angle, for a broad range of frequencies.

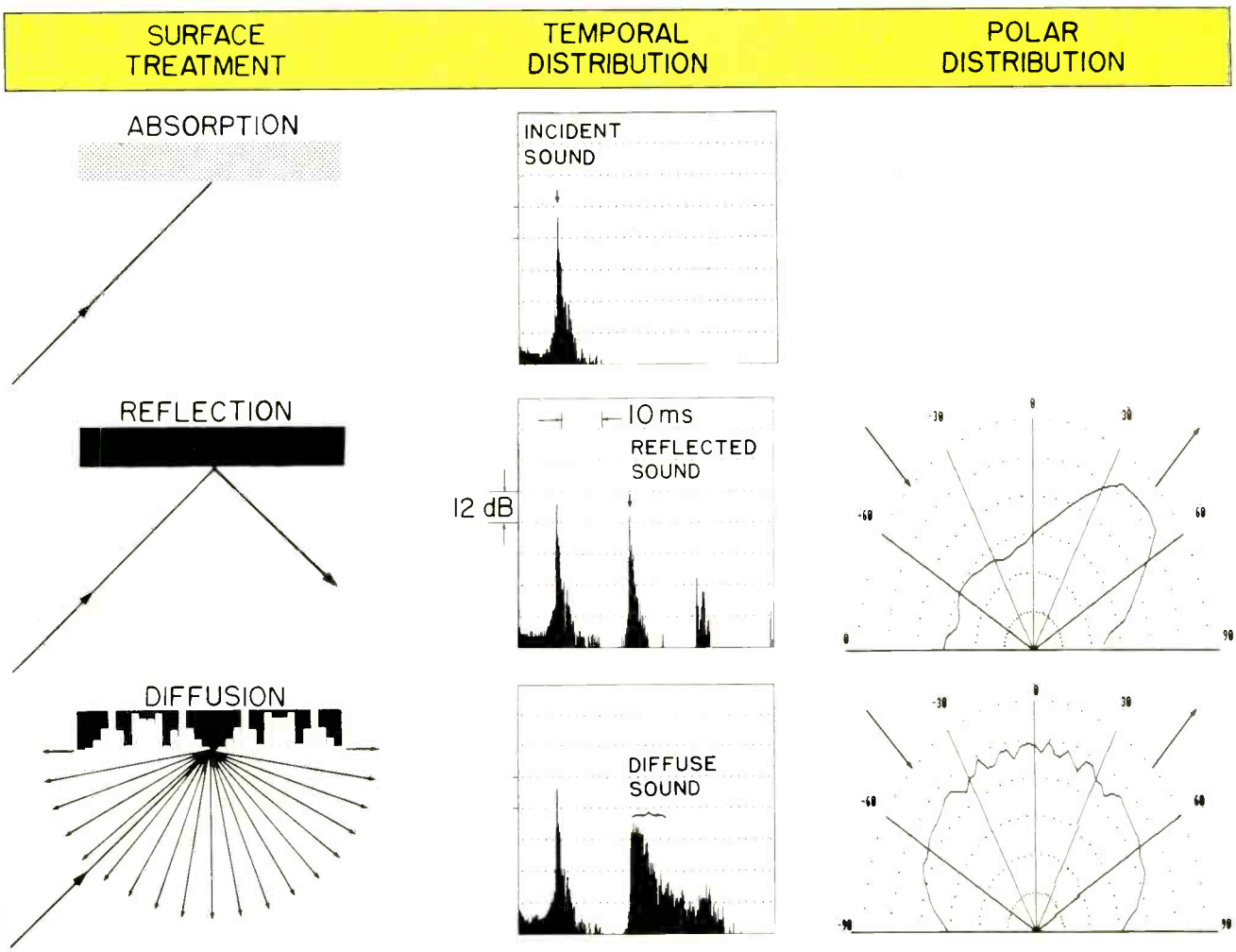


Fig. 2—Comparison of temporal (time) and spatial (polar) diffusing properties of absorptive, reflective, and diffusive surfaces. The scattered energy from an ideal absorptive surface (top row) is negligible; therefore, no polar plot is depicted. The energy scattered from a reflective surface (middle row) has minimal time spread and is reflected principally in one direction for each direction of sound incidence. The diffusive surface (bottom row) provides appreciable time spread and angular distribution of the backscattered sound for all angles of incidence.

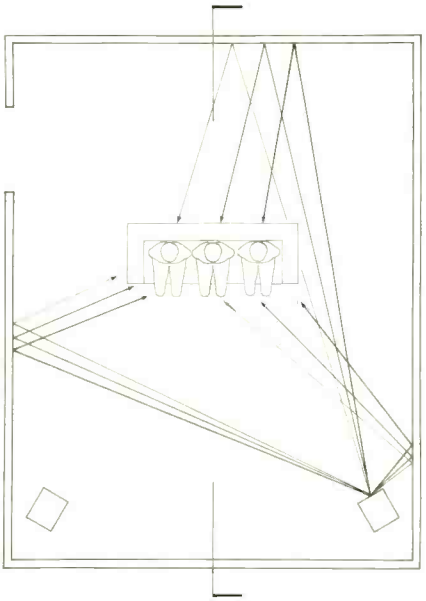
Now, let's briefly examine the effects of the listening environment on stereo imaging, frequency coloration, and envelopment.

Stereo Imaging

The subjective dimensions of "sound space" can be described in terms of directionality of the source, definition, and spaciousness—the perception of distance or depth beyond that which can be inferred from the ratio of direct-to-indirect sound. Stereo imaging is sensitive to frequency-domain notches in the range from 1 to 18 kHz because these notches mimic the pinna and torso transfer functions caused by coherent reflections from the outer ear and upper body. Today it is possible to encode predetermined three-dimensional spatial paths or sonic illusions—e.g., Doug Jones' Listening Environment Diagnostic Recording (LEDR)—with vertical motion and depth perception cues, in addition to the much simpler and more familiar left-right panning effects of contemporary music. This spatial information can be captured during the performance or added afterwards with effect processors such as a "spatial reverberator" [5]. When auditioned over headphones these sonic images can be quite impressive. However, auditioned over loudspeakers, they can easily be completely corrupted by very early reflections in the listening environment. The frequency range of these very early reflections can easily be controlled by creating a diffusive or absorptive Reflection Free Zone.

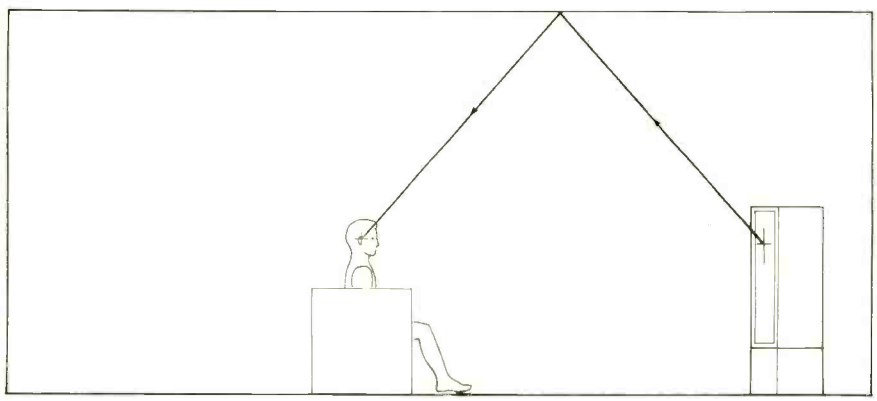
An RFZ is simply a volume of space in which early reflections from nearby and speaker boundary surfaces are minimal, and the predominant sound source is the direct sound from the loudspeakers. Kirchhoff diffraction theory suggests that to minimize early reflected energy at a listening position there is an equation with at least three major variables to consider: The reflection function, which is 1 for a purely reflective surface and less for a diffusive or absorptive surface; the obliquity factor, which is a maximum for normal incidence and reflection, and the interference term, which is a maximum at a specular angle, where the angle of incidence equals the angle of reflection. Therefore, to minimize reflections at a listening position, we can make boundary surfaces diffusive or absorptive; alternatively, we can angle and splay speaker boundary surfaces so reflected energy can be directed away from the listening position.

Fig. 3—Top (A) and side (B) views of a typical home listening room, before treatment. Note the reflecting points on the side walls and ceiling, which require treatment.



A

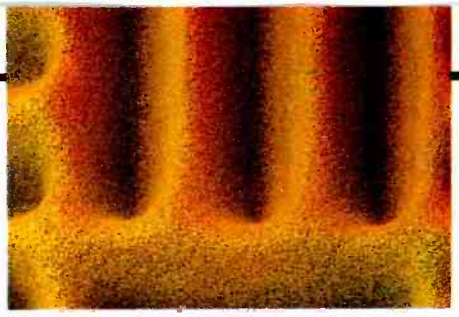
B



A concept helpful to understanding and creating an RFZ is to picture the front speaker boundaries (walls, ceiling, floor) covered completely with mirrors. A person seated at any listening position should not be able to "see" a reflection of either speaker if he or she is within the RFZ.

Here is a simple technique to create an RFZ in your home listening room. It requires two people and a mirror. One

A reflection free zone is simply a volume of space in which early reflections are minimal and the direct sound predominates.



person serves as an observer and the other positions the mirror along potential reflecting surfaces (walls, floor, and ceiling). The object is to identify specular positions which can be splayed, made diffusive, made absorptive, or all of the above. In a typical room with speakers in the corners and a sofa 10 feet away, the observer assumes a position at the left end of the sofa, and the attendant moves the mirror along the ceiling, walls, and floor at the front of the room. Wherever the observer can see a reflection of either speaker, the position of the mirror is marked. This process is repeated with the observer at the center of the sofa and at its far right. The RFZ that can be created by treating the room's surfaces at the marked positions will extend all along the sofa. Now, one has the option of splaying the room's surfaces, if the room can be modified, and/or placing absorption, diffusion, or Abffusion materials along those portions of the boundaries needing treatment. (Abffusion, a trademark of RPG Diffusor Systems, is a surface treatment simultaneously providing absorption and diffusion.) If the room is very small (e.g., 10 by 15 by 8 feet), excessive absorption should not be used, because it will tend to make the room sound smaller. Figure 3A shows locations on the side walls which require treatment, and Fig. 3B shows a location on the ceiling which needs treatment.

Frequency Coloration

In addition to image shifting, very early reflections cause frequency coloration when they are strong with respect to the direct sound. This is called the speaker-boundary interference response (SBIR). The primary effect of the SBIR is the creation of severe broad-band notches in the frequency response, especially at low frequencies, where absorptive/diffusive surface treatments are minimally effective. Frequency coloration can be reduced by flush-mounting speakers in massive, properly splayed boundaries (as is done in critical recording control rooms). In home listening rooms, flush-mounting speakers and splaying walls are rarely done, for a variety of reasons. Positioning a speaker at different distances from the wall, ceiling, and floor can help, but one must still be aware of the coloration imposed by SBIR. To lessen the depth of the first frequency notch, one can position absorption or Abffusion materials in the corners behind the speakers. Again, beware! While absorption is certainly helpful in optimizing a listening position, it should not be used in excess.

Envelopment and the RPG Diffusor

Once we have configured the front of the room so that the predominant energy at all listening positions is the direct sound, we can turn our attention to the acoustical treatment of the sides and rear of the room. We would like the reflections from the room to add some ambience, creating the sensation that we are enveloped in the sound and participating in it, without corrupting the stereo imagery and causing frequency coloration. Psychoacoustic researchers have examined this situation; they have determined that the indirect reflected sound in a room should be sequenced, arriving approximately 20 mS (or at least 10 mS) after the direct sound, and be temporally and spatially diffuse. Temporal diffusion refers to the distribution or density of reflections over time. Spatial diffusion refers to the polar or angular energy distribution. It is important to create a

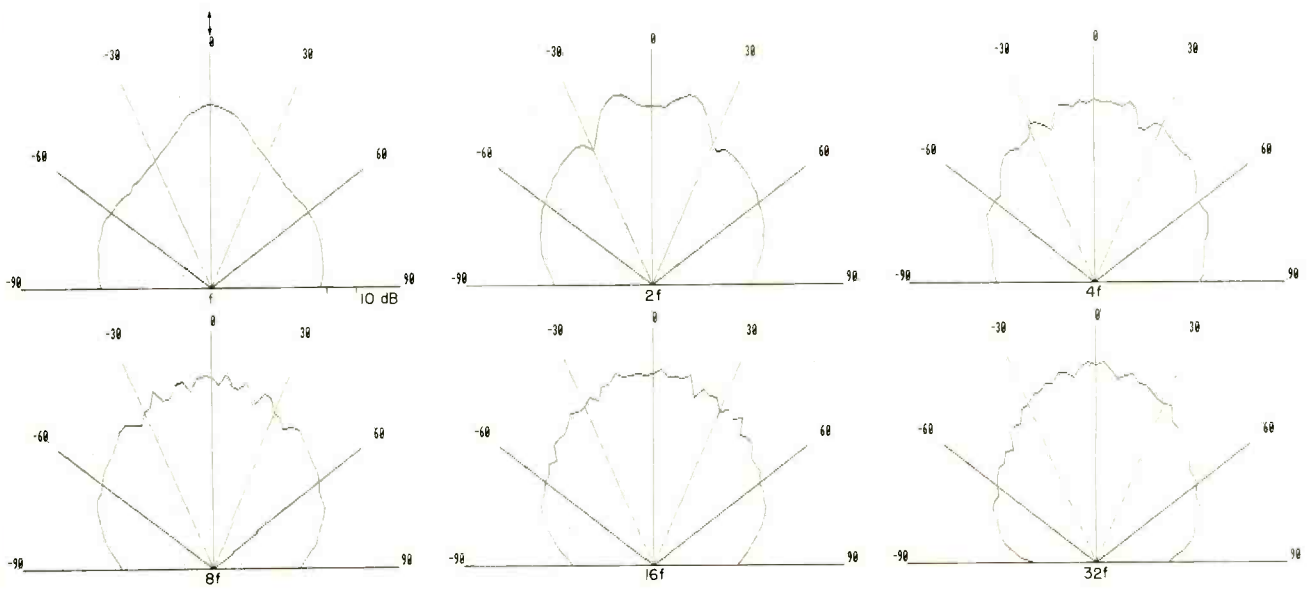


Fig. 4—Polar energy response from an RPG diffusor, showing uniform scattering between −90° and +90° over five musical octaves from f = 250 Hz to 32f = 8,000 Hz.

uniformly (or isotropically) dense reflection pattern so that, over a broad range of frequencies, no point in time or angular direction is favored.

This subjective diffuseness (or lack of directional impression) and the sensation of envelopment are created when the sound fields at each ear are dissimilar and poorly correlated. We perceive directionality instead of diffuseness when the sound reaching each ear is highly correlated over approximately 1 mS (roughly the time it takes for a sound to travel the distance between ears); strong, isolated reflections produce such correlated sound.

Many approaches have been used in the past to scatter sound—irregular geometrical surfaces, monocylindrical and polycylindrical columns, distributed absorption, etc. With the RPG acoustical diffusor, it is quite easy to create, in a small room, a diffuse sound field such as would be found in a larger room. The thin, 2-by-4-foot RPG diffusor consists of a periodic grouping of wells having equal width but different depths, separated by thin dividers. It is an acoustical analog of the diffraction grating used to scatter light for the past 100 years. The diffraction directions for each frequency are determined by the dimensions of each unit of the periodic grouping, and the intensity in any direction is determined by the depth sequence within a period. The depths are based on a series of numbers produced by quadratic equations [6] which provide optimum phase variation, and result in an excellent diffusor. Sound striking these surfaces is scattered over time and uniformly over 180°, incorporating a broad range of frequencies. Figure 4 shows experimental polar patterns from an RPG diffusor; the patterns cover five musical octaves, from 250 Hz (labelled "f" in Fig. 4) to 8,000 Hz (labelled "32f").

The primary functions of RPG diffusion are to:

1. Provide a uniform high density of closely spaced reflections without density gradients or discontinuities;
2. Provide a dense pattern of uniformly distributed, irregularly spaced frequency notches;
3. Uniformly backscatter a broad frequency bandwidth over a wide angular range, and

Fig. 5A—Top view of listening room, showing application of RPG diffusors on rear wall, Abffusors behind speakers in front corners, Triffusors in rear corners, and broad-band absorption (shaded areas) on front and side walls. Uniform diffuse wavefront is indicated by dashed, curved line behind listening position; dashed rectangle in front of listening area represents location of ceiling treatment.

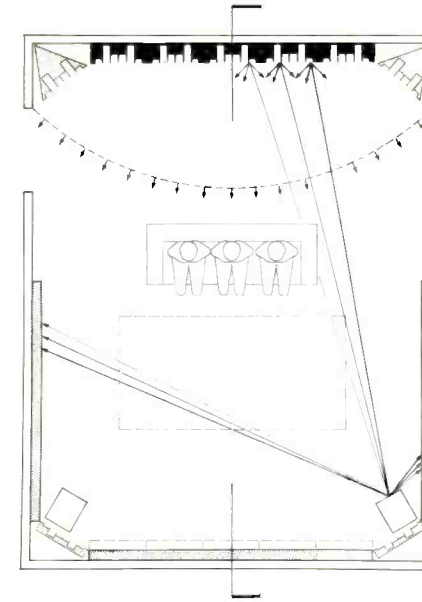
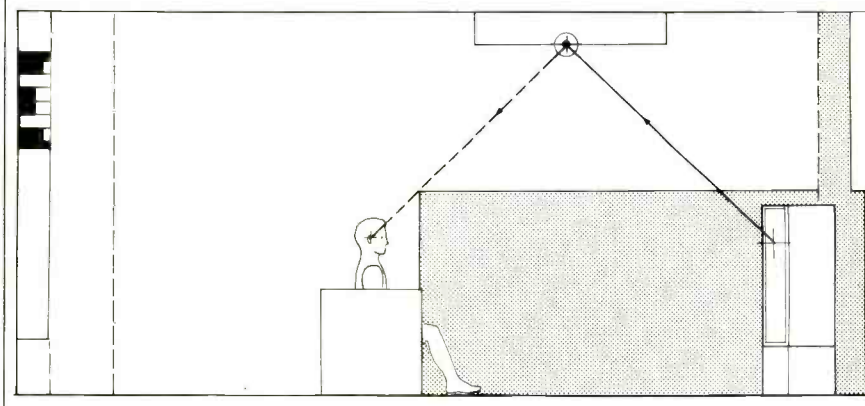


Fig. 5B—Side view of same room as in Fig. 5A, showing absorption on side walls, vertical Abffusors from floor to ceiling in front corners, and absorptive treatment on ceiling. For greater spaciousness, a diffusive ceiling can be used, in which case upper side walls reflect laterally diffused sound (dashed line with arrow) from ceiling diffusors.



4. Reduce backscattered energy, to minimize interference with the direct sound, frequency coloration, and image shifting.

Consider what you hear when listening to music in an auditorium. The first sound you hear from the stage is the direct, line-of-sight sound. The next sound you perceive is the indirect reflected energy from the closest boundary surface. This first significant reflection is separated in time from the direct sound and is not necessarily isolated, because there may be other reflection paths closely spaced in time. Because of the nature of the enclosed space, there is an initial time-delay gap between the direct sound and the first

Room reflections should create a sense of being enveloped, without corrupting the stereo image or causing coloration.

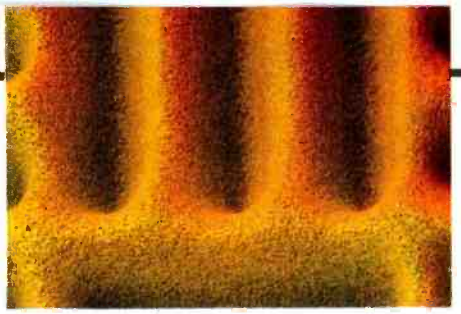


Fig. 6—The dead end of a Live End/ Dead End (LEDE) room in Pisha's home. Front speakers are B & W 801Fs and Janis W1 subwoofers.

Fig. 7—The live end of the same LEDE room as in Fig. 6. Free-standing wall of RPG diffusors measures 8 by 8 feet and is positioned 40 inches from back wall.

After RFZ/RPG treatment, the home listening room's sonics compared favorably with those found in a renowned concert hall.

indirect reflected sound from the auditorium boundaries. Keep in mind the importance of this time gap in the perception of room size.

Can you create an appropriate initial time-delay gap in a small listening room? The answer is yes. And you are well on your way by having first established an RFZ in the front of the room. The creation of an RFZ allows the indirect energy reflection pattern to be sequenced. That is, a time delay gap, related to the time it takes the sound to pass the listening position and return from the rear and rear-side surfaces, will be created, because the RFZ suppresses early reflections from the front of the room. However, a small room is dominated by isolated directional specular reflections and a lack of diffusion. By treating the rear and side walls with RPG diffusors, as shown in Figs. 5A and 5B, the energy passing the listening position is reintroduced after an ITD, temporally and spatially diffused.

In this manner, the combination of an RFZ and RPG diffusors permits the accurate binaural perception of stereo images over a wide volume of space, minimizing frequency coloration and creating the spatial impression of being in a large space while in a physically small room.

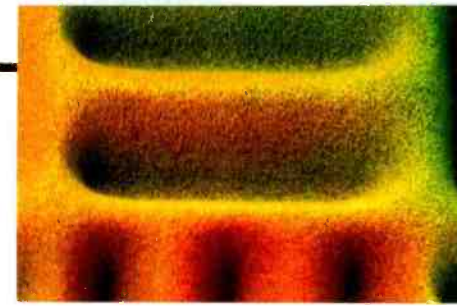
Treatment of a Home Listening Room

We set out to establish an optimum listening environment in the home of coauthor Pisha. The room, which measured approximately 19½ by 13½ by 8½ feet, was cleared of everything but the speaker system. Surface treatment was removed from walls and ceiling. Speakers were arranged near two corners of the room, 10 feet apart, on 8-inch pedestals filled with sand. The listening position was placed equidistant from each speaker and 7.7 feet from the center line between the speakers.

An energy-time curve was taken with the Techron TEF System 10. Figure 8A represents the energy and arrival time of all reflections in the room, before treatment. Note the interfering ceiling, floor, and side-wall reflections and the sparse reflection pattern from the room.

Using the mirror technique described earlier, interfering early-reflection surfaces on ceiling, floor, and side walls were identified for each listening position. These surfaces were then treated with Sound-Sorber foam panels, manufactured by Discrete Technology, to create an RFZ (Fig. 6). Since there was no intention to modify the existing walls or flush-mount the speakers, a triangular wedge of absorptive material was placed in each corner behind the speakers to improve the modal (resonant) response of the room.

Next, specular reflections from the rear surfaces were located. An array of RPG diffusors was positioned parallel



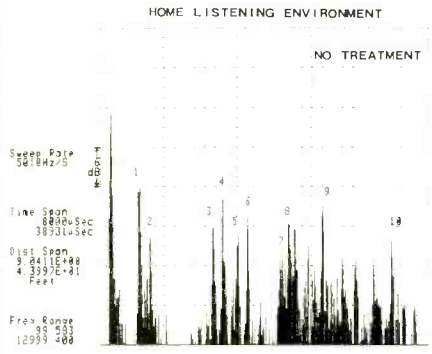


Fig. 8A—Energy-time curve of Pisha's listening room of Figs. 6 and 7, before treatment. Interfering reflections include: (1) 11.7-mS floor reflection between speaker and listening position, (2) 12.7-mS reflection from ceiling between speaker and listening position, (3) 18.6-mS reflection from multiple floor-ceiling paths, (4) 19.5-mS and (5) 21.1-mS reflections from opposite side wall, (6) 21.9-mS multiple floor path, (7) 24.9-mS rear-diagonal left reflection, (8) 25.7-mS rear reflection, (9) 29.2-mS rear-diagonal right reflection, and (10) 35.5-mS multiple-path reflection.

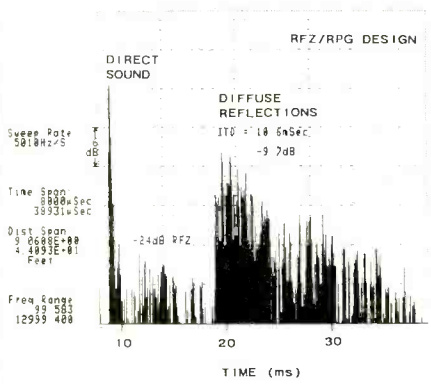


Fig. 8B—Energy-time curve of Pisha's listening room of Figs. 6 and 7 after RFZ/RPG treatment, showing much improved response. An initial time-delay gap of 10 mS was created with an RFZ 24 dB below the direct sound. The reflection pattern consists of a dense, uniform, exponentially decaying sound field.

to and 40 inches from the back wall, covering all specular surfaces. An area of 32 square feet was covered with lateral diffusive surfaces (vertical wells), and an equal area was covered with vertical diffusive surfaces (horizontal wells), forming a cluster measuring 8 by 8 feet (see Fig. 7). The energy-time curve results are shown in Fig. 8B. Note the RFZ, the tremendous increase in density of the reflection pattern from the room, and the exponentially decaying sound field. Aside from scale, the listening-room measurements compare favorably with those of a world-renowned concert hall, the Concertgebouw in Amsterdam (Fig. 9), and of a recording control room at Master Sound Astoria in New York City (Fig. 10).

We verified our sonic changes by auditioning a Telarc CD of Tchaikovsky's "1812 Overture," by playing an LEDR tape (manufactured and distributed by Electro Acoustic Systems Inc., 715 Monroe St., Evanston, Ill. 60202), and by making TEF measurements such as those of Figs. 8A and 8B. Playback equipment included a Mark Levinson ML-3 amplifier and ML-1 preamp, B & W 801F loudspeakers, a Janis Interphase 1A subwoofer amplifier, and Janis W1 subwoofers.

Listening experiments revealed precise and accurate stereo imaging at all listening positions in the room. Psychoacoustically, there was a sense of being immersed in the sound, in a much larger space more commensurate with the environment in which the sound was recorded.

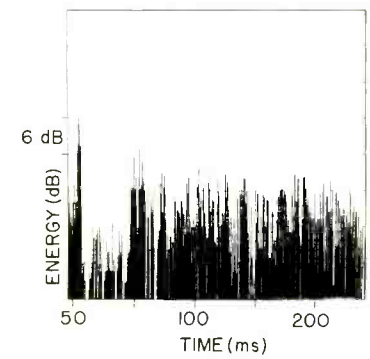


Fig. 9—Energy-time curve of the Concertgebouw concert hall in Amsterdam.

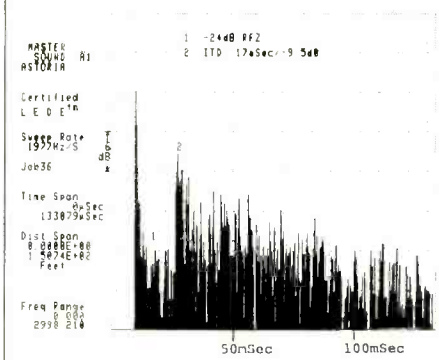


Fig. 10—Energy-time curve of RFZ/RPG control room at Master Sound Astoria.

Based upon the above data and our listening experience, we conclude that it is feasible to use the RFZ/RPG concept in small rooms such as those found in private dwellings.

References

1. D'Antonio, P., and J. H. Konnert, "The RFZ/RPG Approach to Control Room Monitoring," 76th Audio Engineering Society Convention, New York (October 1984), Preprint No. 2157.

2. Barron, M. F. R., "The Effects of Early Reflections on Subjective Acoustic Quality in Concert Halls," Ph.D. Thesis, University of Southhampton (1974).

3. Rodgers, C. A. P., "Pinna Transformations and Sound Reproduction," *Journal of the Audio Engineering Society (JAES)*, Vol. 29, No. 4 (April 1981), pgs. 226-234.

4. Haas, H., "The Influence of a Single Echo on the Audibility of Speech," *JAES*, Vol. 20, No. 2 (March 1972), pgs. 145-159.

5. Jones, Douglas R., William L. Martins, and Gary S. Kendall, "Optimizing Control Rooms for Stereo Imagery," Invited Paper D-1, 110th Meeting of the Acoustical Society of America, *Journal of the Acoustical Society of America, Supplement 1*, Vol. 78 (1985), pg. S9.

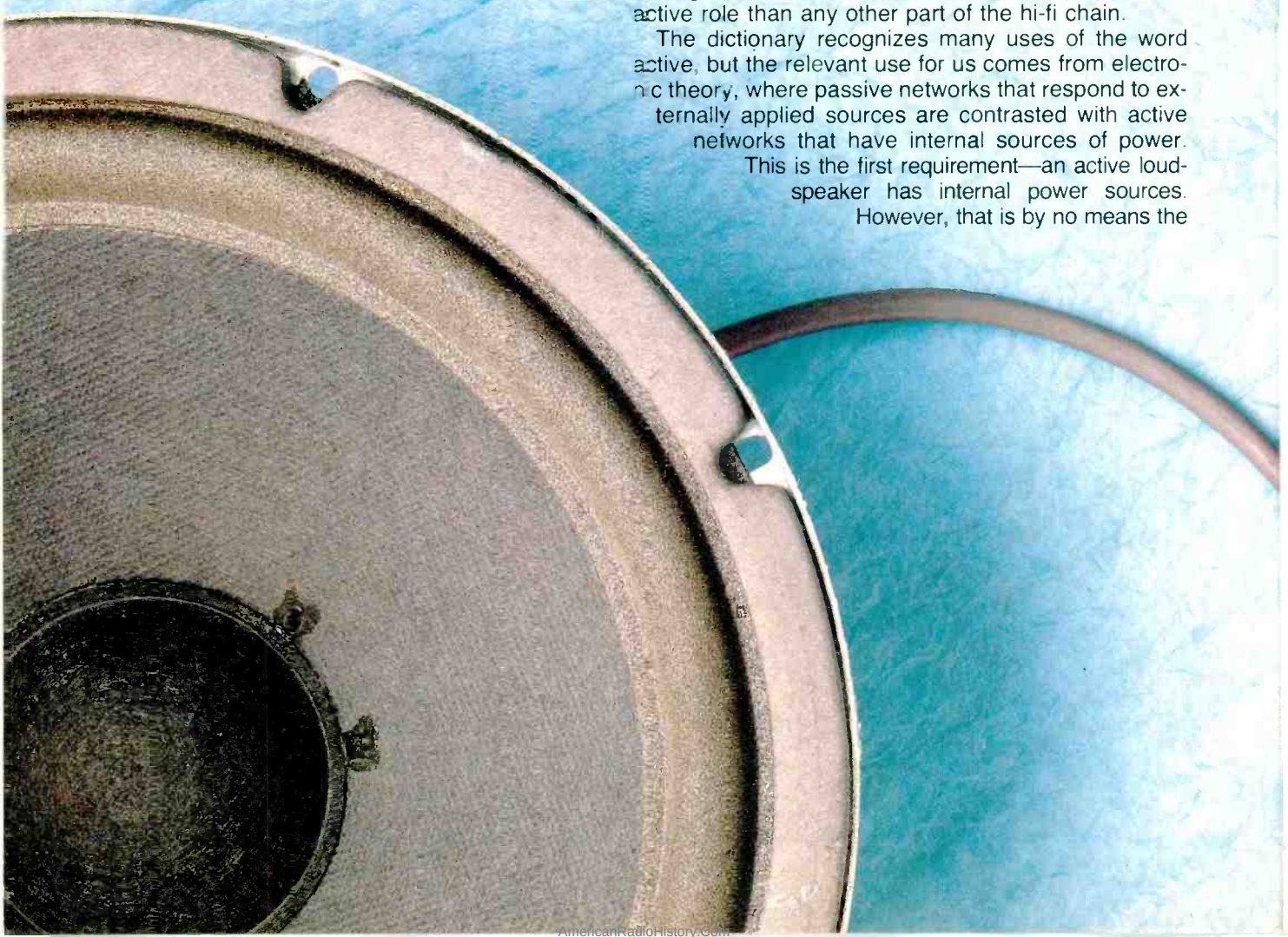
6. Schroeder, M. R., *Number Theory in Science and Communication, with Applications in Cryptography, Physics, Digital Information and Self-Similarity*, Springer, Berlin, 1986.

The Case For Active Speaker Systems

BOB STUART

To the common user, it may not seem too strange to refer to a loudspeaker as "active." After all, in reproducing music, the loudspeaker seems to play a more active role than any other part of the hi-fi chain.

The dictionary recognizes many uses of the word active, but the relevant use for us comes from electronic theory, where passive networks that respond to externally applied sources are contrasted with active networks that have internal sources of power. This is the first requirement—an active loudspeaker has internal power sources. However, that is by no means the



whole story, especially since there are passive designs which use power for establishing transduction (for example, polarization in passive electrostatic speakers or energizing in ionic designs).

Almost since the beginning of audio engineering, it has been understood that sound reproduction over the frequency and amplitude ranges of music cannot be achieved accurately by a loudspeaker with a single radiating element. The reasons are very simple and apply equally to moving-coil (or dynamic) drive units, ribbon elements, and electrostatic membranes. Essentially, flat frequency response calls for frequency-invariant sound pressure, and this can be achieved only with a transducer that produces a constant acceleration at all frequencies. Thus, to achieve the same response, a transducer has to displace greater volumes of air at low frequencies than at high frequencies. In fact, for each octave that the frequency is lowered, the displacement of the radiating element increases fourfold. Consequently, the requirements for a bass radiating system in terms of displacement are very different from those of a tweeter. In addition, the re-

Photograph: David Hamsley

Bob Stuart is Technical Director and cofounder of Boothroyd Stuart, a British firm which manufactures the Meridian line of hi-fi equipment. For several years, the line has included active loudspeakers.

only two 25-watt amplifiers to achieve the same sound. This explains why active systems can be designed to work well with lower powered amplifiers, or to produce surprisingly high levels for the apparent available amplification. If the example is carried on to three 25-watt amplifiers in a triamp system, we might find that in order to get the same volume of sound in a passive loudspeaker system, we'd need a mighty 250-watt power amp!

It is clear from the above that although an active system is harder to design, there are efficiency benefits, and it is by no means a foregone conclusion that an active system need be more expensive to build.

Bass Response

So far, I have described how a designer, by taking a multi-amped approach and by using a low-level electronic crossover, can produce real benefits in the performance of a loudspeaker system. Although there are clear differences of operation, we are still discussing the construction of an active loudspeaker so that its performance will emulate that of a passive design. There are, however, huge benefits possible if the loudspeaker is designed as a system from the outset. By using dedicated electronics, for example, it is possible to change many of the standard rules of loudspeaker system design.

In a passive loudspeaker, there exists a fixed relationship between the low −3 dB cutoff frequency (f), the volume of the box (V_b), and the efficiency (e): $e = V_b/f^3 \times K_1$ (K_1 is a constant relating to the system's design). Try as we may, in a passive system this relationship cannot be broken, and less bass or lower efficiency are the penalties of smaller cabinets.

The designer of an active system is, however, presented with several new tools which essentially allow him to alter the constant K_1 in the equation. Techniques that have been used include making the output impedance of the bass power amplifier negative to increase damping and lower the bass cutoff, or making it frequency- and/or level-dependent to squeeze extra low end or apparent efficiency from the system. The essential point here is that the response and performance of the active system can be synthesized by considering a total system of driver + box + amplifier + crossover + power supply. Other valid techniques to change the constant in the equation are the use of low-frequency boosting, auxiliary filtering, and various types of motional feedback.

Once we admit these possibilities, the design and performance of the active loudspeaker can enter a new domain. Not all the possibilities are beneficial, and some changes may introduce different problems. For example, negative or variable output impedances will lead to greater variation in manufacturing, and to changes in sound quality at different volume levels, all of which can be remedied. Motional-feedback techniques are conceptually the most intriguing, but this technology is full of pitfalls, not the least of which seems to be the general problem of low feedback factors, deciding which part of the transducer to control, etc. Motional feedback has one major disadvantage for the designer of cost-effective systems: The feedback process will, in general, produce an extension and lowering of distortion in the low-frequency output of a bass system, but only at the expense of reducing the high-frequency output of the driver. The normal analogy here is that feedback will result in a reduction of operating bandwidth of the driver due to practical limitations, and this essentially bars true motional feedback from two-way systems. No serious consideration could be given to a loudspeaker that used feedback over only part of the frequency range of a driver.

I believe all loudspeakers should be designed to be acoustically small, to achieve a near-point source radiation pattern in order that the system will give good, lifelike imaging and be easy to listen to. Not all loudspeakers are designed with this overriding consideration in mind, but when it can be achieved, its very worthwhile benefits include a more realistic sound and a smaller system to house.

The basic principle discussed above, our so-called interactive bass principle, uses a system design of cabinet, driver, port, power amplifier, and filtering in the electronic crossover. Its performance is shown in Fig. 7. The interactive bass system uses auxiliary filtering, and the particular alignment gives a sixth-order roll-off and an extra octave of bass compared with the passive speaker of the same volume and efficiency. Put another way, a passive speaker delivering equivalent bass response would need to have eight times the volume or twice the linear dimensions. The chosen alignment is also the one which minimizes the cone deflection of the bass units for a given output. This point is a very interesting one, for at first sight you might expect that all speaker systems were the same in this respect for a given output. The alignment chosen, in fact, results in cone movements one-third as great as those experienced by the same drivers on equal broad-band excitation in a passive sealed box.

To the Future

In the final analysis, the most important thing that any loudspeaker has to do is to convincingly reproduce music in a way that is easy to assimilate and relaxing to hear. My belief is that to reach those goals, the attentive designer can have a set of really powerful tools at his disposal, if he is prepared to design the loudspeaker as a system from the very beginning, and if he employs dedicated, integrated, multi-amped electronics. The system can be smaller, clearer, and just easier and nicer to use. Equally important is the fact that ease of adjustment in the factory will result in a more consistent product.

I often draw an example, contrasting the way people buy motor cars with the way they buy hi-fi systems. Clearly, it might be possible to select a car by choosing the body from one source, the chassis from another, the motor from a third, and many who did so might feel that the result was interesting, unique and so on. How many of you really feel that the end result would perform as well as a carefully balanced, integrated design from one manufacturer? Even if it accelerated well, how good would it be on the corners?

Active systems are the way forward, and even if it takes direct digital technology to ensure it, we will be seeing more and more loudspeaker designs moving this way.

It doesn't take any 批評 from anyone.

It won't stand for any guff from 300ZX. Or RX-7.

Introducing Conquest TSi, the new turbo coupe designed and built by Mitsubishi in Japan.

With a turbocharged, intercooled, fuel-injected 2.6 liter overhead cam powerplant, close-ratio five-speed transmission and up front MacPherson-type suspension. Plus front and rear stabilizer bars and oversize disc brakes with an advanced anti-lock rear brake system.

	ACCELERATION 0-50	BRAKING 60-0	SLALOM	CORNERING
300ZX	6.27 secs.	145.76 ft.	6.19 secs.	.852g's
RX-7	5.73 secs.	141.04 ft.	6.20 secs.	.852g's
CONQUEST TSi	5.53 secs.	142.25 ft.	6.14 secs.	.875g's

*Overall official U.S.A.C. test results of standard equipped TSi, 300ZX with V-6 and RX-7 with rotary engine.

All of which help explain why the 300ZX and RX-7 aren't too thrilled to see that performance chart up there.*

The profile?

Lean and low, with fenders flared to accommodate massive 16″ speed-rated radials.

And inside, there's advanced electronic wizardry, driver-oriented ergonomics and outstanding creature comforts.

The TSi is one of two Conquest models built in limited numbers and imported for Chrysler.

So test drive one soon.

And feel the sheer exhilaration of a creature that moves like greased 雷鳴と稲妻.

Conquest

Conquest is built by Mitsubishi Motors Corp. and sold exclusively at Chrysler dealers.

Buckle up for safety.

Chrysler
Division of Chrysler Motors

1

LUXMAN LV-109 INTEGRATED AMPLIFIER

Manufacturer's Specifications

Amplifier Section

Rated Power Output: 150 watts per channel, 20 Hz to 20 kHz, both channels driven into 8-ohm loads.

Dynamic Power: 240 watts per channel into 8 ohms, 400 watts into 4 ohms, 600 watts into 2 ohms.

Rated THD: 0.03% (8-ohm loads).

S/N: 107 dB, A-weighted.

Frequency Response: 5 Hz to 200 kHz (−3 dB).

Input Sensitivity: 150 mV for rated output.

Tone-Control Range: Bass, ±9 dB at 100 Hz; treble, ±6.5 dB at 10 kHz.

Loudness-Control Action: +6 dB at 100 Hz; +4 dB at 10 kHz.

Digital-to-Analog Section

Input: 0.5 V peak-to-peak, 75 ohms (Sony/Philips format).

S/N: 96 dB, A-weighted (using 30-kHz low-pass filter).

THD: 0.005% at 1 kHz.

Dynamic Range: 94 dB, A-weighted (using 30-kHz low-pass filter).

Video Section

Input: 1 V peak-to-peak, 75 ohms.

Output: 1 V peak-to-peak, 75 ohms.

General Specifications

Power Requirements: 120 V, 60 Hz, 5.5 amperes.

Dimensions: 17¼ in. W × 6½ in. H × 18⅛ in. D (43.8 cm × 16.5 cm × 46 cm).

Weight: 44.9 lbs. (20.4 kg).

Price: $1,500.

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

For literature, circle No. 90

Photograph: ©1987, Bill Kouirinis

The first unusual thing you will notice about this elegant integrated amplifier from Luxman is the fact that it has *no* phono inputs. Does this mean that Luxman has written off the analog turntable and vinyl records? Not at all. It's simply that they have chosen to separate low-level preamplification and record equalization functions from high-level signal handling. A companion component, the Luxman LE-109 phono preamplifier, can be added, if desired, but for those who plan to listen only to Compact Discs, radio, tape (both analog and digital), and the audio tracks of video program sources, Luxman decided not to add the cost of a phono preamplifier circuit. Considering the number of new system buyers who seem to be bypassing analog turntable and cartridge purchases, this makes a great deal of sense. Furthermore, the absence of a phono preamp section is offset by the incorporation of a D/A converter, in keeping with Luxman's "straight line" concept—specifically, that "the best audio reproduction is that which requires the least number of processing steps to transfer music from the source to the listener." By connecting the digital output of a CD player or DAT recorder to one of the LV-109's direct digital inputs, one can eliminate two analog signal-handling circuits (the CD player's analog output and the amplifier's analog input stages) from the audio signal path.

The LV-109 can accommodate virtually any system of audio and video components (though, as mentioned above, an external phono stage is needed for playing LP records). A TV monitor can be directly connected as well, and an extra signal-processing loop is provided for such other components as a graphic or parametric equalizer. In addition to the usual rear-panel jacks, a set of front-panel jacks has been included for easy temporary connection of another audio/video component or of separate audio and video devices. According to Luxman, the video amplifier portion of the LV-109 is flat within −1 dB from d.c. to 6 MHz, with less than 1° differential phase and 1% differential gain.

Among the other unusual features incorporated in the LV-109 is direct dubbing capability for three audio tape decks and two video decks. If desired, all of the control and switching functions, except for volume control, can be completely bypassed, with the signal sent directly from the source input selectors to the power amplifier section.

Circuit Highlights

Luxman uses what they call Voltage Driven Amplification Circuitry in the design of the LV-109. By using selected FETs in critical circuits, only voltage, and not current, is required to drive the amplifier, thereby eliminating the loading effect inherent in bipolar circuitry. The first stage of the power amplifier section consists of a differential amplifier surrounded by a cascode "bootstrap" circuit, a current-mirror circuit, and a current-mirror constant-current circuit, thus achieving high gain, high speed, and low distortion. The predriver stage is a cascode circuit using a MOS-FET of high transconductance (G_m) and having a constant-current load that makes it well suited to feed the driver stage. The power MOS-FETs used in the output stage are designed to handle up to 50 watts (with 8-ohm loads). Above that power level, signal handling is switched over to output transistors which have greater power-handling capacity.

The built-in D/A converter can handle digital input signals from such sources as a CD player with a digital output, a PCM processor, a DAT recorder, or even a broadcast-satellite tuner. Sampling frequencies of 32, 44.1, and 48 kHz are automatically recognized, and the circuit adjusts automatically for each of these frequencies. A single "clock" is used at the digital input for data demodulation and digital filtering. The digital filter is an 80th-order, linear-phase type with band ripple of only 0.09 dB, using two-times oversampling. Out-of-band attenuation is 90 dB or more at 24.8 kHz. The analog filter used in conjunction with this circuit is a fifth-order Chebychev low-pass type.

This amplifier is constructed using a box-type chassis to provide the needed strength. Inside there are three compartments, each shielded from the others. The power-supply section is in the center compartment, with the D/A stage. A second compartment houses the input sections and the third houses the control sections (tone controls, loudness circuit, etc.). The bottom plate and top cover have corrugated surfaces that help absorb external vibration, to keep such vibration from reaching sensitive internal components.

Protective circuitry incorporated in the LV-109 includes a power limiter with an appropriate time constant, a current limiter for protection against short circuits at the outputs, a thermal protector that monitors heat-sink temperatures, and a d.c. detection circuit.

Control Layout

The attractively designed black front panel of the LV-109 is divided into logically arranged sections, each of which is delineated by vertical grooves. The various selector switches take the form of squares or rectangles which are flush with the front surface. At the left are a "Power" button and its

At mid-frequencies into 8-ohm loads, the LV-109 delivered over 170 watts, and it still beat its rating at 20 Hz and 20 kHz.

associated indicator light; below them is a stereo headphone jack. The next section to the right contains three indicators which tell the user the sampling rate of any direct-connected digital program source. Also in this panel section are buttons which select the speaker outputs, activate the three tape monitor loops, disable or activate the recording outputs, and offer three options for tape dubbing ("Tape 1→2," "Tape 2→3," and "Tape 3→1/2").

The next panel section has only a single, light-colored button, the "Digital Direct" selector, which is back-lit when depressed. The rotary "Bass" control is directly below this section; to the bass control's right is the "Treble" control, a button for selecting the extra signal processing loop, a mono/stereo "Mode" button, and a rotary balance control. Above these, in the next two delineated sections, are buttons for selecting either of the two "Digital Direct" inputs, pushbuttons for selecting among the six available analog line-level inputs, and the back-lit "Line Straight" button, which is used to bypass tone controls and other line-level amplification stages for direct feed of any analog program source to the power amplifier. Along the lower right edge of the panel are three audio/video inputs that can be selected by means of a nearby "Front/Rear" pushbutton. Above these, in the rightmost delineated section, are a large master "Volume Control," an audio muting switch, and the "Loudness" switch. Luxman's familiar "L" trademark at the lower right corner of the panel, as well as all other nomenclature, is tastefully applied and clearly legible.

The rear panel carries the digital input jacks as well as the usual array of analog input jacks, color-coded binding posts for two sets of stereo speaker systems, and three convenience a.c. outlets (one switched, two unswitched). Notwithstanding the absence of phono inputs, a ground terminal—normally associated with such inputs—is also available. Two clear hookup diagrams are provided in the brief owner's manual, one for an audio component system, the other for audio/video components. Of course, a mix of both types of components is possible, providing the number of available tape monitor loops (three in all) is not exceeded.

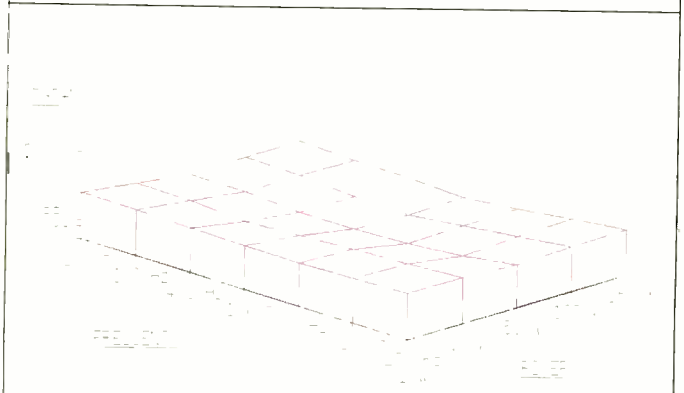


Fig. 1—Power output vs. THD + N and frequency for 8-ohm load.

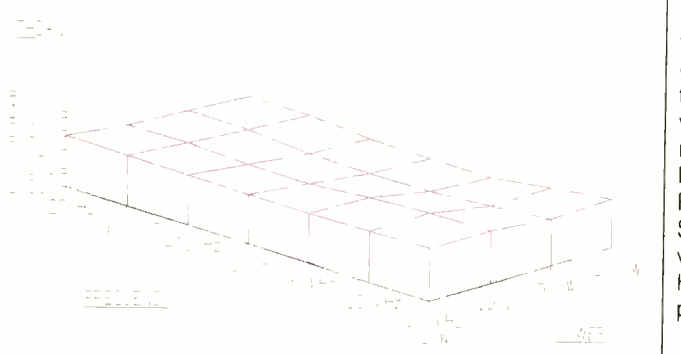


Fig. 2—Same as Fig. 1 but for 4-ohm load.

Measurements

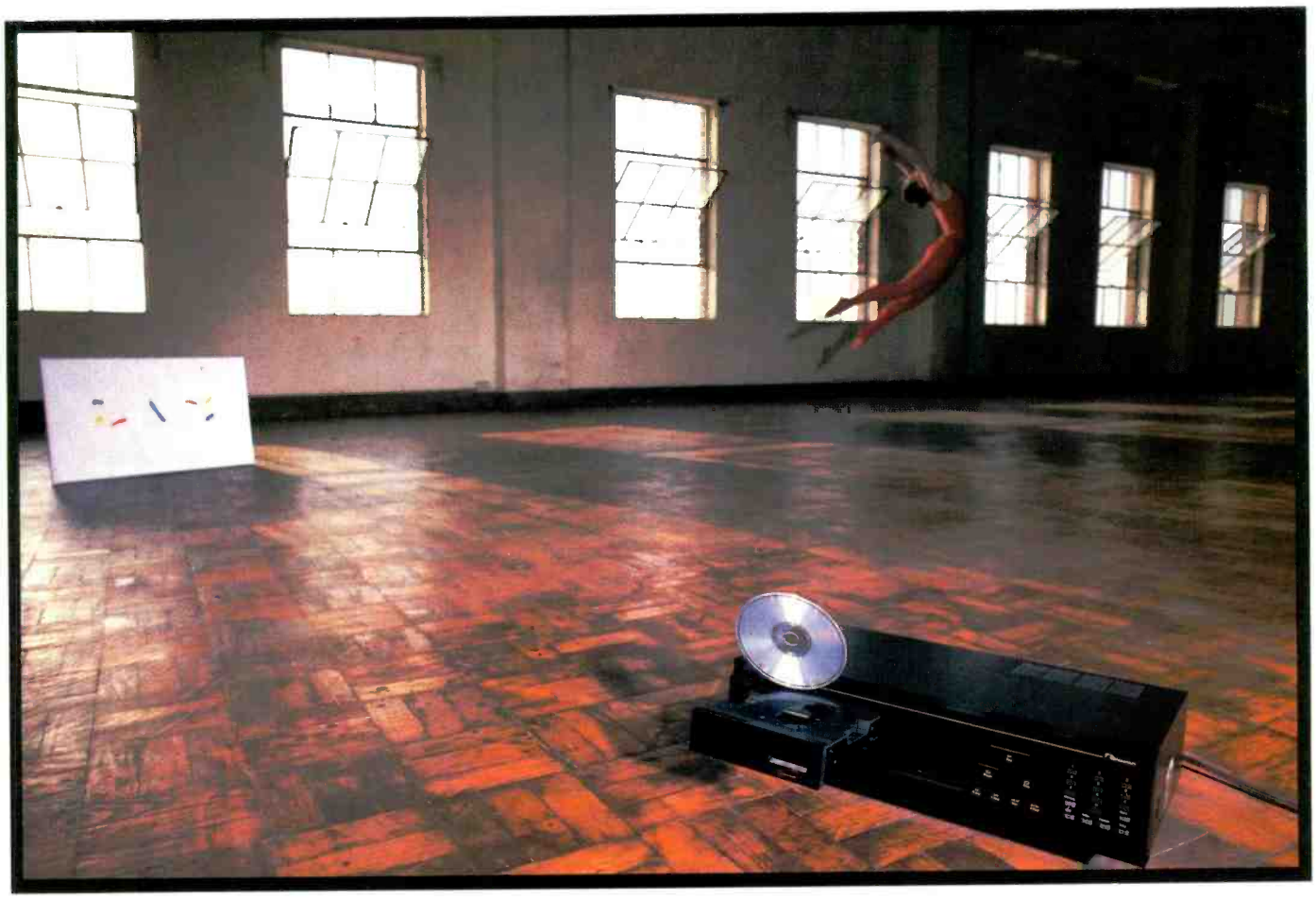
Connected to 8-ohm loads, the amplifier delivered 171 watts at 1 kHz before THD rose to its rated value of 0.03%. At 20 Hz, maximum power output for that level of distortion was 156 watts per channel; at 20 kHz, the amplifier produced 159 watts of power per channel for the same THD level. At rated output (150 watts per channel, both channels driven), THD was only 0.003% at mid-frequencies, rising to 0.006% at 20 Hz and 0.027% at 20 kHz. Figure 1 shows how distortion varied as a function of power output and frequency with 8-ohm loads. SMPTE IM at rated output, again into 8 ohms, was an infinitesimally low 0.004%, and CCIF IM measured only 0.0026%. Damping factor, measured using a 50-Hz signal and an 8-ohm load, was just over 200.

When power output tests were repeated using 4-ohm loads, distortion rose a bit, though it was still so low as to be completely inaudible until overload levels were reached. Specifically, at 240 watts per channel output, THD measured only 0.007% for a 1-kHz test signal. At the highest test frequency, however (20 kHz), THD rose, with readings of 0.04% at 100 watts output. At 20 Hz, the amplifier delivered 214 watts per channel for 0.03% distortion. Figure 2 shows the relationship of THD + N to frequency and power output levels for 4-ohm load operation.

When I first measured frequency response of the overall amplifier, I was somewhat surprised to find that the high-end cutoff points were nowhere near the frequencies specified by Luxman. While certainly adequate (the −1 dB point was at 26 kHz, the −3 dB point at 45 kHz), these cutoff points were a long way from the 200 kHz specified for −3 dB. I quickly discovered that to reach these wide-band results, the volume control had to be turned fully clockwise. In other words, the shunt capacitance from the volume control's movable arm to ground, when combined with the resistance between the volume control's arm and upper tap, formed an RC filter that caused a slight roll-off of high frequencies. Since few users are likely to operate the amp at maximum volume, the claimed frequency response is a bit misleading. However, when I did open up the control fully, the −3 dB point occurred at 200 kHz, exactly as specified.

Dynamic headroom with 8-ohm loads measured just over 1.7 dB. That means that for short-term power peaks, the amplifier can deliver as much as 240 watts per channel into 8-ohm loads or around 400 watts when driving 4-ohm loads!

You may have heard music like this in a dream.



It takes much more than an impressive array of features and specifications to realize a product of dreams.

Our company's commitment to quality and leading-edge technology has produced some of the finest audio components known to man.

At Nakamichi, our dream has always been to create the ultimate musical experience.

After all, we know that nothing can make the spirit soar like music.

Our best: The OMS-7AII, one of five unusually creative compact disc players from Nakamichi.

Nakamichi

For the name of your nearest authorized Nakamichi home audio or mobile sound dealer, please call or write:

Nakamichi America Corporation
19701 South Vermont Ave.
Torrance, CA 90502 (800) 421-2313
(800) 223-1521 (California)
Nakamichi Canada (800) 663-6358

I didn't hear a difference when switching between analog and digital inputs, which speaks well for Luxman's D/A circuitry.

Input sensitivity for all of the high-level inputs measured 12 mV for 1 watt output. For rated output, that would translate to about 147 mV, very close to the 150 mV specified by Luxman. Signal-to-noise ratio with respect to 1 watt output, referenced to 0.5 V input, measured 80 dB, and S/N with the volume control fully counterclockwise measured 87 dB.

Figure 3 shows the maximum cut and boost range of the LV-109's bass and treble controls, and Fig. 4 shows the response characteristics of the loudness circuit at various volume levels from maximum to −50 dB. One can see that the degree of compensation in Luxman's loudness circuit is linked to specific settings of the volume control. Most loudness circuits are constructed this way, instead of having a separate, continuously variable compensation adjustment. Without such a separate adjustment, it is impossible to attain proper loudness compensation for varying input program levels—and today, these levels can vary more than ever, with CD players typically delivering 2.0 V of output while tuners and analog tape decks may deliver less than 1.0 V. Compensating for these differences by means of the volume control alone means that proper loudness compensation at low listening levels cannot possibly be achieved for all connected program sources, unless those program sources also have level controls.

Use and Listening Tests

The LV-109 provides many ways in which to listen to a wide variety of musical fare. I can report with reasonable assurance that the direct or "straight line" mode of listening did provide a very subtle degree of improvement in overall sound clarity and, particularly, in my ability to single out individual instruments in a large orchestral ensemble. Since my reference CD player has a digital output jack, I was eager to feed that output to a direct digital input on the LV-109. In order to make an instant A/B comparison, I also hooked up my player's analog outputs to a set of analog inputs on the LV-109. That way, I was able to quickly switch between analog and digital CD inputs just by pressing and releasing the amplifier's "Digital Direct" button. Try as I might, I could not hear any difference between the two modes. In a way, that speaks very well for the D/A converter circuitry in the Luxman unit, since my reference CD player has one of the most linear and accurate D/A converters that I have yet measured. I suspect that if I had had a lower cost, lower grade CD player with which to conduct this test, the results might have been different. On the other hand, low-cost CD players do not have digital output jacks.

This much I can say: The digital input circuitry on the LV-109 instantly identified the sampling rate of the digital input and decoded it accordingly. Just to prove that it would work at alternate sampling rates, I hooked up my newly acquired reference DAT player. (Yes, contrary to some rumors, *it's absolutely legal to import DAT players from abroad* even while Congress debates whether or not they should require that anti-copy chips be incorporated in them!) Sure enough, when I connected the DAT player's digital output to the LV-109's digital input, and played back a recording that I had made on the DAT player, the indicator light instantly switched to 48 kHz (the sampling rate at which home recordings are made on DAT recorders), and clean, distortion-free audio filled my listening room. The quality of sound was indistinguishable from that of the CDs I had used to make the DAT recordings, despite the fact that the DAT recordings had been made from the analog outputs of the CD player. Discs which I used in this evaluation included a recently acquired London CD of Brahms' Symphony No. 1, performed by the Chicago Symphony Orchestra, and a recent Telarc release of Mozart's Symphonies Nos. 36 and 38, performed by the Prague Chamber Orchestra. A few other CDs were also used, to evaluate the reproduced quality of the human voice and that of a solo piano.

When Luxman products first appeared in this country in the mid-'70s, the company was perceived as being totally dedicated to state-of-the-art audiophile products. When management of the company was turned over to Alpine Electronics some years ago, it was feared that the product mix would be changed so as to appeal to a broader, more price-conscious audience. Indeed, for a couple of years that seemed to be the case. I am happy to report that Luxman has once again returned to the design philosophy that won them a pre-eminent reputation in their home market. With this flagship integrated amplifier, Luxman sound and quality are back where they belong—in a superb class by themselves.

Leonard Feldman

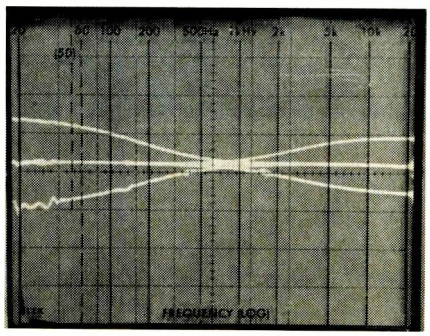


Fig. 3—Tone-control characteristics.

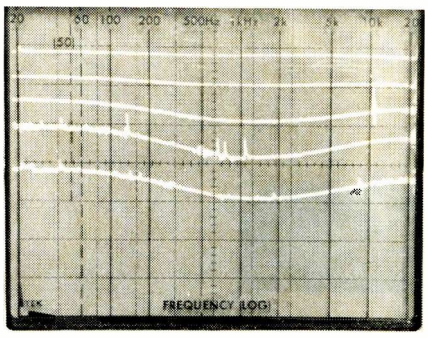


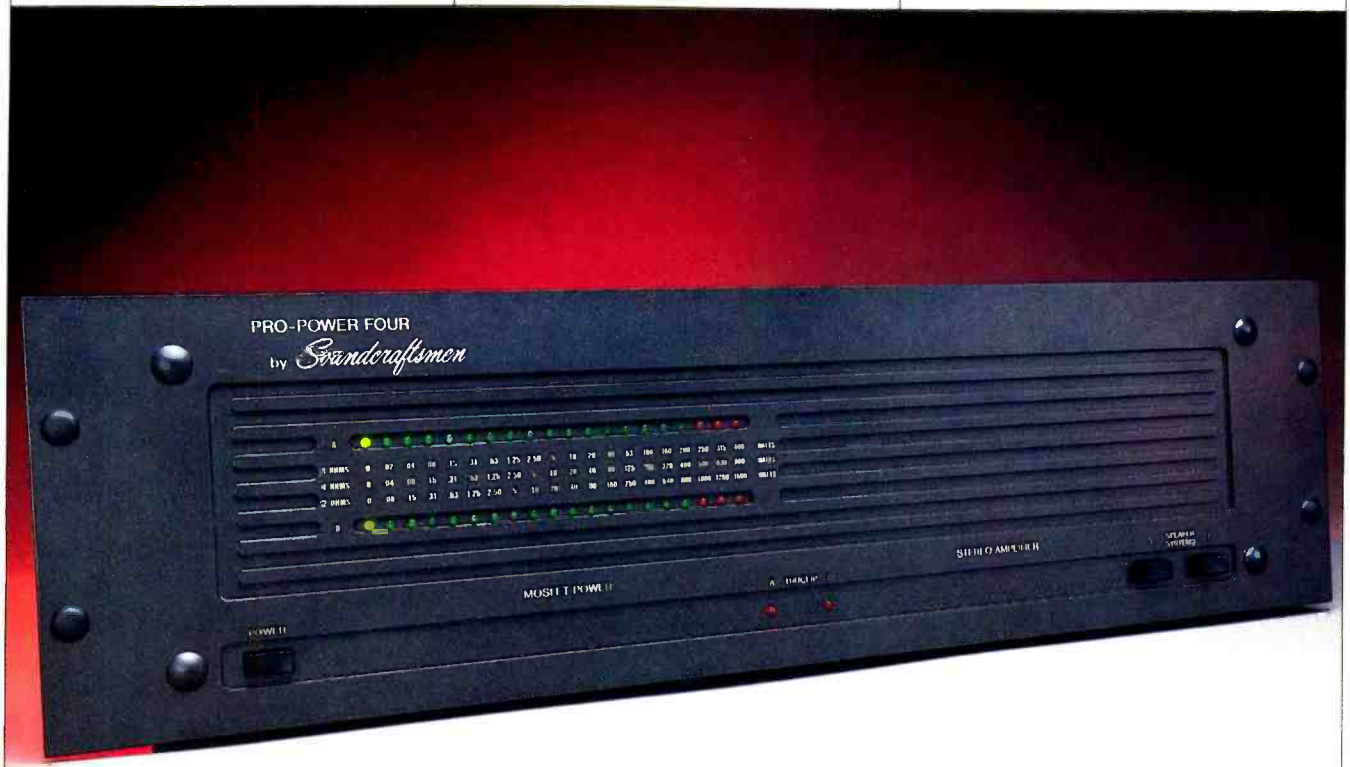
Fig. 4—Loudness-compensation control characteristics at various volume levels, from maximum to −50 dB.

2

SOUNDCRAFTSMEN PRO-POWER FOUR AMPLIFIER

Manufacturer's Specifications

Power Output: 205 continuous watts per channel, 20 Hz to 20 kHz, into 8-ohm loads; 300 watts per channel into 4 ohms; 450 watts per channel into 2 ohms; bridged mode, 900 watts into 4 ohms.
Rated THD + N: 0.05%.
Frequency Response: 20 Hz to 20 kHz, +0, −0.3 dB; −1.2 dB at 5 Hz, −2.1 dB at 100 kHz.
SMPTE IM: Less than 0.02%.
S/N: 105 dB, A-weighted, re: rated output.
1-kHz Power at Clipping: 237 watts into 8 ohms, 333 watts into 4 ohms.
Damping Factor: Greater than 200 at 50 Hz into 8 ohms.
Dynamic Power: 250 watts into 8 ohms, 420 watts into 4 ohms.
Sensitivity: 76 mV for 1 watt output into 8 ohms.
Dimensions: 19 in. W × 5¼ in. H × 11 in. D (48.3 cm × 13.3 cm × 27.9 cm).
Weight: 30 lbs. (13.6 kg).
Price: $749.
Company Address: 2200 South Ritchey, Santa Ana, Cal. 92705.
For literature, circle No. 91



For some reason that I have never been able to fathom, Soundcraftsmen, the California-based company which offers a wide variety of professional and home audio equipment, has never gotten the credit and recognition that it deserves. Perhaps it's because the company's management refrains from flamboyant advertising and promotion.

Did you know, for example, that it was Soundcraftsmen's engineers who first designed, developed, and marketed so-called "Class-H" signal-tracking power-supply circuitry, way back in 1976?

The Pro-Power Four amplifier represents another Soundcraftsmen innovation and advancement in power-supply

THE ADCOM GFP-555
PREAMPLIFIER

A remarkable combination of exceptional performance, flexibility and value.

The GFP-555's musical performance is outstanding–by any measurement or listening criterion. For example, *Stereophile** calls it "one of the most satisfying preamps around in terms of overall tonal balance... You can go back to it after a few weeks and still feel it to be basically right; it reveals most associated equipment as more colored than itself."

At the same time, the GFP-555 is surprisingly affordable. Again, from *Stereophile**: "It outperforms several 'competitors' from the $2500 bracket... you may well find that you just saved $1500 to use on new speakers, turntables, CD players, or wine."

Here are just a few examples of how we did it. The GFP-555's gain path includes the most innovative state-of-the-art linear amplifiers ever used in high fidelity components, and is simple and direct from input to output.

The speed of the gain stages is almost fifty times faster than CD or LP signals. And the noise and distortion measurements are incredibly low. Direct coupling makes possible a frequency response from below 1 Hz to beyond 400,000 Hz.

Superb construction, incorporating regulated power supplies with large filter capacitors, provides superior performance no matter how widely the musical signal or AC line voltage may fluctuate.

As for flexibility, you can listen to any source while taping from another. There's an unusual number of inputs and outputs, plus adjustable phono gain and capacitance.

If you'd like the full story of this remarkable preamplifier and the review from *Stereophile**, please write. Of course, the fastest way to hear its demonstrably superior combination of sonic performance, flexibility and value is to visit your nearest Adcom dealer.

**Vol. 9 No. 7 (Nov. 1986)*

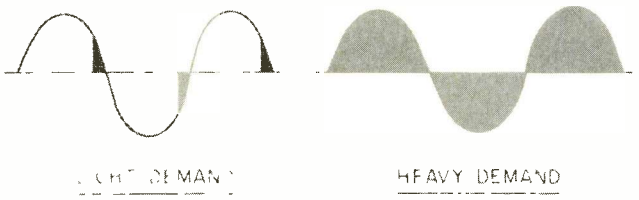
ADCOM®

11 Elkins Road, East Brunswick, NJ 08816 201-390-1130

Distributed in Canada by PRO ACOUSTICS, INC.,
Pointe Claire, Quebec H9R 4X5

Enter No. 1 on Reader Service Card

Soundcraftsmen believes continuous power is more important to musicality than peak power; thus, dynamic headroom is low.



A B

Fig. 1—With light demand, Phase Control Regulation delivers power-supply voltage for only a portion of each a.c. cycle (A); with heavy demand, the entire cycle is used (B).

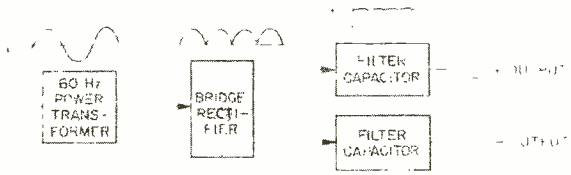


Fig. 2—Block diagram, conventional amplifier power supply. (See text.)

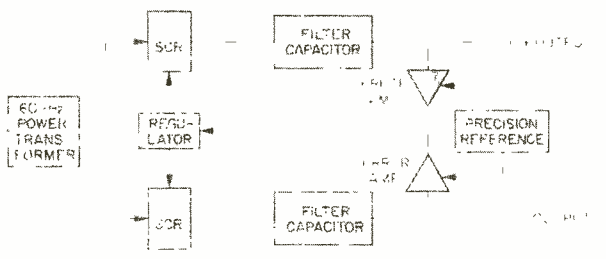


Fig. 3—Block diagram, Soundcraftsmen's Phase Control Regulation circuit. (See text.)

design. The unique circuit employs what the company calls Phase Control Regulation, but it has nothing to do with audio phase response of the amplifier itself. Rather, PCR is a highly efficient means of controlling the average power supplied to the amplifier's output stages. It involves a process of rapid switching which connects and disconnects an a.c. supply to a load for an optimized fraction of each a.c. cycle. With very light signal demand (Fig. 1A), a small fraction of the a.c. cycle is used to provide power. With heavy demand (Fig. 1B), the full cycle is used.

To fully understand the benefits of PCR, consider the block diagram of Fig. 2, which depicts a more conventional amplifier power supply. The a.c. line voltage is supplied to a power transformer, which isolates the line while providing whatever output voltage the circuit requires. The voltage is full-wave rectified by the bridge rectifier, supplying pulsating d.c. which is then filtered by capacitors to provide a d.c. voltage at the output. Figure 3 shows a block diagram of Soundcraftsmen's Phase Control Regulation circuit. Input a.c. voltage is applied to the power transformer for line isolation and input voltage adjustment. The a.c. voltage from the transformer's secondary winding is rectified by silicon controlled rectifiers (SCRs) and smoothed by filter capacitors to provide d.c. During operation of the amplifier, this d.c. voltage is constantly compared to a reference voltage, and an error-eliminating signal is applied to the Phase Control Regulator. It is this regulator which controls the conduction time of the SCRs, maintaining the output voltage at a precise, fixed level. The positive and negative output voltages go to the supply rails for the amplifier stages. (For a more extensive description of how PCR works, see the review of Soundcraftsmen's PCR800 amplifier in the August 1984 issue.)

This method of regulating the power supply has a lot to do with the Pro-Power Four's power output capabilities. Most conventional amplifiers have poor supply-voltage regulation. As the load demands more power, the amplifier's d.c. supply voltages tend to drop. This can significantly reduce power output during operation at high volume levels, especially when dynamic peaks of more than a few milliseconds are encountered. Soundcraftsmen's approach differs from others in that they believe continuous power to be of greater importance to accurate musicality than peak power. The test of dynamic headroom which I perform on amplifiers involves the use of a 20-mS burst of a 1-kHz signal, followed by 480 mS of a 1-kHz signal at a level 20 dB lower. This is designed to replicate what happens to an amplifier when it is handling short-term musical peaks. Almost all amplifiers can deliver power levels well above their continuous ratings for such a short period. Soundcraftsmen's engineers maintain that accurate musical reproduction of the complex content of a very loud musical note requires far more than a 20-mS time frame. Thus, in their high-powered amplifier designs (of which the Pro-Power Four is certainly one), the emphasis is on maintaining high output power over the long term, or continuously, rather than for 20 mS as dictated by the IHF Dynamic Headroom test. All of this serves to explain why the Pro-Power Four exhibited rather minimal dynamic headroom during my tests, but more than met its continuous power output ratings with both 8- and 4-ohm loads. And, of

You get out of our new Sherwood S-2770R CP digital remote-control receiver what you put into it. Like your TV audio. Your VCR audio and video. Your compact disc player. Your turntable. Your tape deck. Your everything. All in stereo. At 74 watts per channel.

The S-2770R CP even has the ability to synthesize stereo from monaural sources, such as normal broadcast and cable TV. Add an extra pair of speakers in the back of your entertainment room and turn it into a theater.

The S-2770R CP can decode rear channel information present in most stereo sound and video programs. Video tapes of movies you buy or rent are made from films originally shown in theaters, where rear channel sound is all part of the experience. The S-2770R CP lets you recreate that surround-sound experience right in your own home.

You also get full video dubbing capability through permanent rear panel connections, or through conveniently located jacks on the front for those occasions you need a second VCR. There's more:

The wireless remote to control all of your components from across the room. A quartz digital AM/FM tuner with 16 presets. A digitally controlled seven-band graphic equalizer/spectrum analyzer with five different EQ memory settings. Auto/manual scan tuning. Loudness and sub-bass EQ. —20dB mute function. An LED signal-strength indicator.

All so you can put everything you've got (or intend to get) into it, except a lot of money. Just ask any of the dealers listed below. They'll prove to you that Sherwood stops at nothing to give you better, more enjoyable, live-performance sound — whatever you're listening to — at a surprisingly affordable price.

Sherwood®
LIVE PERFORMANCE SOUND™

Southern California — Leo's Stereo, (213) 537-7070, Maryland — Luskins, (301) 799-9000, New England, Georgia — Lechmere, Chicago area — Musicraft, (312) 991-7220, Ohio — Sun T.V., (614) 445-8401, New York Metro, Eastern Pa., Connecticut — Crazy Eddie, (201) 248-1410

Put Everything You've Got Into It. Except A Lot Of Money.

Enter No. 29 on Reader Service Card

S/N ratio measured 82 dB referred to 1 watt output, and CCIF IM was an almost imperceptible 0.0025% for 8-ohm loads.

course, since 205 watts per channel is more than adequate for driving most modern speakers to lifelike loudness levels and beyond, there's no need to be concerned with short-term power peaks beyond this high level of power.

The output stages utilize power MOS-FETs particularly suited to the high current requirements that are of such importance when reproducing digital program sources. The use of MOS-FETs eliminates the need for conventional current-limiting protection circuitry. Each channel is protected from overheating by a system of thermal sensing devices that control the speed of an internal cooling fan and, if necessary, reduce the power-supply voltages. MOS-FETs are costlier than bipolar devices having similar power ratings, but the extra expense is evidently balanced out by cost savings in the Pro-Power Four's power supply (brought about by the PCR circuit) and by somewhat simpler mechanical packaging.

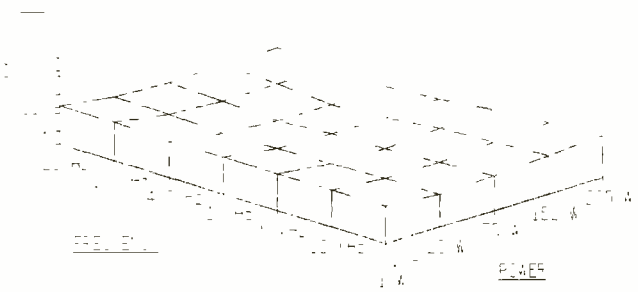


Fig. 4—THD vs. power and frequency, with amp driving 8-ohm load.

Fig. 5—Same as Fig. 3 but with 4-ohm load.

Control Layout

The Pro-Power Four's 19-inch front panel, like that of Soundcraftsmen's professional amplifiers, extends beyond the width of the chassis proper, so the unit can be rack-mounted easily. Two rows of LEDs, horizontally positioned across much of the front panel's left half, indicate peak power levels and are calibrated for 8-, 4-, and 2-ohm loads. The first 17 LEDs in each row are green and the last three are red, to indicate the approach of clipping level. (Actual clipping is indicated by a separate pair of LEDs located at the center of the panel's lower edge.) The leftmost pair of green LEDs serve as power-on indicators and remain lit even in the absence of an input signal. The first pair of LEDs to indicate actual power output are calibrated at 0.02, 0.04, or 0.08 watt, for 8-, 4-, or 2-ohm operation respectively. A "Power" switch at the lower left and a pair of speaker selector pushbuttons at the lower right complete the front-panel layout.

Centered between the air intake and exhaust areas on the rear panel are color-coded, five-way binding posts for speaker connection. Up to two pairs of speakers may be used with the Pro-Power Four. However, if the speakers are rated at less than 4 ohms, only one pair should be used. Because speaker impedances often dip below their nominal ratings at some frequencies, paralleling two 4-ohm speakers on each channel could result in impedances of less than 2 ohms at the frequencies in question. A pair of phono-tip input jacks are positioned alongside the speaker terminals. There are no input level controls.

Measurements

Connected to 8-ohm resistive loads, the Pro-Power Four did not reach its rated THD + N of 0.05% until it was delivering 231 watts of continuous power per channel, both channels driven, at 1 kHz, as against only 205 watts claimed by Soundcraftsmen. For a 20-Hz test signal, output power for rated THD + N was 214 watts; at 20 kHz, output power reached 226 watts for the same distortion level. At the rated power output level of 205 watts per channel, THD + N measured a very low 0.004% at mid-frequencies, 0.005% at 20 Hz, and 0.018% at 20 kHz. SMPTE-IM distortion was only 0.005% at rated output; the amplifier could be driven to 233 watts per channel before the IM reading increased to its rated value of 0.02%. How distortion varies as a function of power output and frequency is illustrated in Fig. 4 for 8-ohm loads and in Fig. 5 for 4-ohm loads.

Soundcraftsmen rates this amplifier at 300 watts per channel into 4-ohm loads for the rated THD + N level of 0.05%. It did just a shade better than this at mid-frequencies, delivering 302 watts per channel. However, it couldn't quite make the 300-watt level for a distortion reading of 0.05% at 20 Hz or at 20 kHz. Distortion for 300 watts of output at 20 Hz measured 0.3%, and at 20 kHz it increased to 0.4%. To reduce THD to the rated 0.05% at these fre-

The concert continues with the Ford JBL Audio System.

Imagine the music of 12 speakers driven by 140 watts...

Just imagine a car audio system that could really deliver music as rich and powerful as a live concert.

Imagine music emanating from 12 JBL speakers—specifically equalized and adjusted to the surrounding environment and deftly capable of reproducing digitally accurate full-range, high fidelity sound.

- 12 JBL speakers including 2-6" × 9" woofers, 2-3½" midrange speakers and 2-⅞" tweeters located in the rear deck; 2-5¼" woofers mounted in the doors; and 2 tweeters and 2 midrange speakers in the instrument panel. Selective frequency fading so all woofers remain in operation at controlled levels when faded front/rear.

Imagine the sheer impact of 140 watts of total system power. Ample power to virtually eliminate distortion for the most comfortable listening—even at high volume for very long periods of time.

- 140 watts TSP—4 amplifiers, 35 watts per channel into 4 ohms at 1000 Hz with .07% THD. 105 dB SPL maximum acoustic output. Excursion control computer with continuously variable loudness compensation and automatic overload protection.

Then stop imagining and hear the real thing for yourself, exclusively at your Lincoln-Mercury dealer today.

JBL loudspeakers are featured in world renowned sound systems everywhere, including Tokyo's NHK Hall, Los Angeles Music Center, Tanglewood Music Shed, Frankfurt Opera House and now the Lincoln Continental and the Lincoln Town Car.

Ford JBL

AUDIO SYSTEMS

You can spend five times as much as what this amp costs, but you won't get a better, more reliable, or more musical unit.

quency extremes, I had to back down until power output was 267 watts at 20 Hz and 255 watts at 20 kHz.

Damping factor at 8 ohms, referred to a 50-Hz test signal, was 205, allowing for the minimal resistance of my heavy-gauge speaker cables. Signal-to-noise ratio measured 82 dB referred to 1 watt output. Soundcraftsmen chose to quote S/N with respect to full rated output. Since 205 watts is 23.12 dB greater than 1 watt, that would put my reading relative to rated output at 105.12 dB, almost exactly the figure quoted by Soundcraftsmen. Input sensitivity for 1 watt output was 75 mV referred to 8-ohm loads.

CCIF IM (twin-tone intermodulation distortion) measured an almost imperceptible 0.0025% at 8 ohms and 0.003% at 4 ohms. Frequency response extended from 5 Hz to 60 kHz for the −1.0 dB roll-off points and from 2.5 Hz to 125 kHz for the −3 dB cutoff points. As I expected, dynamic headroom was very low, only 0.4 dB at 8 ohms and 0.6 dB at 4 ohms. As I have often pointed out, dynamic headroom is an informational specification and not a qualitative one. The low dynamic headroom of this amplifier is in keeping with Soundcraftsmen's avowed design philosophy of using "stiff," well-regulated power supplies.

Use and Listening Tests

I hooked up this powerful amplifier to a variety of speaker systems, including my reference KEF 105.2s and a pair of B & W Model 300s. I even used a pair of fairly low-cost units, DCM's Time Frame TF250 speakers, being careful not to exceed their 100-watt maximum power rating. One way of describing the performance of this carefully designed amplifier is to say that it brought out the best in all of the loudspeaker systems with which I tried it. I sensed an effortlessness about the musical crescendos reproduced from some of my CD "spectaculars."

After having confirmed the fact that great gobs of dynamic headroom are not necessary if you have adequate continuous power available, I settled down to more musical fare and confirmed, in my own mind, what Soundcraftsmen president Ralph Yeomans maintained in the final paragraph of a recent letter to me. "Above all else in importance is musicality. We have listened to A/B tests of each one of our MOS-FET amplifiers, including the Pro-Power Four, and in each case we find it absolutely impossible to detect any real difference in superb sound reproduction between our models and the very finest amplifiers made." I'll amplify this a bit and say that there *is* a major difference between the Pro-Power Four and some of the finest amps I've ever listened to. That difference is *price!* In my view, you can spend two, three, even five times as much as what the Soundcraftsmen Pro-Power Four costs but you won't get a better, more reliable, or more musical-sounding power amplifier.

Leonard Feldman

Your loudspeakers may well have some of the most advanced drive units and crossovers in the whole world.

Even so, something is still standing between all the natural sound they produce and your ears.

The loudspeaker cabinet walls.

When the drive units vibrate, they will make the cabinets vibrate as well. Stopping the complete sound spectrum that comes from the drive units from ever reaching you.

This effect is known as colouration. And it's the reason you're always conscious that you are listening to music produced by two loudspeakers rather than a truly live concert performance.

INSIDE EVERY BOX IS THE NATURAL SOUND STRUGGLING TO GET OUT

Colouration is a great barrier to pure sound reproduction. Loudspeaker manufacturers all over the world have been searching for a way to break through it.

Now B&W have finally done it. With an invention that's the most exciting and important breakthrough in loudspeaker technology that even they have made in the last 20 years.

It's the Matrix series of new digital monitors. The first ever loudspeakers to totally eliminate the colouration from the loudspeaker cabinet.

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

For more information please contact: B&W Loudspeakers of America, Box 653, Buffalo, NY 14240 (416) 297-0595

Enter No. 4 on Reader Service Card

3

NAD 7220PE RECEIVER

Manufacturer's Specifications

FM Section

Usable Sensitivity: Mono, 10.8 dBf.
50-dB Quieting: Mono, 14.4 dBf; stereo, 37 dBf.
S/N: Mono, 80 dB; stereo, 74 dB.
THD: Mono, 0.1% at 1 kHz, 0.2% at 100 Hz and 6 kHz; stereo, 0.1% at 1 kHz, 0.3% at 100 Hz and 6 kHz.
Frequency Response: 30 Hz to 15 kHz, ±0.5 dB.
Capture Ratio: 1.5 dB.
Selectivity: 58 dB.
AM Rejection: 60 dB.
Image Rejection: 70 dB.
I.f. Rejection: 90 dB.
Subcarrier Rejection: 60 dB.
SCA Rejection: 60 dB.
Stereo Separation: 45 dB.

AM Section

Usable Sensitivity: 5 μV.
S/N: 45 dB.
THD: 0.5%.
Selectivity: 30 dB.
Image Rejection: 45 dB.
I.f. Rejection: 35 dB.

Amp and Preamp Section

Power Output: 20 watts per channel, 20 Hz to 20 kHz, 8-ohm loads.
Rated THD: 0.04%.
Dynamic Headroom: 4.4 dB at 8 ohms.
Clipping Power, 1 kHz: 25 watts per channel at 8 ohms.
Dynamic Power Per Channel (Short Term): 55 watts at 8 ohms, 75 watts at 4 ohms, 85 watts at 2 ohms.
Damping Factor: Greater than 30 at 8 ohms, 50 Hz.
SMPTE IM: Less than 0.04%.
CCIF IM, IHF IM, and TIM: Less than 0.04%.
Input Sensitivity for 1 Watt Output: Phono, 0.55 mV; high level, 33 mV.
S/N (A-Weighted): Phono, 75 dB re: 5 mV input; high level, 84 dB re: 1 watt output.
Phono Overload: 200 mV at 1 kHz, 20 mV at 20 Hz, 1,700 mV at 20 kHz.
RIAA Accuracy: ±0.5 dB.
Frequency Response: High level, 20 Hz to 20 kHz, +0.5, −1.0 dB.
Tone-Control Range: Bass, ±10 dB at 50 Hz; treble, ±7 dB at 10 kHz.
Infrasonic Filter: −3.0 dB at 15 Hz, 24 dB/octave.

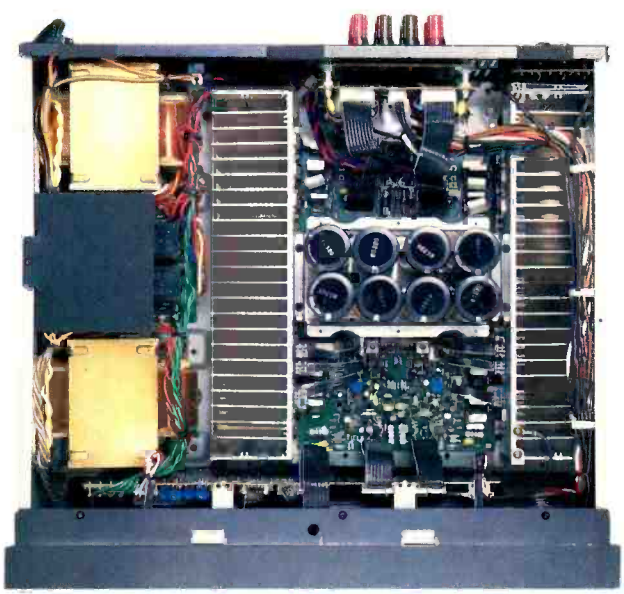
General Specifications

Power Consumption: 120 V, 50/60 Hz a.c., 150 watts.
Dimensions: 16½ in. W × 3⅜ in. H × 10¾ in. D (42 cm × 8.6 cm × 27.3 cm).
Weight: 12.1 lbs. (5.5 kg).
Price: $278.
Company Address: 575 University Ave., Norwood, Mass. 02062.
For literature, circle No. 92

NAD has always eschewed the bells, lights, and whistles approach to audio product design. Judging from its front panel, the 7220PE might well be characterized as the "plain Jane" of stereo receivers. Yet, when you look behind that rather drab front and begin to explore its innovative circuit design, solid construction, and consistently high-quality performance, you can't help but wonder how NAD is able to market this receiver at such a low, low price.

Circuit Description

Since circuit innovation is what makes this an outstanding performer, let's discuss that first. To begin with, don't be put off by the low continuous power rating of 20 watts per channel into 8-ohm loads. NAD had to specify that low power level to conform with FTC rules, but I know I don't listen to continuous steady-state tones and I'll bet you don't either. In the real world of musical listening, the 7220PE's unusual power supply, the heart of what NAD calls their Power Envelope circuit, can deliver short-term peaks that are 4.4 dB greater than the nominal continuous power rating. That would bring the total up to about 55 watts per channel. In fact, my measurements of dynamic headroom were even a bit better: 4.8 dB. In terms of power, that works out to be just a shade over 60 watts per channel!



The 7220PE's interior (left) is uncluttered, and its rear panel (below) includes two unusual switches (see text).

Another feature of the receiver prompted me to reminisce about the time when vacuum tubes and output transformers were used in all audio amplifiers. In those days, the secondary windings of output transformers had taps at different impedances so that optimum impedance matches could be obtained for speaker loads of 4, 8, or 16 ohms. In somewhat similar fashion, NAD has provided an impedance switch on this receiver. In its 8-ohm position, maximum output voltage is provided for loudspeakers of 8 ohms or higher. In its alternate, 4-ohm setting, voltage is lowered but current capacity is correspondingly increased to allow driving lower impedance speakers or two pairs of speakers wired in parallel.

A "soft-clipping" circuit developed by NAD, when switched on, gently limits the waveform if the output transistors are driven into saturation. Those who believe "tube sound" is superior to "solid-state sound" will appreciate this feature—especially if they tend to play music at loud levels that might exceed the amplifier's short-term power output capacity.

Another enhancement found in the 7220PE is an infrasonic filter. Unlike most built-in subsonic "rumble" filters that have a shallow roll-off characteristic of 6 dB/octave, this one has a 24-dB/octave slope with a cutoff point of 15 Hz.

Those who still think that "tube sound" is superior will appreciate the NAD's soft clipping, especially if they play loud music.

This receiver employs frequency-synthesis tuning, and the FM front-end uses a dual-gate MOS-FET which provides adequate sensitivity while resisting overload or cross-modulation distortion at high signal levels.

Control Layout

At the left of the matte black front panel is a green "Power" button, with a stereo headphone jack immediately to its right. A button labelled "Extra Speakers" follows.

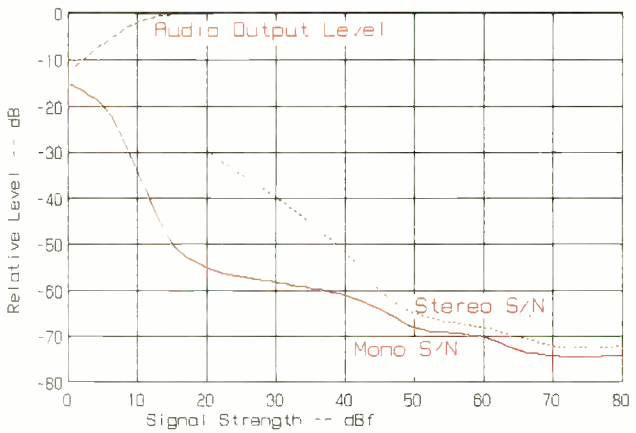


Fig. 1—Mono and stereo quieting characteristics, FM section.

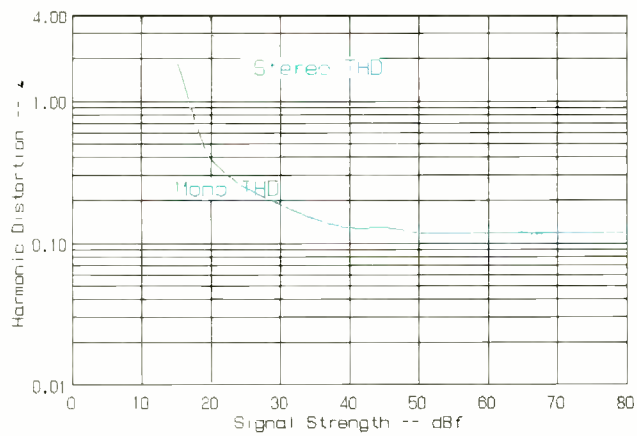


Fig. 2—Mono and stereo THD characteristics, FM section, at 1 kHz.

NAD's approach here is to give the user only the option of turning a second set of speakers on and off—the system's primary speakers are always on. The owner's manual offers tips on how to connect a second set of speakers for "ambience recovery," should you want that kind of sound enhancement; of course, the second set of speakers can also be wired in the conventional manner for use as a stereo pair in another room. "Bass," "Treble," and channel "Balance" knobs, each with a center detent position, come next. After these are a "Tape Monitor" button (only one tape monitor loop is provided) and a cluster of five matching input selector buttons. In keeping with current trends, the two high-level inputs are identified as "CD" and "Video." These, of course, are nothing more than extra high-level audio inputs which can be used for any stereo program source you wish. The next pair of pushbuttons are for mono/stereo switching and turning on loudness compensation. A large rotary "Volume" control knob is at the extreme right of the panel; just above it is a momentary rocker switch for up and down tuning.

The upper center section of the panel houses the frequency display, five station preset buttons, "FM Stereo" and "Center Tune" indicator LEDs, an "Enter" button for memorizing up to five FM and five AM station frequencies, and a "Search" button. When "Search" is in its depressed position, touching the tuning bar causes the tuner to seek the next usable FM or AM signal.

As ergonomically ideal as the front panel of this receiver seems to be, it's clear that somebody wasn't thinking as carefully when they designed the back panel. The antenna terminals are, in my opinion, both poorly labelled and poorly configured. If your FM antenna's 300-ohm twin lead comes with handy spade lugs, you'll have to cut them off and strip the wires to feed them into the spring-loaded terminals provided for antenna connection. In all fairness to NAD, I should mention that the supplied twin-lead dipole antenna does have its leads stripped back at the connection point, so you won't need to use any tools if you choose to use it. Still, you'll have to be careful when you connect its two wires: One of them should go to the terminal for 300 ohms and the other to the adjacent terminal for 75 ohms—not to the terminal marked "G" for ground. On the other hand, if your FM antenna has a 75-ohm coaxial line, you'll have to cut off the standard F-type connector. Then you'll have to strip back and braid the cable's outer shield and strip some insulation from the inner conductor to fit into the 75-ohm and ground terminals. If you want to listen to AM, you must connect a wire to the "AM Antenna" terminal, as there is no built-in antenna. NAD does provide a length of wire for this purpose (which, in most instances, is all you'll need), but the omission of the usual loopstick is unusual.

The phono input jacks are at the extreme left end of the rear panel, with a ground terminal conveniently located nearby. The remaining sets of input jacks and tape output jacks are beneath the antenna terminals. Farther to the right are the "Soft Clipping" switch, two color-coded sets of spring-loaded speaker terminals (not unlike the antenna terminals), the previously discussed "Impedance" switch, and convenience a.c. receptacles (one switched and one unswitched).

"McIntosh . . . no other transistor amplifier is capable of reproducing as well."

"All the sounds, even those different one from another, remain separated and distinctive. There results a sensation of contrast, precision, and uncommon clarity.

. . . A close analysis of different frequencies reveals an extremely deep bass, very rich in spatial detail . . . The upper bass region is very linear testifying to an extraordinary richness of information. The very structured mid-range contributes enormously to listening pleasure.

The feeling of power is never refuted and instead of stunning the listener, the 7270 recreates an audio environment of a majesty that *no other transistor amplifier is capable of reproducing as well.*" Need we say more?

—REVUE DU SON, foremost French stereo magazine.

For a copy of the REVUE DU SON and information on the McIntosh MC 7270 Amplifier and other McIntosh products write:

McINTOSH LABORATORY INC.
P.O. Box 96 EAST SIDE STATION, DEPT. A47
BINGHAMTON, NY 13904-0096

Enter No. 19 on Reader Service Card

The FM frequency response was excellent. It deviated by only 0.1 dB at 15 kHz, where some tuners are off by 2 or 3 dB.

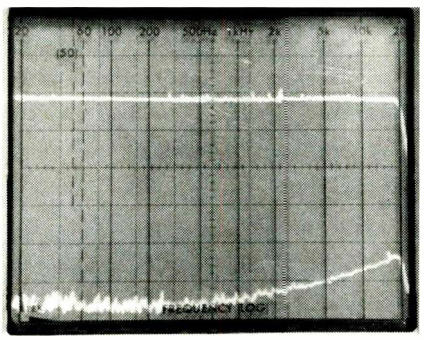


Fig. 3—FM frequency response (top trace) and separation vs. frequency (bottom trace).

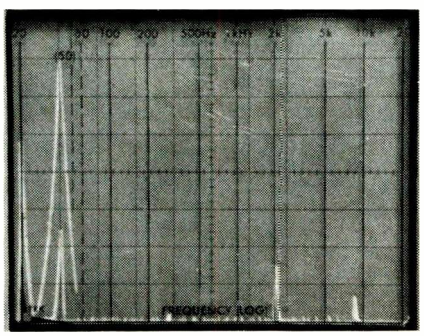


Fig. 4—Separation and crosstalk components for a 5-kHz FM modulating signal.

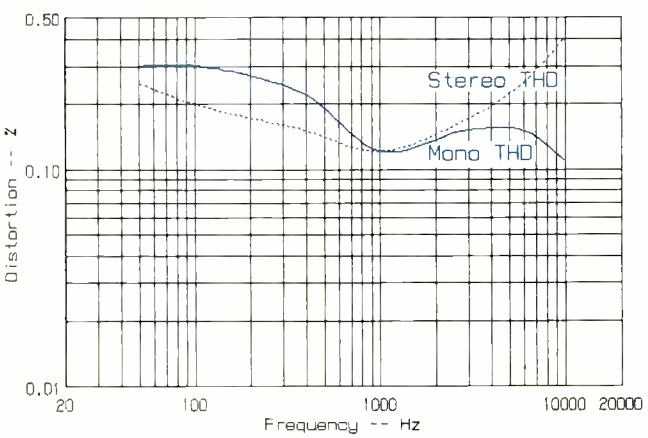


Fig. 5—THD vs. frequency, FM section.

Tuner Measurements

Mono usable FM sensitivity measured 11.0 dBf, very close to the 10.8 dBf claimed by NAD. Stereo usable sensitivity, not specified by NAD, was 20 dBf. Signal-to-noise ratios for strong input signals, as seen in Fig. 1, fell somewhat short of NAD's claims, measuring 74 dB in mono and 72 dB in stereo. Figure 2 shows how THD varied with increasing signal strength. At 65 dBf, both mono and stereo THD at 1 kHz measured 0.12%, just slightly higher than the 0.1% specified.

The tuner's FM frequency response and stereo separation are shown in Fig. 3. Response (top trace) was excellent, deviating by a mere −0.2 dB at the low frequency extreme and by an insignificant 0.1 dB at 15 kHz, where most FM tuner sections exhibit roll-offs—as much as 2 or 3 dB in some cases. Separation (bottom trace) at 1 kHz was nearly 50 dB; at 100 Hz and 10 kHz, separation remained a more than adequate 45 and 43 dB, respectively.

Figure 4 shows what was present at the receiver's left and right outputs when a 5-kHz signal was used to modulate only one channel of the FM tuner's input signal. The difference in height between the tall spike at the left and the shorter one within it represents separation, about 45 dB. (The vertical scale is 10 dB per division.) The components at the extreme right of the photo are sidebands surrounding the suppressed 38-kHz subcarrier. Note that, at least within the 70-dB dynamic range of this analysis, there is evidence neither of any 19-kHz residual pilot signal nor of any other distortion components at the output of the unmodulated channel. All of this speaks well for the FM tuner's phase linearity and the effectiveness of its multiplex decoder.

Figure 5 shows how distortion varied with frequency for strong FM signals in mono and stereo. Below 900 Hz or so, stereo THD was actually a bit lower than mono THD, but this situation was reversed at higher frequencies.

Capture ratio was 1.8 dB. AM rejection was surprisingly high, almost exactly the claimed 60 dB. I.f. and SCA rejection, at 90 and 60 dB, met specification. My measurements of selectivity (62 dB) and image rejection (75 dB) were somewhat higher than the claimed values (by 4 and 5 dB, respectively). Subcarrier rejection, 70 dB, was far better than claimed, a full 10 dB greater than NAD's spec. Spurious-response rejection, not specified by the manufacturer, was 85 dB. No interstation muting is provided on this tuner; stereo threshold was 20 dBf.

The high-frequency response of the AM tuner section was not significantly better than that of most receivers' AM sections. Still, it must be said that over the useful range of response that was provided (up to around 3.0 kHz), response was very uniform, as shown in Fig. 6. Many AM tuner sections I've tested in the past have tended to roll off both the bass and the treble; this one maintained good bass response down to 20 Hz.

Amplifier Measurements

The amplifier section of the 7220PE produced 30.8 watts of continuous power per channel at mid-frequencies into 8-ohm loads. At 20 Hz, maximum continuous power for the rated THD of 0.04% was 26 watts; at 20 kHz, the amplifier delivered 30 watts per channel for the same THD level. The

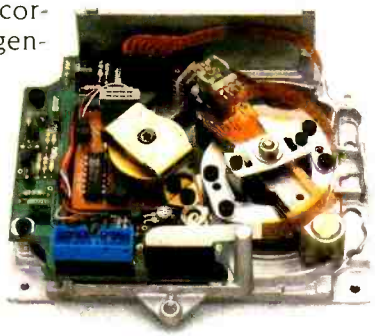
Revox B226: Digital at the Vanishing Point

Connect a new Revox B226 CD player to a very high quality home audio system. Load it with a superbly recorded disc. Sit back, press "play" on the IR remote control . . . and something peculiar happens.

The B226 virtually disappears.

What you hear is pure music. Nothing added, nothing taken away. No harshness, no grittiness, no coloration, no shrinking, no softening, no etching. Nothing except all the depth, dynamics, and subtle nuances of a live musical performance.

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 dirty or damaged discs.

In the crucial analog output stages, Revox uses strictly professional grade components. B226 circuit boards meet the same performance and reliability standards as boards made for our Studer professional mastering recorders. Little wonder, since both come from the same plant in the Black Forest of West Germany.

Essentially, then, the B226 delivers a purity and transparency of sound that challenges "custom conversion" units. But without sacrificing convenience and flexibility.

With Revox you still get full programmability of virtually every imaginable function, plus digital outputs for audio and CD-I/CD-ROM, fixed and adjustable audio outputs with ample voltage for directly driving power amps, and the convenience of infrared remote control with multi-room capability.

For a convincing demonstration, visit your nearest authorized Revox dealer. Slip your favorite CD into a B226, sit back, and listen to digital audio at the vanishing point.

STUDER REVOX

1425 Elm Hill Pike, Nashville, TN 37210
615-254-5651

Enter No. 33 on Reader Service Card

Clearly, the impedance switch does optimize the match between the output stages and the load for maximum power transfer.

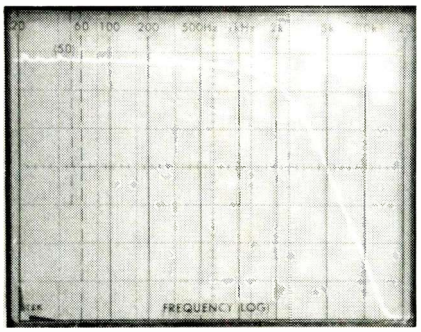
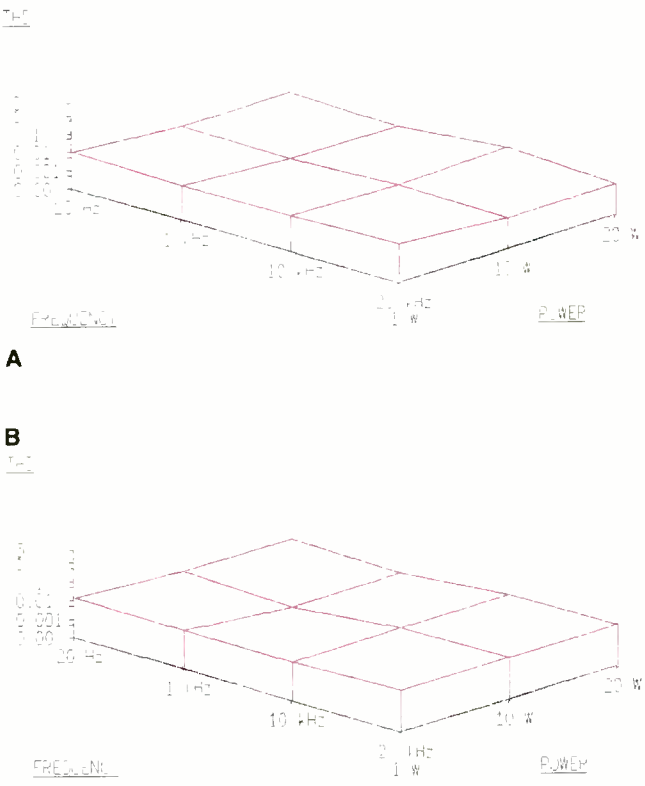


Fig. 6—AM frequency response.



A

B

Fig. 7—THD vs. frequency for three power levels, with 8-ohm load (A) and 4-ohm load (B).

"three-dimensional" plot of Fig. 7A shows how distortion varied with power output at four different test frequencies: 20 Hz, 1 kHz, 10 kHz, and 20 kHz. At rated power output (20 watts per channel, continuous), THD was a mere 0.0035% at 1 kHz, 0.0045% at 20 Hz, and 0.019% at 20 kHz. SMPTE-IM distortion measured only 0.006% at rated output. Using a reference power level of 20 watts per channel, dynamic headroom for 8-ohm operation measured an amazingly high 4.8 dB, thanks to NAD's unique Power Envelope design. Damping factor at 8 ohms, using a 50-Hz test signal, measured 56 as against NAD's minimum claim of 30.

NAD does not provide a continuous power rating for 4-ohm operation. Nevertheless, I measured this parameter in much the same way that I did for 8 ohms. Results for the four major test frequencies are plotted in Fig. 7B. I should note that these measurements were made with the receiver's impedance selector switch in the 4-ohm position. Just out of curiosity, I checked to see how much power would be delivered into 4-ohm loads if the switch were left in the "wrong" (8-ohm) position. For 0.04% THD, the amplifier delivered an amazingly high 68 watts per channel at 1 kHz when the switch was properly set, as against only 41.6 watts per channel when the switch was improperly set. At the frequency extremes, the differences were not as great. The amplifier produced 38 watts at 20 Hz and 45.5 watts at 20 kHz with the impedance switch properly set to 4 ohms; with the switch set to 8 ohms and the amplifier still connected to 4-ohm loads, maximum output at 20 Hz and 20 kHz measured 33 watts and 39 watts, respectively. In any case, it's very clear that this impedance switch does optimize the match between the output stages of the receiver and the load for maximum undistorted power transfer. Assuming an arbitrary continuous power rating of 35 watts per channel into 4-ohm loads, dynamic headroom measured 3.5 dB. This means that for peaks of short duration, as much as 78 watts per channel is delivered—actually a bit more than the 75-watt "Dynamic Power" specification published by NAD for these operating conditions.

Figure 8, a plot of the boost and cut range of the bass and treble controls, illustrates yet another well-designed feature of the amplifier/preamplifier section. Notice that in the mid-range—from around 200 Hz to about 3 kHz—there is practically no tone-control action even when the bass and treble controls are rotated fully clockwise and counterclockwise (as they were for this test). This type of tone-control action will allow you to vary the strength of the bass and the crispness of the treble detail without changing the overall timbre of a singer's voice or the sound balance of solo instruments. Such would not be the case if the tone controls had their turnover or pivot points smack in the midrange area between 500 Hz and 2 kHz, as so many tone-control circuits do.

Loudness compensation, plotted for various volume settings in Fig. 9, was very moderate, imparting no more than about 5 or 6 dB of bass boost and less than 3 dB of treble emphasis at low listening levels. Overall frequency response from the high-level inputs to the speaker outputs was flat to within −1.0 dB from 17 Hz to 35 kHz. The −3 dB point occurred exactly at 15 Hz, as determined by the built-in subsonic filter, while high-end roll-off reached −3 dB at

ONE STEP IN THE MAKING OF A KEF

'Most speaker companies buy their drivers from somebody else. Either they don't know how to make their own, or they just can't be bothered. Here at KEF, we've been building our own drive units for over 25 years.

'We're very fussy about our ingredients – bextrene, neoprene, nomex, cast aluminium and such. And I better do a good job in putting everything together. Because the lads in the laboratory test every single driver.

'They test for mechanical tolerances. They test for frequency response. Then they test the completed systems. There surely must be easier ways to make speakers. But not better.'

KEF
The Speaker Engineers

MODEL C60

'We make a better speaker starting at the very beginning.'

—Jean Britt, KEF DRIVE UNIT CONSTRUCTOR

Enter No. 15 on Reader Service Card

KEF Electronics Ltd., Tovil, Maidstone, Kent ME15 6QP, England
KEF Electronics of America Inc., 14120-K Sullyfield Circle, Chantilly, VA 22021 703/631-8810
Smyth Sound Equipment Ltd., 595 Rue du Parc Industriel, Longueuil, Quebec, Canada 514/679-5490

I have minor complaints, but if you're on a budget and looking for a great value, give a listen to the NAD 7220PE.

50 kHz. Phono frequency response conformed closely to the RIAA playback characteristic with absolutely no deviation above 400 Hz and with a maximum deviation of only +0.3 dB at 30 Hz.

Input sensitivity for the phono section, for 1 watt output, measured 0.55 mV, while the high-level inputs required 30 mV of signal to produce 1 watt output into 8-ohm loads.

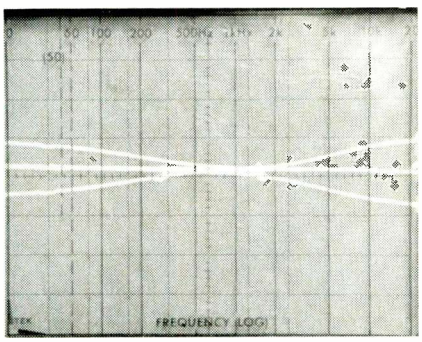


Fig. 8—Tone-control range; see text.

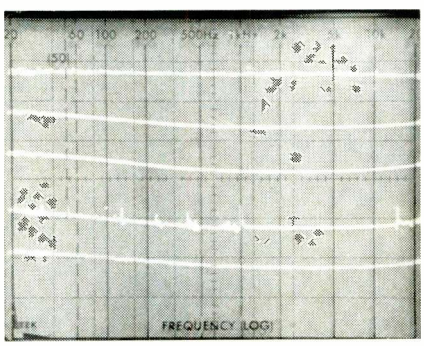


Fig. 9—Loudness-control characteristics at various volume settings.

Phono overload for a 1-kHz input signal measured 225 mV, well above the already impressively high 200 mV claimed by NAD. Phono and high-level hum and noise were identical, a notably high 81 dB below 1 watt output. At minimum volume, residual noise was 94 dB below 1 watt.

Use and Listening Tests

The advantages of the Power Envelope design (large dynamic headroom) became immediately apparent when I hooked up the 7220PE to my low-efficiency reference speakers. While in truth I wasn't able to develop nearly as much sound power as I normally get when these speakers are hooked up to my reference (200 watt/channel) amplifier, the clean loudness levels that I did achieve were far more than I would ever have expected from a receiver whose "official" continuous power rating is only 20 watts per channel. In fact, when I substituted a somewhat more efficient pair of speakers that have a sensitivity rating of around 89 dB per watt at 1 meter, I was able to get as much SPL as I would reasonably ever want. Normally, these same speakers have required amplifiers whose power ratings were at least in the range of 60 to 75 watts. At all listening levels below clipping, I found the sound to be well balanced and reasonably transparent. With the receiver's soft-clipping switch turned on, even moderate amounts of overload seemed tolerable.

I missed having some sort of signal-strength indicator for the FM tuner section, but I did find that the center-tune indicator was completely accurate. I think you will appreciate the fact that the 7220PE's FM section tunes in increments of only 50 kHz. This will be useful if you pick up FM signals from a cable TV system which carries them at nonstandard frequencies. It may also prove helpful in dealing with adjacent-channel interference; if the desired signal is strong enough, off-tuning the set by 50 kHz may get rid of the adjacent-channel crosstalk (or other forms of interference) without causing severe distortion. Off-tuning worked in at least two cases in my metropolitan New York listening area, where radio stations seem to be stacked practically one on top of the other.

I sort of wish that some form of interstation muting had been provided too, since quite a bit of popping noise was generated as the tuner moved up and down the dial in manual or search tuning mode. I quickly learned to avoid this noise by reducing volume levels while tuning from one signal to another.

If I were to rate the 7220PE's sections in terms of performance and quality, I'd put the amplifier first and the preamplifier next. The tuner was only average in its performance. Although certainly adequate for most AM and FM listening environments, it is not as sensitive or selective as more expensive, separate tuners generally are.

For all my minor complaints, however, there's no denying that this receiver is attractively priced considering the performance it delivers. After all, many people pay as much or more for separate components that offer no more (and often less) than this all-in-one unit. If you're on a tight budget and are looking for great value in an audio receiver, I suggest that you have a look at—and a listen to—the NAD 7220PE.

Leonard Feldman

ONE STEP IN THE MAKING OF A KEF

'For decades, loudspeaker design was a matter of random trial and error. Engineers had no systematic means of identifying and correcting development problems.

'At KEF, computerised testing and computer-aided design have changed all that. For example, KEF's computerised modal analysis enables me to pin-point troublesome cabinet vibrations. And it helps me determine the most effective countermeasures.

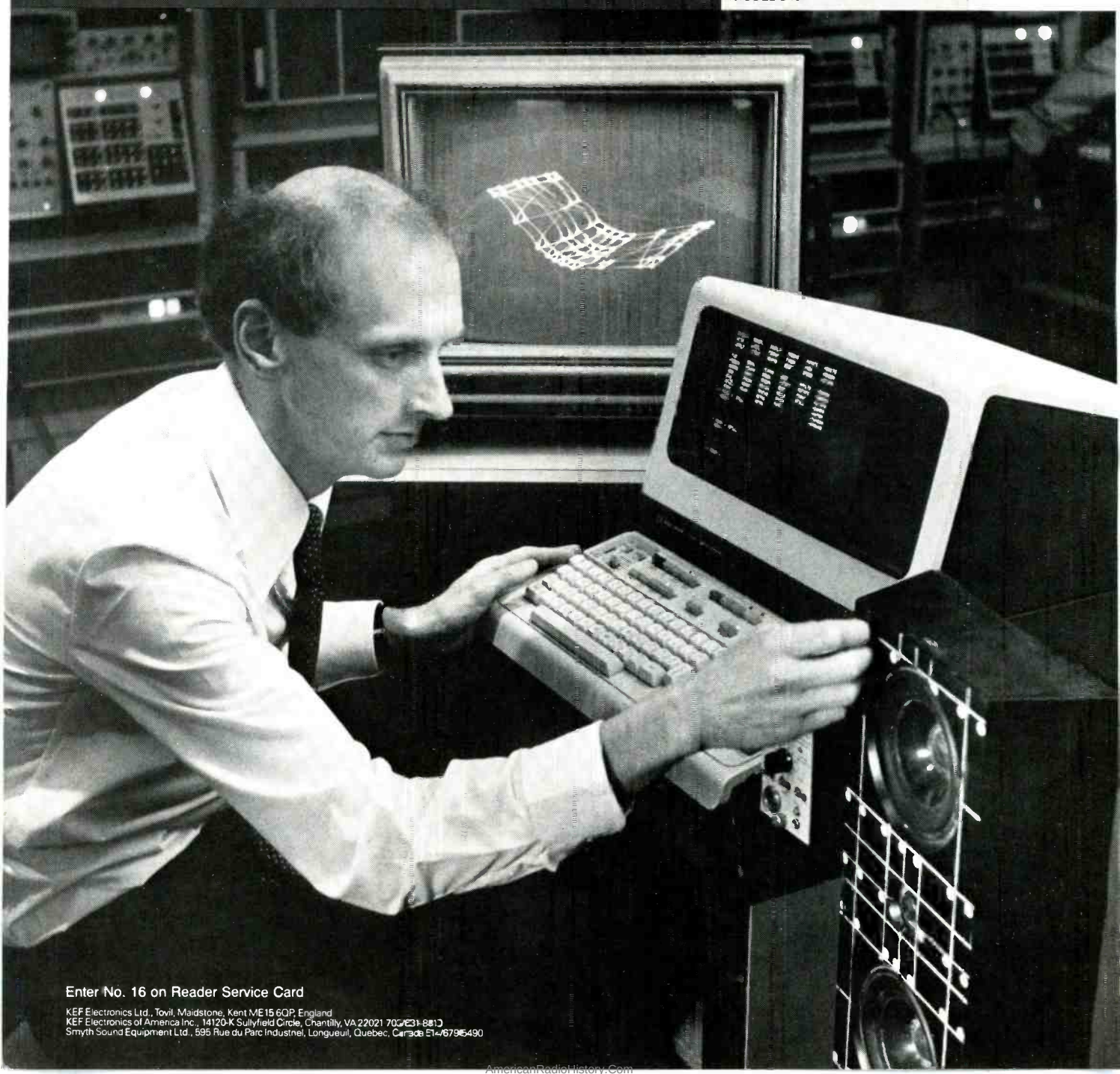
'While computers will never take the place of innovative engineering, they do enable us to examine and perfect loudspeaker performance as never before.'

KEF
The Speaker Engineers

MODEL C40

'By the time we build the final prototype in wood, we've already "built" dozens on computer.'

— Tim Barton, KEF SENIOR RESEARCH ENGINEER



Enter No. 16 on Reader Service Card

KEF Electronics Ltd., Tovil, Maidstone, Kent ME15 6QP, England
KEF Electronics of America Inc., 14120-K Sullyfield Circle, Chantilly, VA 22021 703/631-8810
Smyth Sound Equipment Ltd., 595 Rue du Parc Industriel, Longueuil, Quebec, Canada 514/679-5490

After the mountains of Europe, the canyons of North America pose no problem for a Blaupunkt.

For a Blaupunkt car stereo, the radio reception difficulties created by big city buildings are no big deal.

Because ever since the first

Blaupunkt was introduced in 1932, our tuners have had to overcome much bigger obstacles.

The Alps.

The Pyrenees.

The Apennines.

These European mountain ranges make even the towering headquarters of modern mega-corporations appear puny by contrast.

Yet thanks to the ingenuity of our 326 car audio engineers in Hildesheim, West Germany, Blaupunkt car stereos are superbly equipped to handle even the most extreme FM reception problems.

You see, a car stereo's ability to capture an FM radio signal is determined by five factors: FM sensitivity. Selectivity. Multi-path distortion. Signal attenuation. And RF intermodulation.

Most car stereo systems do a reasonably good job with two—perhaps three—of these factors.

But due to the persistence of our engineers—and the dozens of patents we've earned in this area alone—Blaupunkt's CODEM III and ORC II dynamic tuning systems do exceptionally well in all five areas.

Which helps explain why Blaupunkt has earned a reputation for engineering the world's finest tuners.

We even take the trouble to design our own antennas.

Something not one of our competitors bothers with.

So if you're an urban motorist frustrated by all those buildings wreaking havoc with the signals of all your favorite stations, pay a visit to your independent Blaupunkt car stereo specialist. (For the one nearest you, please call us at 1-800-237-7999.)

What you hear will be music to your ears.

Without all the static you've been accustomed to.

BLAUPUNKT

Designed for people with ears. And something between them.

Enter No. 5 on Reader Service Card

4

KYOCERA DA-710CX COMPACT DISC PLAYER

Manufacturer's Specifications
Frequency Response: 5 Hz to 20 kHz, ±0.5 dB.
THD: 0.005%.
Dynamic Range: Greater than 95 dB.
S/N: Greater than 95 dB, A-weighted.
Number of Programmable Selections: 24.
Separation: Greater than 90 dB at 1 kHz.
Output Level: Line, 2.0 V rms; headphone, 40 mW into 8 ohms.
Phase Response: 80° from 20 Hz to 20 kHz.
Power Requirements: 120 V a.c., 60 Hz, 16 watts.
Dimensions: 18⅛ in. W × 3 9/16 in. H × 12⅛ in. D (46 cm × 9 cm × 30.8 cm).
Weight: 12 lbs., 9 oz. (5.7 kg).
Price: $800.

Company Address: 100 Randolph Rd., Somerset, N.J. 08873.
For literature, circle No. 93

Kyocera's latest entry in the CD player category is a far cry from their earlier models. The DA-710CX has every imaginable convenience feature, and its circuit innovations and mechanical construction place it at the very highest pinnacle of performance and sound quality. Since the name Kyocera is an acronym based on the words Kyoto Ceramics, it is no surprise that the DA-710CX utilizes ceramic materials: Four ceramic spacers are strategically located in the chassis to isolate key components from external vibration, and zirconia-ceramic guide shafts assure smoother travel of the laser pickup transport mechanism for greater tracking stability.

Kyocera's literature notes that while other manufacturers are just now coming around to the use of true 16-bit D/A converters plus four-times oversampling, the DA-710CX actually represents the third generation of Kyocera players to use this digital-to-analog conversion technique. But the DA-710CX goes far beyond that in its circuit innovations. Of course, it employs separate D/A converters for each channel, but it also uses optical coupling to isolate the digital stages from the analog section, in order to prevent digital noise from leaking into the analog output. Other technical features of the DA-710CX include a direct digital subcode output port, third-order Bessel-derived analog filters, a three-beam laser tracking system, and gold-plated output contacts.

As for convenience features, the DA-710CX offers a complete assortment, including 24-track programming and an illuminated 20-key panel for direct access to tracks. The usual forward and backward "skip" functions are provided, as are repeat of a track, a set of programmed tracks, or a whole disc. Fast forward and reverse are also provided. There's even a button for playing all the tracks of a disc in random order. Sony was first to offer this feature in some of their players; they dubbed it "Shuffle Play." Kyocera calls it "BGM," and though I read the owner's manual carefully, I could not for the life of me discover what the abbreviation stands for. So I called Kyocera, and learned that BGM stands for "Back Ground Music." Of course, of course! While programming is possible only for tracks, you can, in the normal access and play mode, begin playback from an index point if you wish (providing, of course, that the disc in question has encoded index flags).

A fluorescent display presents a wide variety of status indications as well as current track number and elapsed or remaining time. Additional features include a headphone output jack with its own volume control, and play activation via an external timer. The 39-function remote control supplied with the unit duplicates all of the front-panel functions except for power turn-on. The DA-710CX can also be operated using Kyocera's RC-101/RT-102 System Remote Control, a network that integrates any compatible Kyocera receiver, cassette deck, and CD player into a single wireless remote-control system.

Control Layout

The "Power" on/off button and a "Timer" switch are at the left end of the front panel, beneath the disc drawer. To the right of the drawer, at panel center, is the large display area. In addition to track and time information, it offers alphabetic

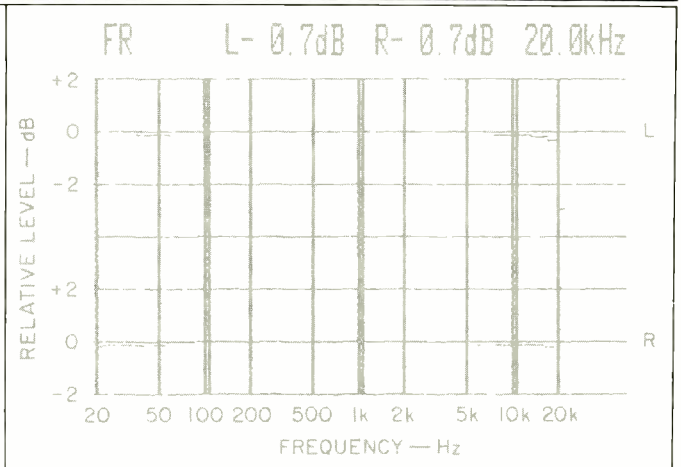


Fig. 1—Frequency response, left (top) and right channels.

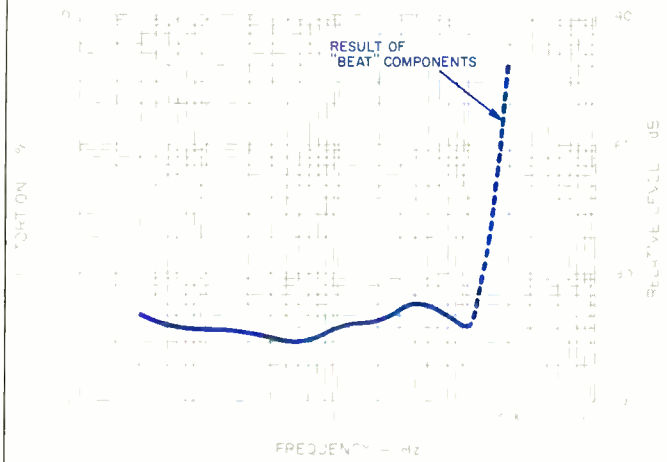
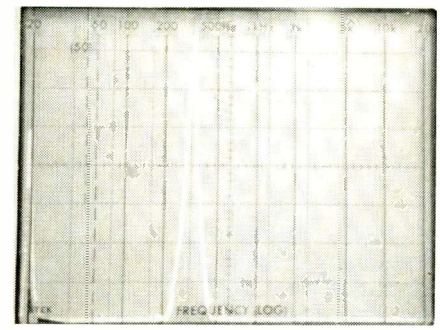


Fig. 2—THD vs. frequency at 0-dB (maximum) recorded level. Dashed line shows effect of out-of-band "beats" rather than true distortion.

Fig. 3—Spectrum analysis of 20-kHz test signal. Sweep is linear from 0 Hz to 50 kHz.



The fluorescent display offers a wide variety of status lights—even small indicators to tell you the type of repeat mode in use.

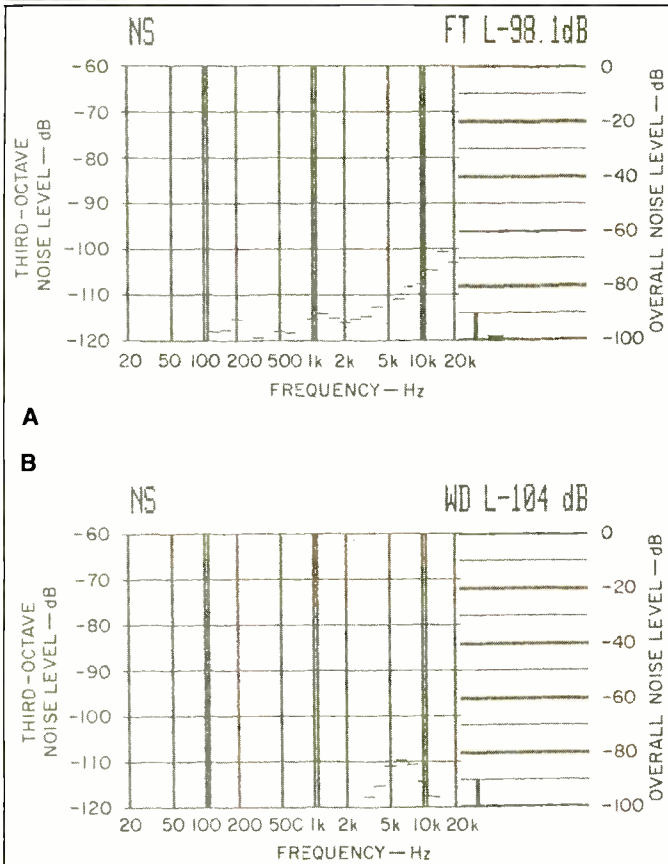


Fig. 4—S/N analysis, both unweighted (A) and A-weighted (B).

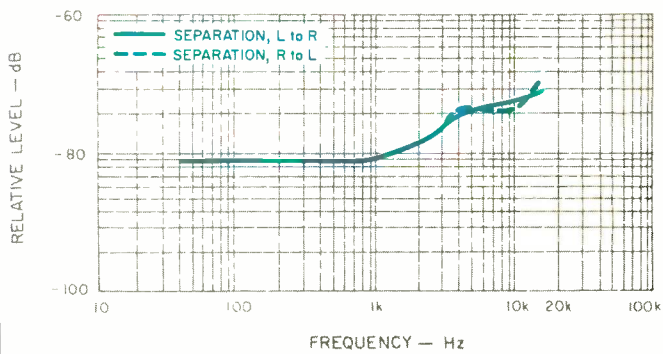


Fig. 5—Separation vs. frequency, from left to right and from right to left channels.

displays such as "Set Disc," "Play," and "DIR" (direct track call-out), among others. There's also a "Play/ Pause" indicator and small lights to tell you which type of repeat-play mode has been engaged ("One" track, "All" tracks, or the musical phrase between predetermined points "A-B"). The "Open/Close" button and the basic operating controls are to the right of the display, as are such secondary control buttons as "Repeat," "A-B," "Time Remain," "Index," and "BGM." Further to the right are the 20 numbered buttons used for direct track or index access and for programming. Additional buttons needed for programming are located below the 20 numbered buttons. A stereo headphone jack and its output level control are at the extreme right.

On the rear panel are the usual pair of output jacks, the digital (subcode) output port, and a "Remote Input" to which Kyocera's optional remote control center, mentioned earlier, can be connected.

Measurements

Figure 1 shows the frequency response at the output of each channel when playing back a swept-frequency test signal from below 20 Hz to above 20 kHz. At 20 kHz, I measured an attenuation from reference level of 0.7 dB for each channel. 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 as a function of frequency is plotted in Fig. 2. At 0-dB (maximum) recorded level, THD at 1 kHz was only 0.004%; even more important, *without interposing a low-pass filter of any kind*, I found only a very slight rise in apparent distortion when THD at high frequencies was measured. In other words, the usual "beats" outside the audio band when playing a 20-kHz test signal were hardly noticeable on my spectrum analyzer (Fig. 3).

Unweighted signal-to-noise ratio (Fig. 4A) measured 98.1 dB. When an A-weighting network was added in the measurement path (Fig. 4B), S/N increased to 104 dB, about the highest A-weighted figure I have obtained from any CD player. Dynamic range, specified as "greater than 95 dB," was in fact very much greater than that conservative figure. Measuring in accordance with the EIAJ Standard (and the future EIA Standard), I obtained a reading of 110 dB. This result was arrived at by adding the measured THD for a −60 dB signal (expressed in dB rather than percent) to 60 dB. In the case of the DA-710CX, THD for a −60 dB, 1-kHz test signal measured 0.316%, corresponding to 50 dB below the test-signal level. So, 60 dB added to 50 dB yields an effective dynamic range of 110 dB.

Linearity of the DA-710CX was accurate to within 0.1 dB all the way from maximum recorded level to −80 dB. Wow and flutter was too low to be measured, and the level difference between channels was 0.05 V (approximately 0.2 dB) for a nominal output of 2.14 V rms at maximum recorded level. SMPTE IM measured 0.012% at maximum recorded level; twin-tone CCIF IM measured only 0.0047% at maximum recorded level and 0.003% at −10 dB.

Stereo separation, including the effects of my connecting cables and measurement instrumentation, is plotted in the graph of Fig. 5. At mid-frequencies, I measured left-to-right and right-to-left channel separation of approximately 81 dB.

SIAMESE TWINS BORN IN JAPAN.

Introducing the Teac AD-7. Our latest cassette deck that comes with a rather unique attachment—our latest CD player. Together they offer a compilation of technical advancements equal to the most sophisticated of components.

On the left side, we've installed our exceedingly accurate 3-beam laser compact disc player. It includes enough features and programmability to merit a box of its own.

On the right side, there's an auto-reverse cassette deck with real-time reverse record and playback cobalt amorphous heads. Dolby B, C, and dbx** noise reduction. 15-selection memory program and bias fine tuning. Plus Time Edit, an exceptionally intelligent device capable of discerning which selections on the disc will fit on each side of the tape. So there's no long blank space at the end of the first side and nothing is recorded over the tape's reversal period. You can even listen to a disc while you're taping an outside source. And all of this can happen via a wireless remote.*

Now there's only one question. Is this the most advanced CD player, or is this the most advanced cassette deck?

TEAC

Made In Japan By Fanatics.

With all its refinements and features, I'd have been mighty surprised if this player had not sounded great. It did.

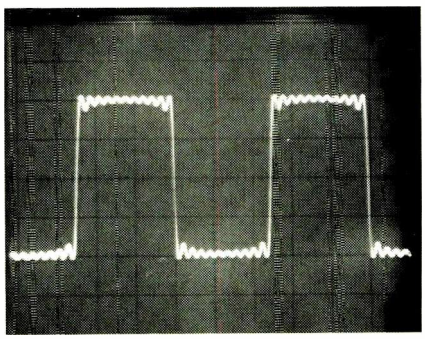


Fig. 6—Reproduction of a 1-kHz square wave.

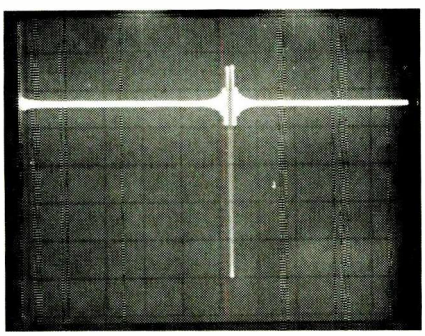


Fig. 7—Single-pulse test.

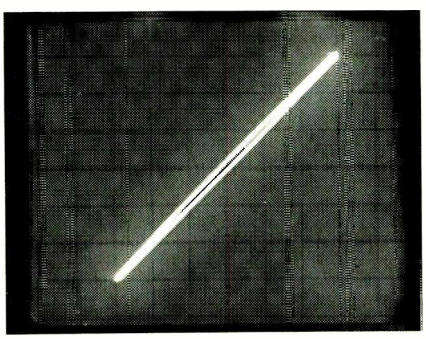


Fig. 8—Interchannel phase comparison at 20 kHz. Slightly elliptical pattern indicates minimal phase error. (See text.)

The symmetry of the 1-kHz square wave shown in Fig. 6 and of the unit pulse in Fig. 7 confirms Kyocera's use of digital filtering and oversampling. There was a slight phase error between the left- and right-channel outputs of a 20-kHz test signal, as shown in Fig. 8. If there were a complete absence of phase error or time delay between left- and right-channel outputs, the Lissajous pattern of Fig. 8 would be a straight, 45° line. One can see a slightly elliptical pattern here; however, this does not imply the use of a single D/A converter. Had only one D/A converter been used, a much more pronounced ellipse would have been displayed. The slight phase shift evident in Fig. 8 is more than likely the result of a small phase error caused by components, such as coupling capacitors, in the player's analog output stages. It is so minimal as to be of no concern to me.

Use and Listening Tests

I find that the easiest CD players to use are those which allow you to "punch in," by number, the tracks that you want to hear. The DA-710CX, with its 20 numbered keys, falls into that category. Kyocera has even come up with an easy method for calling up tracks that have numbers higher than 20: First, one pushes a button labelled ">10"; then two additional number buttons are pressed, each corresponding to a digit of the track number desired. Speed of access was very good—something less than 1 S between adjacent tracks and no more than 4 S from an innermost to an outermost track. Tracking stability was superb, and the player had no difficulty handling the simulated scratches, dirt, and fingerprint smudge on my "defects" test disc.

With all of the circuit refinements and user convenience features found in the DA-710CX (not to mention the excellent lab measurements), I would have been mighty surprised if this latest player from Kyocera had not sounded great. Sound reproduction, in fact, was so clean and open that I couldn't resist playing some of the early "problem" discs—those which lacked good stereo depth and those whose tonal balance seemed harsh when played on a first-generation CD player (I keep such a player on hand, just to refresh my memory). Played on the Kyocera, a few of those early discs still left something to be desired. More than half of them, however, seemed to benefit from the modern design philosophy embodied in the DA-710CX.

If you want to hear what a good CD player can sound like when playing well-recorded discs, put on a copy of Telarc's *Round-Up*, featuring the Cincinnati Pops Orchestra playing a wide variety of music associated with the American West. The folks at Telarc have included a rousing version of the last part of Rossini's "William Tell Overture," the section that's irrevocably associated with *The Lone Ranger*. I tell you, played on the Kyocera hooked to a good component system, the clean, unmuddied bass and the wide dynamics of this rendition were enough to turn Silver into a bucking bronco! The BGM (random play) feature proved fun to use with this disc, as well as with others I own that contain a wide variety of unrelated selections. However, I still think the wrong acronym has been chosed for this feature. With the kind of sound that the Kyocera DA-710CX produces, a more apt acronym might have been "FGM," for *Fore* Ground Music!

Leonard Feldman

Digital Discrimination.

BECAUSE ALL CD'S ARE NOT CREATED EQUAL, THE NEW CARVER DTL-200 COMPACT DISC PLAYER IS INTRIGUINGLY DIFFERENT.

The Carver DTL-200 answers the audiophile's demand for a CD Player which provides not only the greater dynamic range and richer bass expected from compact disc technology, but also the musicality, spectral balance and spatial qualities of well executed analog high fidelity recordings.

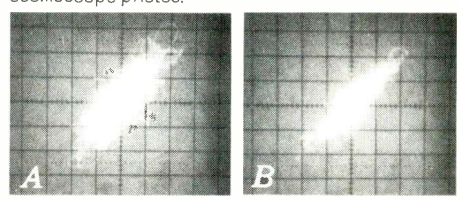
The new remote control Carver DTL-200 represents the next logical evolutionary step towards marrying the awesome technology of digital playback with Bob Carver's commitment to the re-creation of the live performance. It embodies the latest digital/analog conversion circuitry with oversampling, sophisticated laser system and a wealth of operating features. And it possesses unique Carver circuitry that solves real-world sonic problems associated with commercial CDs.

TIME DOMAIN CORRECTION. The Carver DTL-200 incorporates an important new computer logic innovation that monitors the incoming digital signal for imperfections and "glitches" caused in recording and production. Such errors are immune to conventional error-correction processes because they are actually data anomalies. Yet they can add overall harmonic distortion and cause audible changes in sound quality.

The DTL-200's Time Domain Correction circuit constantly performs a complex, 25-bit digital calculation on passing data. This high-speed error correction algorithm, in conjunction with a 121-pole digital filter, terminates distortion-causing high harmonics as they occur in the bit stream. The result is frequency response within 1/1000 of a dB of the original, with significant reduction of distortion to less than 0.007%.

PLUS THE DIGITAL TIME LENS. On top of this unerring ability to produce natural, real-sounding music from the CDs' digital bits, the Carver DTL-200 has the remarkable Digital Time Lens circuit to insure your listening enjoyment.

When Bob Carver obtained his first compact disc player, he was surprised at the sound derived from most of the compact discs he purchased. The three-dimensional musical perspective which his analog system provided in lush abundance on phono discs evaporated into a flat, brittle wasteland. After extensive testing, Bob uncovered two fundamental flaws in almost all compact discs: 1) An unpleasant, harsh spectral energy balance. The overall octave-to-octave energy balance was shifted on the CD towards more midrange above 400 Hz; 2) The amount of L-R signal (which carries the spacial detail of the music) on the CD was inexplicably, but substantially, reduced when compared with the amount of L-R signal found on the corresponding analog disc. The difference is obvious in these two oscilloscope photos.



A. Lissajous pattern showing spatial detail (L-R) (L+R) ratio from an LP record.
B. The same instant of music but taken from the CD version. Note the decreased (L-R) content, as shown by the narrowed trace.

Carver's circuitry corrects the ratio of L-R to L+R by performing one extra, but important mathematical operation on the signal stream that all other CD players fail to perform. This final operation makes all the difference.

The result is a natural sound with more of the three-dimensional information that places us in the same space with performers. You won't need the Digital Time Lens on all CDs. But it is there when you need it.

In the beginning, Carver hoped, indeed he expected, that once recording artists and engineers became more experienced with CD technology fewer and fewer CDs would require the Digital Time Lens. But both laboratory and listening tests reveal that the majority of even the most recently released CDs benefit significantly from the Digital Time Lens.

PACKED WITH USEFUL FEATURES. The Carver DTL-200 makes enjoying Compact Discs a simple exercise in button pushing from your favorite listening chair. You can program any combination of up to twelve tracks from a single CD, repeat a specific track or a whole Compact Disc for uninterrupted enjoyment.

Along with the ability to skip forward or backwards song-by-song, a touch of a key allows you to audibly review a disc backwards or forwards at many times normal speed. An A-B Specific Phrase Repeat lets you carefully analyze one section of a performance or simply provide a point of reference in a long, un-indexed symphonic movement.

All functions are displayed on an easy-to-read but subtle LCD display including programming sequence, current selection number, individual and total playing times plus indexing cues.

HEAR THE CARVER DIGITAL DIFFERENCE. Just as all CD's are not created equal, neither are Compact Disc Players. Of all the models currently available, only the new DTL-200 (and DTL-50) have the innovative and exacting Bob Carver touches that can substantially enhance your enjoyment of the digital medium.

Audition the new DTL-200 today at your Carver dealer, using a variety of discs. You will be surprised at how audibly it can improve on what is already the best playback medium ever offered.

SPECIFICATIONS. *Frequency Response* 5Hz-20kHz +0dB, ±0.2dB *Total Harmonic Distortion* 0.007% S/N 100db *Channel Separation* 90dB • 1kHz *Dynamic Range* 96dB *Wow & Flutter* unmeasurable. *Programming* 12-track remote and manual

CARVER P.O. Box 1237, Lynnwood WA 98046

POWERFUL MUSICAL ACCURATE

Enter No. 9 on Reader Service Card

Distributed in Canada by: evolution technology

WINNER, AGAIN?

COUNTERPOINT builds the best amplifiers and pre-amplifiers you can find at any price, anywhere. Our products deliver superb sound with unsurpassed stereo imaging. Each of our amplifiers—from the inexpensive ($595) SA-7 on up—is the best in the world in its price range.

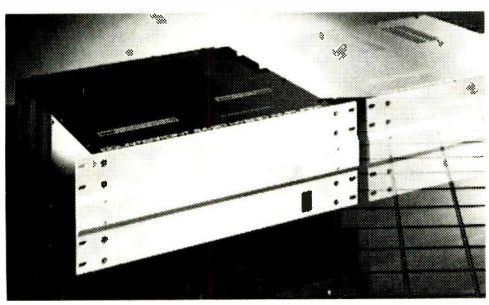
Says who?

In the audio world, it seems most everyone claims ultimate quality. Luckily, there are three proven ways to sort the wheat from the chaff:

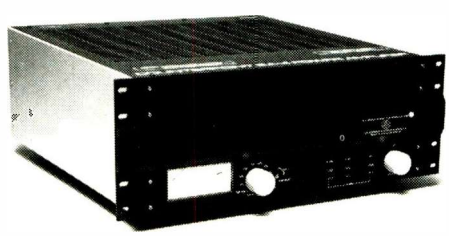
1. Ask the experts

For the past 3 years, each new Counterpoint product has won a prestigious award—both at home and abroad. For instance, our SA-20 Power Amplifier just won Japan's Component of the Year Award (not too bad these days, for a designed-and-made in the USA product!)

SA-20 Power Amplifier. . . hybrid technology at its best



SA-4 Power Amplifier. . . Golden Sound Award; Stereophile, 1986 Class A Rating



Recent Counterpoint Awards — (clockwise from bottom) Golden Sound Award, SA-4. Class 1A Rating, IAR, SA-2. Class 1A Rating, IAR, SA-12. Component of the Year, SA-5. Component of the Year, SA-3. Component of the Year, SA-20. Design & Engineering, SA-1. Design & Engineering, SA-4. Innovations '86, SA-9/11.

2. Ask any audiophile

Ask your friends who treasure the magnificence of high-end sound. Ask them what makes Counterpoint products better, and why.

3. Ask yourself

Learning about high-end audio electronics starts with *hearing* Counterpoint products. Our dealers are intelligent, friendly, and eager to demonstrate Counterpoint amplifiers at any time.

Call to find your nearest dealer, and to get more FREE INFORMATION about high-end audio.

800-247-6468 IN CALIF: **(619) 453-9090**

COUNTERPOINT

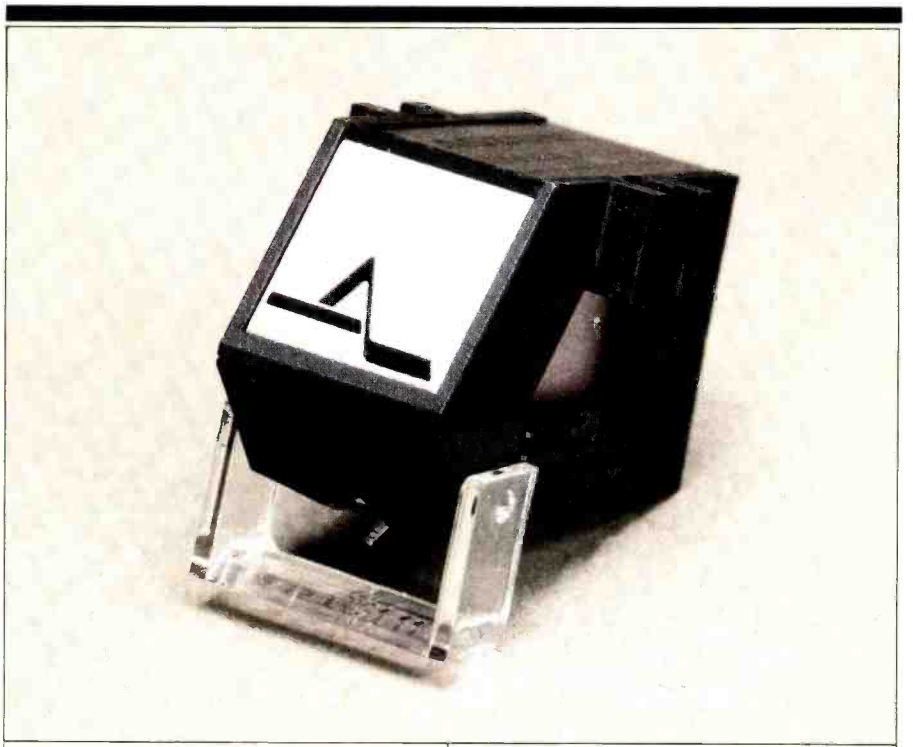
Dept. C., P.O. Box 12294, La Jolla, CA 92037

CANADA: Pro Acoustics, Inc., 227G Brunswick Blvd., Point Claire, Que. H9R 4X5 (514) 694-4790

Enter No. 11 on Reader Service Card

5

CTI ASTATIC MF-100MR CARTRIDGE



Manufacturer's Specifications
Type: Moving magnet.
Stylus: Micro-Ridge.
Cantilever: Tapered aluminum tube.
Frequency Response: 10 Hz to 40 kHz.
Separation at 1 kHz: 25 dB or greater.
Vertical Tracking Force: 1.25 grams, ±0.25 gram.
Compliance: 50 × 10^{-6} cm/dyne.
Output: 3.5 mV at 5 cm/S at 1 kHz.
Channel Balance: Within 1 dB at 1 kHz.
Inductance: 90 mH.
Load Resistance: 47 kilohms.
Load Capacitance: 100 pF.
Cartridge Mass: 5.5 grams.
Price: $100.
Company Address: P.O. Box 120, Harbor and Jackson Sts., Conneaut, Ohio 44030.
For literature, circle No. 94

The MF-100MR is the top of the line of cartridges currently offered by Astatic, a company that has been involved in sound reproduction since 1930. This magnetic cartridge is a patented "Moving Flux" type, made by the Mitachi Corporation of Japan. It uses a Micro-Ridge stylus mounted in a tapered aluminum cantilever which is supported by a front pivot system. Astatic says that in their design the cantilever is held at the one point where the effective mass of the stylus assembly is lowest. This is to help safeguard against any wandering motion of the pivot point with changes in frequency. It is claimed that these arrangements allow a re-creation of sound with a high level of fidelity to the original, without significant intermodulation distortion.

The MF-100MR uses a tiny magnet at the end of the cantilever tube; this magnet is positioned in the cartridge body in close proximity to a specially wound coil assembly. As the stylus traces the record grooves, the magnet and its associated flux lines move, and that flux which intersects the coils generates an output voltage. As in moving-coil cartridges, the conversion of mechanical motion to an electrical signal is instantaneous, but unlike moving-coil cartridges, the MF-100MR has a high conversion efficiency, and no step-up transformers or pre-preamps are required.

I studied the stylus and cantilever under 100X magnification; the stylus appeared to be accurately mounted to the cantilever and was of good polish and shape. The cartridge came in a two-piece plastic container, along with mounting hardware to allow attachment to any universal tonearm conforming to EIA Standards. The usual screwdriver and stylus brush were included as well.

When this cartridge first reached me for review, its suggested retail price was $320. In the interim, the company has been sold. The new management has decided that, since they have large stocks of the MF-100MR but do not currently have a full dealer network, they will sell these cartridges factory direct, at $100 each.

Measurements

After measuring an inductance of 94 mH and a resistance of 1.6 kilohms, I mounted the MF-100MR in a Grace G-747 tonearm. The tonearm was then placed in its mount on a Denon DP-6000 turntable and the cartridge aligned with the aid of a Telarc Omnidisc. Measurements were made on both channels to assure accuracy, but only the left channel is reported unless there was significant variation. During the test period the ambient temperature was 72° F, ±2° (22.2° C), and the relative humidity ranged from 40% to 60%. The following test records were used in making the measurements reported here: CBS STR-100, STR-112, CTC-300, CTC-310, and CTC-330 (the latter three from the company's recently issued Professional Series); Deutsches HiFi No. 2, and Shure TTR-103, TTR-110, TTR-115, and TTR-117.

The cartridge's extended high-frequency response is evident from its 8.4-μS rise-time, which is one of the fastest I've measured.

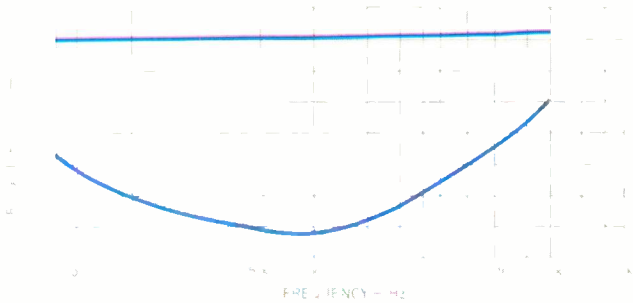


Fig. 1—Frequency response (top curve) and separation (bottom curve). Test record is CBS CTC-310.

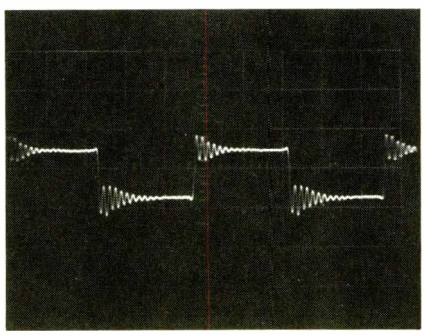


Fig. 2—Square-wave response. Test record is CBS CTC-310.

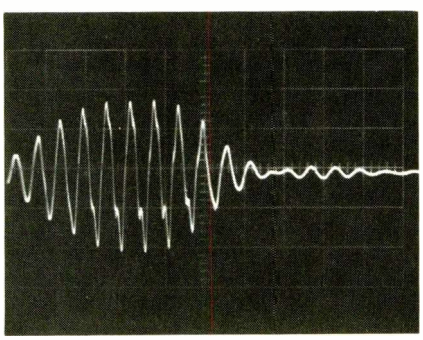


Fig. 3—Output for 10.8-kHz pulse test at 30 cm/S, a very high recorded level. Test record is Shure TTR-103.

The tracking force found to be optimum was 1.3 grams, and the optimum anti-skating force was 1.5 grams. For testing, a load resistance of 47 kilohms and a load capacitance of 100 pF were used.

The low-frequency arm/cartridge resonance resulted in a 7-dB rise at a frequency of 14 Hz. The combination of a 7-dB rise and a relatively high resonant frequency allowed the combination to track warped records with little problem.

Figure 1 shows the frequency response and channel separation of the MF-100MR, measured using the CBS CTC-310 test record. Response was within 2 dB from 20 Hz to 20 kHz. Separation at mid-frequencies was around 30 dB, reaching a high of 32 dB at 1 kHz. Separation over the entire audio spectrum was quite high, higher than that of most cartridges made a few years ago.

Figure 2 shows the response to a 1-kHz square-wave test signal obtained with the CTC-310 record. I used an expanded 'scope trace to measure an 8.4-μS rise-time, one of the fastest I have measured. There are several cycles of oscillations at a frequency of approximately 50 kHz, indicating underdamped resonance somewhere in the moving system, but this is of little concern since the oscillations are in the ultrasonic region. The extended high-frequency response of the cartridge is evident from its fast rise-time.

Figure 3 illustrates the tracking of the highest level of the 10.8-kHz pulsed sine wave on Shure's TTR-103 test record. It is recorded at a peak velocity of 30 cm/S, and although there is visible distortion present, there is little evidence of amplitude compression or objectionable resonances.

Dynamic vertical compliance was 9×10^{-6} cm/dyne, while dynamic lateral compliance was 7×10^{-6} cm/dyne. Using the STR-100 test record, I found the output for the left channel to be 3 mV for a 5-cm/S lateral recorded velocity, with a channel balance of 0.5 dB or better. Lateral (+9 dB) IM distortion using CTC-310 (400/4000 Hz, 4-to-1) was: Left, 3%; right, 2.6%. With the STR-112 test record, vertical (+6 dB) IM distortion was: Left, 5%; right, 4.5%.

CTC-300 contains lateral- and vertical-polarity bands, and with it I found that the MF-100MR produces a positive signal on outward and upward groove excursions.

The cartridge was able to track most of my test records with no distortion audible to my ears or visible on my oscilloscope. It tracked the highest vertical 300-Hz band of the Deutsches HiFi No. 2 test record, which is recorded at 55.4 microns (0.00554 cm) at 10.32 cm/S at 5.86 dB. It was also able to track the highest lateral level, which is recorded at 114 microns (0.0114 cm) at 21.50 cm/S at 12.10 dB. Playing the mid-frequency trackability test of Shure's TTR-103 (an equal-amplitude mixture of 1,000 and 1,500 Hz), the MF-100MR was able to track at 31.5 cm/S (band 7, side one), the second-highest level of this signal on the disc. On the record's low-frequency trackability test, a 4:1 mixture of 400 and 4,000 Hz, the cartridge tracked the highest level band (band 8, side 2), recorded at 30 cm/S peak velocity.

There are five levels on Shure's Era IV Audio Obstacle Course (TTR-115), with level 5 being the hardest to track. The cartridge was able to pass all of the individual instrument tests, level 4 of the harp and flute test, and level 5 of the bell and flute test. Shure's Era V Obstacle Course (TTR-117) contains six bands of a complex signal composed of

Only Sony offers the most advanced headsets for every mindset.

Look to the company that listens to digital audio four different ways.

If you're going to invest in the world of digital audio, then only the right kind of headphones will do.

That's why you'd be most comfortable with headphones made by Sony, The Leader in Digital Audio. Like our best digital equipment, Sony's advanced headphones are designed to let you realize the full potential of digital sound reproduction.

Each Sony model is built with sensitivity, utilizing the most precise technology available. For example, cobalt diaphragm drivers for superior musical resolution and wider dynamic range; linear crystal, oxygen-free copper wiring for less signal path resistance, and gold-plated contacts for the finest possible conductivity.

And if all that sounds good to you, listen to this: Sony offers more types of advanced headphones for the widest variety of digital audio applications. So try one on and see what it's like to get the most from your music.

After all, once you've paid for the finest digital audio components, anything less than Sony wouldn't be a sound investment.

Headphones. SONY

THE LEADER IN DIGITAL AUDIO™

Soundcraftsmen S-E-P-A-R-A-T-E-S.

MADE IN U.S.A.

THE NEW PRO-POWER FOUR MOSFET AMPLIFIER IS A "BEST-BUY" POWER STEP-UP FOR ANY FINE SYSTEM...

HERE ARE A FEW REASONS WHY!

REASON #1: It is guaranteed to improve and enhance your present receiver or integrated Amplifier, with our $39.00 Power Coupler, the PCT. It enables you to plug in any Soundcraftsmen Amplifier to your existing stereo system, whether Receiver, or integrated Amplifier.

REASON #2: High Current where it's really needed. 50 Amps per channel available for instantaneous peak output capability of 2500 watts per channel.

REASON #3: Pure tube-like sound...smooth, clean, no "edginess," through the superb—and costly—MOSFET fully-complementary power output stages. So pure it out-performs even the "esoteric," "price-no-object" amplifiers!

REASON #4: The Pro-Power Four is an ideal "main component" for up-grading—or starting—a High Powered stereo system. It is capable of fully reproducing, with distortion-free, spine-chilling sonic clarity, all of the demandingly high dynamic peaks inherent in the new Compact Discs and Hi-Fi VCR's.

REASON #5: Distortion-free performance, typically <0.02% THD and IMD, with TIM unmeasurable. Continuous FTC total power of 410 watts at 8 ohms, 20Hz to 20kHz, 205 watts channel.

REASON #6: Speaker System switching, 1, 2, or both...plus the High Current low impedance power required to drive Multiple Speaker Hookups in addition to Systems 1 and 2.

FOR A DEMONSTRATION, VISIT NEAREST DEALER LISTED BELOW

However, many additional Dealers—too numerous to list here—are located throughout the U.S. with many models on display. If no dealer is shown near you, or you encounter any difficulty, please phone us at 714-556-6191, ask for our **"Dealer Locator Operator."**

ARIZONA
Glendale
D&G STEREO
Yuma
WAREHOUSE STEREO

ARKANSAS
Jonesboro
THE SOUND CENTER

NO. CALIFORNIA
Chico
D&G STEREO
Concord
SOUND DISTINCTION
Goleta
HOUSE OF AUDIO
Milpitas
AMERICAN VIDEO CENTER
Sacramento
LISTEN HERE
WORLD ELECTRONICS
San Francisco
AUDIO VIDEO CENTER
LISTENING POST
San Jose
LZ PREMIUMS

SO. CALIFORNIA
Carrnos
FEDCO (MEMBERS ONLY)
Costa Mesa
ATLANTIC MUSIC
FEDCO (MEMBERS ONLY)
Goleta
HOUSE OF AUDIO
Hollywood
AMETRON
SPEAKER REPAIR
OF CALIFORNIA
Los Angeles
FEDCO (MEMBERS ONLY)
BEL-AIR CAMERA
Mission Viejo
VIDEO LASER
Montebello
SML, INC.
Newport Beach
ATLANTIC MUSIC
Ontario
FEDCO (MEMBERS ONLY)
Orange
FIDELITY SOUND
Pasadena
FEDCO (MEMBERS ONLY)
San Bernardino
FEDCO (MEMBERS ONLY)
San Diego
FEDCO (MEMBERS ONLY)
Santa Ana
FIDELITY SOUND
Torrance
SOUND-EYE
Van Nuys
FEDCO (MEMBERS ONLY)
Westminster
MANCHESTER MUSIC
Whittier
HI FI HAVEN

COLORADO
Colorado Springs
THE SOUND SHOP
Denver
WAXMAN'S

CONNECTICUT
Bristol
TUNXIS ELECTRONICS
Danbury
CARSTON STUDIOS
Newington
TUNXIS ELECTRONICS
Waterbury
TUNXIS ELECTRONICS
West Hartford
TUNXIS ELECTRONICS

FLORIDA
Clearwater
DALTON AUDIO VIDEO
Fort Lauderdale
SPEAKER WAREHOUSE
Fort Myers
STEREO GARAGE
Fort Walton Beach
AUDIO INTERNATIONAL
Hollywood + Hialeah
SPEAKER WAREHOUSE
Lakeland
THE SOUND FACTORY
Melbourne
AUDIO MART
Merritt Island
AUDIO MART ELECTRONICS
Miami
AUDIO PLUS
LA MIRAGE
LAS FABRICAS
MIAMI HI FI CENTER
Naples
STEREO GARAGE
Orlando
AUDIO MART ELECTRONICS
MARKETPLACE ELECTRONICS
St. Augustine
AUDIO DESIGNS
St. Petersburg
THE MUSIC SHOP
West Palm Beach
SOUND SHACK

GEORGIA
Augusta
THE STEREO SHOP
Warner Robbins
WORLD HIFI

HAWAII
Hilo
YAFUSO T.V. APPLIANCE
Honolulu
VIDEO LIFE
Lihue, Kauai
JACK WADA ELECTRONICS
Wailuku, Maui
ADRIAN'S ELECTRONICS

IDAHO
Idaho Falls
PHASE 4 STEREO

ILLINOIS
Chicago
MARTROY ELECTRONICS
MUSICRAFT
Dekalb
AUDIO PLUS
Gurnee
DPUS EQUIPMENT
Peoria
ELECTRONICS DIVERSIFIED
Quincy
MERKEL'S
Springfield
REEL TO REAL DESIGNS

INDIANA
Anderson
ANDERSON ELECTRONICS
Hammond
R&R AUDIO EXCHANGE
Kokomo
SOUND EXPO
Michigan City
AUDIO CONNECTION
New Haven
NJS SOUND
South Bend
TWILIGHT ZONE
West Lafayette
VON'S ELECTRONICS

IOWA
Davenport
GRIGG'S MUSIC
Mapleton
BRENNER'S

KANSAS
Overland Park
AUDIO ELECTRONICS
Salina
DEL'S TV
Wichita
AUDIO PLUS

KENTUCKY
Florence
A SOLID GOLD SOUND
Louisville
HI-FIDELITY, INC

LOUISIANA
Covington
NORTHSHORE AUDIO
Lake Charles
SIGHT & SOUND
ENT. CENTER
New Orleans
SOUTHERN RADIO SUPPLY
TULANE STEREO

MARYLAND
Annapolis
MID SHIPMEN'S STORE
Baltimore
STANSBURY STEREO

Eastport
THE ELECTRONIC $HOP
Gaithersburg
AUDIO BUYS
Owings Mills
LIGHTING EXPERIENCES

MASSACHUSETTS
Boston
ENCORE AUDIO
Dartmouth
MIKE ROSE ENT.
Sunderland
SCIENTIFIC STEREO

MICHIGAN
Eaton
STEREO VILLAGE
Detroit
PECAR ELECTRONICS
Grand Rapids
ELECTRONIC SOUND EQUIPMENT
Livonia
CARTEL DISTRIBUTING
Marquette
AMERICAN TV

MINNESOTA
Litchfield
QUALITY STEREO

MISSISSIPPI
Gulfport
TIPPIT'S MUSIC

MISSOURI
Chesterfield/St. Louis
INSTANT REPLAY
Kansas City
SOUND DYNAMICS

NEBRASKA
Lincoln
LIGHT & SOUNDS FANTASTIC

NEW HAMPSHIRE
New London
NORTH STAR ELECTRONICS

NEW JERSEY, SO.
Cherry Hill
WIDE WORLD ELECTRONICS
Wildwood
SEASHORE STEREO

NEW YORK CITY, NORTHERN N.J.
All stores of
CRAZY EDDIE
Belmar, NJ
SOUND SYSTEMS
Bloomfield, NJ
SOUND REPRODUCTION
Boundbrook, NJ
PRANZATELLI'S STEREO
Bronx, NY
BRONEN ENTERPRISES
Bronx, NY
VICMARR STEREO
Brooklyn, NY
GALAXY ELECTRONICS
Brooklyn, NY
MAGNA ELECTRONICS
Greenbrook, N.J.
ENTERTAINMENT CONCEPTS
Hawthorne, NJ
THE SPEAKERMAN
Jackson Heights, N.Y.
ATIF ENTERPRISES
Kingston
SCHWAN'S ELECTRONICS
Little Falls, NJ
DRUCKERS
Morristown, NJ
DRUCKERS
Livingston, N.J.
PRINCE RANGE
Newark, NJ
MEG RADIO CORP.
New York, NY
CANAL HI FI
CRAZY EDDIE
LEONARD RADIO
S&S AUDIO
STEREO PLAZA
THE LAST DETAIL
VICMARR STEREO
Staten Island, NY
CLONE AUDIO
Willowbrook, NJ
DRUCKER
Glen Cove, NY
ISLAND AUDIO
Woodside, NY
LEONARD RADIO

NEW YORK —UPSTATE
Plattsburgh
GREAT NORTHERN STEREO
Syracuse
MORRIS ELECTRONICS
SUPERIOR SOUND
Watertown
HAPPY EAR STEREO

NORTH CAROLINA
Fayetteville
QUALITY SOUND
Greensboro
High Point
Winston-Salem
AUDIO-VIDEO CONCEPTS
Goldsboro
PRO SOUND
Hendersonville
PRO SOUND & ELECTRONICS
Hickory
MC LAUGHLIN'S TV
Raleigh
CREATIVE ACOUSTICS
Shelby
SOUND ADVISE
Wilmington
JUST CD's

OHIO
Boardman
ELECTRONICS LTD.
Bowling Green
HART AUDIO
Canton
METRODYNE
Cleveland
B&B APPLIANCE
OHIO SOUND
Lima
HART AUDIO
Middleburg Hts.
B&B APPLIANCE
Parma
DESIERD ENT.
Warren
ELECTRONICS LTD.

OKLAHOMA
Oklahoma City
JOHNSON TV & SOUND

OREGON
Eugene
BRADFORD'S HIGH FIDELITY
Klamath Falls
HIGH COUNTRY RECORDS

PENNSYLVANIA
Bloomsburg
WEBBER'S PRO AUDIO
Chambersburg
SUNRISE ELECTRONICS
Hermitage
CUSTOM SOUND CO.
McKeesport
HI FI CENTER
Philadelphia
RADIO 437
SOUND OF MARKET
SOUND SERVICE
Pittsburgh
AUDIO JUNCTION
Reading
Shillington
PHOENIX HI F
Sharon
ELECTRONICS LTD.
Willow Grove
SOUNDEX

PUERTO RICO
Santurce
R. F. ELECTRONICS

SOUTH CAROLINA
Columbia
NORTON STEREO
Greenville
DON JONES STEREO
Myrtle Beach
IMPACT AUDIO
Newberry
THE ELECTRONIC SHOP
Spartanburg
DON JONES CUSTOM STEREO

TENNESSEE
Nashville
AUDIO SYSTEMS

TEXAS
Arlington
SOUND IDEA
Beaumont
BROCK AUDIO
Corpus Christi
SOUND VIBRATIONS
El Paso
SOUND ROOM
Fort Worth
SOUND IDEA
Houston
HOME ENTERTAINMENT
Hurst
SOUND IDEA
Laredo
JETT SALES
Midland
FOLGER'S ENTERTAINMENT
San Antonio
CCA ELECTRONICS

UTAH
Bountiful
INKLEY'S
Midvale
INKLEY'S
Salt Lake City
INKLEY'S
St. George
ARROW AUDIO

VERMONT
Brattleboro
SCIENTIFIC STEREO

VIRGIN ISLANDS
St. Thomas, U.S. and
British Virgin Islands
ELECTRONICS UNLIMITED

VIRGINIA
Arlington
LERMA AUDIO
Falls Church
AUDIO BUYS
Richmond
GARY'S
Washington, DC
VENUS STEREO

WASHINGTON
Olympia
DESCO ELECTRONICS
Spokane
MILLMAN'S STEREO
Yakima
STEREO FIRST

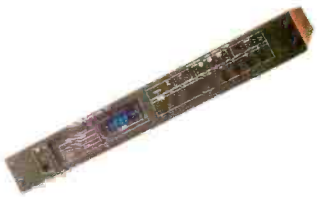
WEST VIRGINIA
Morgantown
THE SOUND POST
Princeton
THE SOUND POST

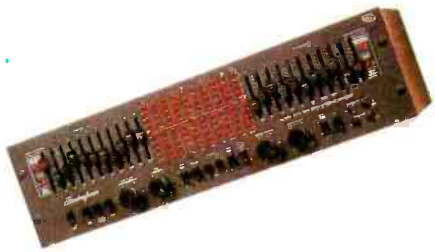
WISCONSIN
Appleton
AMERICAN TV
Glendale
SOUNDSTAGE
Madison
AMERICAN TV
Oshkosh
AUDIO PLUS
Sheboygan
GENE'S CAMERA & SOUND
Waukesha
AMERICAN TV

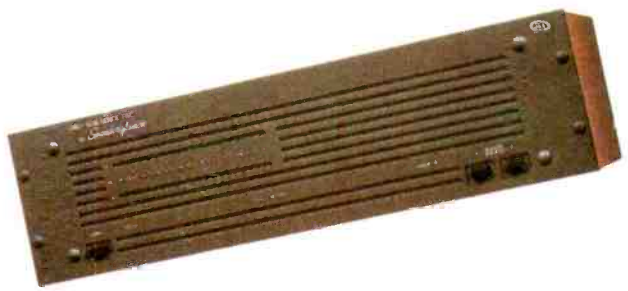
2200 So. Ritchey, Santa Ana, California 92705, U.S.A./Telephone (714) 556-6191/U.S. Telex/TWX 910-595-2524 • International Telex: 910-595-2524/Answer-back Code: SNDCRFTSMN SNA

YOU MUST SEE AND HEAR THE NEW Soundcraftsmen

DIGITAL C-MOS
CONTROL CENTER
PREAMPLIFIER







OUR 19-INCH RACK-MOUNT professional quality separates offer you many choices of the finest American quality separate components, to add to your present system, or to start a new system. From our 410-watt amplifiers at $499. to our $1,399 Pro Power Eight, incredibly powerful at 900 watts RMS per channel into 2 ohms, 3,000 watts of instantaneous reserve power.

Plus a selection of 4 Preamp Control Centers, 5 Signal Processors, and a 16-station preset AM-FM Tuner.

STEP UP to a new "HIGH" in Audio Reproduction...

Soundcraftsmen introduces the all new **PRO-CONTROL FOUR**, featuring digital **CMOS** switching. Soundcraftsmen's new switching technique provides the utmost in versatility plus the least distortion and noise. This **NEW** digital electronic switching completely eliminates the signal distortion and noise that is caused by mechanical switching. The **PRO-CONTROL FOUR** is the most flexible, simple to operate, control center/preamplifier ever designed.

A special "direct" mode bypasses both tone controls, as well as all signal processing circuitry, to create the ultimate pure signal path, a "straight wire with gain." Our exclusive "Auto-Bridging" circuit provides all the necessary processing for mono-bridging of two stereo amplifiers, tripling the output power.

Five tape monitor circuits for audio tape decks and/or VCR's provide the highest degree of recording/dubbing flexibility to be found anywhere. Three additional inputs are provided for compact disc player, tuner and phonograph. Two more loops are provided for signal processors, (such as equalizer, noise reduction, range expander, etc.) and may be individually switched into the signal monitoring path and/or recording path.

STEP UP to a new "high" in audio reproduction with the **PROCONTROL FOUR,** our technologically advanced digital **CMOS** control center and discrete phono preamplifier!

FREE!

16-PAGE, FULL-LINE, FULL-COLOR BROCHURE, AND $19.95 SYSTEM-EVALUATION KIT: 1-12" LP Spectrum Analysis Test Record, 2-sets of Compytone Charts, 1-Connector Cable for comparison test, 1-instruction folder for use with your present stereo system. JUST WRITE TO US OR CIRCLE READER SERVICE CARD for FREE SPECIAL OFFER DETAILS.

Enter No. 30 on Reader Service Card

The MF-100MR has an even response in the midrange, bass as low as one will ever need, and an unrestrained high end.

200 Hz, 2.1 kHz, and 17 kHz. The MF-100MR was able to track all bands of this disc without any audible mistracking or visible waveform distortion on my oscilloscope.

Some of the Professional Series test records from CBS contain recorded levels higher than those mentioned in the above tests. Using CTC-300, I found the cartridge's maximum lateral tracking ability to be 112.8 μm, the next-to-highest band. It could track the highest vertical band, recorded at 63.4 μm.

An X/Y plot of monophonic signals from several test records revealed good linearity and phasing between the two channels.

Use and Listening Tests

This cartridge was used to audition several digitally mastered and direct-to-disc recordings, using the same Denon turntable and Grace tonearm that had been used when making measurements. Toshiba-EMI records used were: *Super Strings*, Tokyo String Ensemble, Kouichi Sugiyama conducting (LF-95010); *Sgt. Pepper's Lonely Hearts Club*, Jun Fukamachi (LF-95014), and *30 Years in 30 Minutes*, Eiji Kitamura & All Stars (LF-95012). Other records used included: Beethoven's "Piano Sonata No. 23 in F Minor, Op. 57, Appassionata," Ikuyo Kamiya, piano (RCA RDC-4, JRL 1-1105); Ravel's "Quartet in F Major" and Bartók's "Quartet No. 3," Sequoia String Quartet (Delos DMS 3004); Stravinsky's "Firebird Suite" and Debussy's "Afternoon of a Faun," Los Angeles Philharmonic Orchestra, Erich Leinsdorf conducting (Sheffield Lab 24); Chopin's "Sonata No. 3 in B Minor, Op. 58," Steven Gordon, pianist (Reference Recordings RR-5), and *Ragtime Concert*, Nexus (Umbrella UMB DD-2). Also used were the superb Opus 3 test records Nos. 1 and 2, *Knud Jörgenson Jazz Trio* (also Opus 3), Amanda McBroom's *Dreaming* (Gecko Records), and *Caetano Veloso* (Nonesuch 79127, digital).

This cartridge's sonic qualities could not be faulted. It performed well on all program material, superbly reproducing massed strings and voices, and it handled warped records as well as, or better than, most cartridges. Channel separation was above average, as were the localization and imaging of solos and instruments on the sound stage.

The MF-100MR's response is virtually flat over the audio range and extends considerably above it. As one would expect from its uniform response, it is a neutral-sounding cartridge, without the tizzy sound that one hears from cartridges with a rising high end. It has an even response over the midrange, bass that extends as low as material is recorded, and an unrestrained high end.

The MF-100MR is inexpensive, considering the level of quality, and if you are thinking of buying a new, high-quality cartridge, this one deserves to be considered.

George Shellenberger

CAN YOUR SPEAKERS HANDLE THE EXTREMES?

It takes sophisticated engineering and pure craftsmanship to produce speakers that deliver the extremely wide dynamic range of digital recordings. The new EPI Time/Energy Series II speakers deliver *everything* that digital recordings have to offer; their quiet solos, thunderous finales and lightning quick transient response.

All this is made possible by the Time/Energy technology which involves making speaker cones and domes from special two layer materials. The combined physical properties of the two layers provide the performance that gets the most from *any* recording.

A case in point is the new EPI model T/E 280 Series II. It exemplifies the EPI tradition of achieving high levels of performance by using imaginative engineering and precision manufacturing, not complex designs and exotic, expensive materials. Its efficiency, power capacity, wide range response and just plain beautiful sound will make even the most die-hard technophile forget the graphs and specs and sit back to revel in the sound. And, with a suggested retail price of $199.95, forget about what it cost to get it.

There is an EPI Time/Energy speaker for everyone regardless of their listening habits, their electronics or their budget. Each one gives dedicated music lovers the kind of performance, quality and reliability that will keep them listening for years to come. With the Time/Energy speakers you can literally hear today what you'll listen to in the future.

The EPI T/E 280 Series II. One of eight Time/Energy Series II speakers and Time/Energy Monitors offering EPI performance and value with suggested retail prices of from $99.95 to $299.95. Epicure Products, Inc., Newburyport, MA 01950, 800-225-7932, in Mass. 800-892-0565.

EPI®

Enter No. 13 on Reader Service Card

ONKYO P-308 PREAMP AND M-508 AMP

Company Address: 200 Williams Dr., Ramsey, N.J. 07446.
For literature, circle No. 95

The P-308 preamplifier and M-508 amplifier, which belong to Onkyo's "Grand Integra" series, are the latest two products in the company's effort to establish a high-end line of audio gear. They have an appropriate "high-end" character—superb styling and "feel"—but still have relatively moderate prices: The P-308 costs $630, and the M-508 is $1,150. While these prices are scarcely cheap, they also are not expensive for a full-featured audiophile preamp including a pre-preamp, and for a high-quality power amp rated at 200 watts per channel into 8 ohms (and capable of dynamic power of 460 watts per channel into 4 ohms, 685 watts into 2 ohms, and 860 watts into 1 ohm).

The P-308 and M-508 also provide an exceptionally wide range of features. The preamp initially appears to have a simple straight-line design, but a door at the bottom opens to reveal switches for choosing between a moving-magnet and moving-coil phono input, with variable loading at 47 and 100 kilohms for MM and 3 to 10 or 10 to 40 ohms for MC. The P-308's defeatable tone controls have a switchable turnover frequency to add bass boost to speakers that only need a touch of bass power. There are excellent switching facilities for three tape recorders and five program inputs, with a pair of input jacks on the front panel.

The P-308 is an FET design and uses high-grade components, short signal-path routing, special circuits for protection against d.c. and ELF (extra low-frequency signals, below 3 Hz), and an advanced power supply designed to minimize problems related to power, noise, and phase. Although the circuitry is more complex than is typical of high-end U.S. and British preamps, there is no question that a great deal of attention has been paid to design.

As for the M-508, it is a solid, 55-pound unit, with enough styling to make it look more like a piece of sculpture than an amp. It also has more features than most power amps, including a large pair of meters with switchable power ranges, variable and direct inputs, and switches and jacks for two pairs of speakers. Like the preamp, it has vanishingly low rated harmonic and IM distortion—less than 0.003%. The claimed damping factor is high, at 140, and rated bandwidth extends from 1 Hz to 100 kHz.

The M-508 is a dual-mono design with separate power transformers, rectifiers, and capacitor filter blocks. The thermal protection allows the amp to drive very low-impedance loads and still pass peak currents of up to 60 amperes. The output circuits are designed to minimize crossover notch and switching distortion and to extend the Class-A operating range. There are also a number of good small touches, such as the use of LEDs in the bias circuitry to minimize residual noise.

Both the P-308 and the M-508 produce a very clean and detailed sound and perform well in many ways. They are exceptionally quiet and noise-free, much more so than most high-end British electronics and rivalling the best U.S. designs. The moving-coil phono stage in the P-308 is considerably better than that of most Japanese-made preamps, and shows far more sensitivity to real-world cartridge loadings. (Most Japanese units standardize on 100 ohms, which I have consistently found to be inappropriate for all of the better moving-coil cartridges I've auditioned.) The M-508 amplifier can deal handily with difficult loads like the Quad electrostatics, the Apogee Duetta IIs, and the new Eminent Technology speakers.

Having said this, however, I come to a tougher set of judgments. I cannot fault the Onkyo gear as being in any way harsh or "hard" by the standards of most competing equipment. In fact, I prefer the sound of the P-308 and M-508 to that of most Japanese equipment and, indeed, to that of many U.S. and most European designs. Yet, comparing them to other relatively low-priced high-end gear, I perceive the P-308 and M-508 as sounding too flat and two-dimensional. There is not enough depth, and the sound stage of virtually all music is brought too far forward. While there is a great deal of sonic detail, much of this detail is not musically natural. The sound is a bit

Sonic Impressions.

Do you like to listen to great-sounding music... or to state-of-the-art sine waves?

At Coustic, after ten years' experience in car audio design and manufacturing, we don't use technology for technology's sake. We use it only when it benefits *you*...only when it makes what you listen to sound better.

That's the philosophy behind our new 500 series of cassette/receivers.

This series is designed specifically for the discriminating car audio buyer who demands quality products that are also functional and reliable. Some of the visible user-friendly features of various 500 series models are Dolby B & C, Tape Program Search, AM-FM station presets for instant electronic frequency selection, and a digital clock display. The control for each of these functions is easily accessible in a handsome illuminated control panel.

The not-so-visible, but still highly desirable features of the 500 series radios are auto-azimuth correction tape transport with servo motor, high power (50 watts), auxilliary inputs to accept a portable CD player, and pre-amp outputs for the easy addition of a power amplifier or equalizer component.

All of this means the Coustic 500 series radios allow you to create the ultimate car audio system at any time you choose. After all, isn't t great music you're interested in?

Coustic...a sound investment.

coustic
4250 Charter Street
Vernon, CA 90058-2596
213/582-2832

Available at fine dealers such as:

Rockland, Mass.
Nantucket Sound
(617) 871-3078

Waterton, N.Y.
Happy Ear
(315) 788-7692

Newton, N.J.
Par Troy Sound
(201) 383-6564

Anderson, S.C.
Music Machine
(803) 225-2628

Natrona Hts., PA.
Butch's Sound Shack
(412) 224-7000

Indianapolis, Ind.
Ovation
(317) 576-1662

Seattle, WA.
Car-Tronics, Inc.
(206) 938-4456

San Jose, CA.
Motor Stereo
(408) 292-6547

Springfield, MO.
CarFi Specialist
(417) 869-1868

Vancouver, B.C.
Aralex Acoustics, Inc.
(604) 879-2966

Enter No. 12 on Reader Service Card

These units produce a very clean and noise-free sound, but there is too little depth, and the sonic detail is not musically natural.

analytical on all material, even when the same record or CD sounds musically natural on the best high-end components. The bass is powerful without having completely natural impact or dynamics, and transient passages are always just slightly constricted or compressed. The sound is never annoying or unmusical, but it does tend to be sterile and this sense of sterility grows worse with time.

These problems increase in direct proportion to the number and type of gain stages involved. The amp alone sounds much better than the preamp, and the high-gain stages of the preamp sound much better than the phono stages. The moving-magnet stage sounds better than the moving-coil.

I could live quite happily with the M-508 amplifier alone, provided I had a front-end with outstanding depth and natural musical timbre and dynamics, but the P-308 preamp is, to be blunt, tiring. After the initial interest that highly detailed or analytical sound equipment always arouses, the net effect is to deprive the music of some of its emotional and spiritual impact.

To be fair, there are audiophiles who like this kind of sound and who prefer equipment that seems to highlight detail and to etch musical information. I also have to stress that the Onkyo P-308 and M-508 sound better than the majority of the equipment in their price range. Nevertheless, other manufacturers do produce similarly priced equipment that to my ears provides the same level of information in a substantially more musically natural and convincing form.

For all the debate over whether amplifiers and preamplifiers sound different, I believe most readers will hear the effects I describe. If you are interested in listening for yourself, I suggest that you audition the P-308 and M-508 after listening to live music. I think that if you use a good, natural, acoustic recording—with a good sound stage and well-recorded strings and woodwinds—you will hear information on that recording that will immediately sound "hi-fi" rather than lifelike. I'll stick with lifelike. Given today's state of the art, the test of audio gear is how natural it can sound.

Anthony H. Cordesman

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.

And, our NA-1050 Audio/Video Control Center lets you group mix audio and video signals from VCRs 1 and 2, L/R Mic Lines, Tapes 1 and 2, Tuner, Phono, Auxiliary, or CD sourcing, with features like a 6-channel audio mixer, a 4-band EQ, and Nikko's exclusive Dual Line Switching System.

So, if the technological rubble is leading you down the cluttered path of false promises, come by and talk to us. Nikko has made a new commitment in your behalf: To Nikko Video Technology...and, oh yes, to delivering what we promise.

NIKKO AUDIO

The power of technology.

Asti Nikko Technology Corporation Of America • 5830 South Triangle Drive • Commerce, CA 90040 • (213) 721-1168

Nikko audio systems and components are available exclusively through Authorized Nikko Audio Dealers.

Enter No. 20 on Reader Service Card

EDWARD TATNALL CANBY

ELECTRIFYING ETUDES

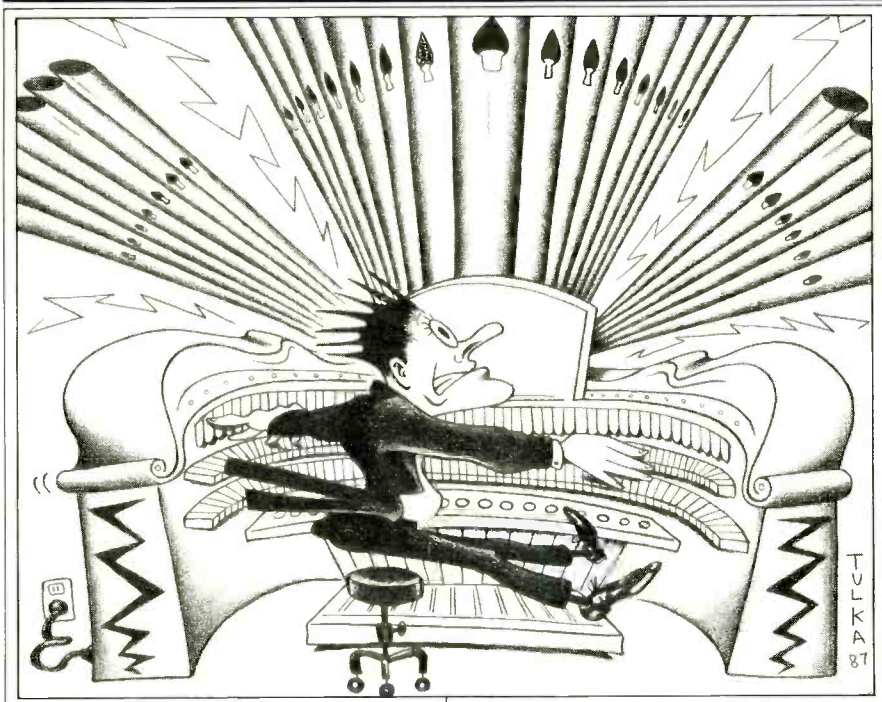


Illustration: Rick Tulka

Bengt Hambraeus: Livre d'orgue, Volume III. John Grew, organ. **McGill University Records 85024.** (Available from McGill University Records, 555 Sherbrooke St. West, Montreal, Que., Canada.)

Now here is an astonishing record for anyone who is looking for new and unexpected music and audio! Not only does it expose the very soul of the old tracker organ (the French version, brighter and shinier) with clinical audio clarity, it is far-out contemporary "organized sound," in the Varèse sense, by one of Sweden's outstanding avant-garde composers. Though Bengt Hambraeus is also a professor of music at McGill University, he is far from being a musty musicologist. His background is in electronic music, and *that* is what you hear—sheer electronic music, transferred to McGill's Redpath Hall organ, an outstanding instrument. Such sounds! Such music!

There is a piece at the end of side one that gripped me almost to the point of hysteria. It contained loud, extremely dissonant chords held for long periods, one after the other, with an extraordinary bustle of inner works going on inside the sound, each chord more intense than the one before; at the end, the organist "pulls the plug"—cuts the power and slides some of the mechanical stop sliders partway closed so that the organ expires in dying sighs and shudders. Phew!

Yet, for all that, the short works of this "organ book" are in the oldest tradition, a set of what the 19th century called études, each taking up a different facet of composition, a different set of pipes, a different spacing high to low. This is precisely what the old French composers did with the original organs after which this instrument is so meticulously modelled—but these sounds are today's, and the organ practically shudders in astonishment at the music it is making. Only the first and last pieces on each side are really loud, *plein jeu*; the rest is mostly slow, but all of it has that intense exploration of one particular sound combination which can be so powerful, even when quiet.

The recording is also astonishing. It is close-up and unrelenting in the smallest detail of sound production, even unto squeaks, rattles, clanks, slider noises, and, most of all, deliberate and sometimes almost frightening *beats*, some subsonic and some high-pitched, and all of them deliberate, purposely induced as part of the sound.

Recording technique? McGill vouchsafes not a word. Whatever the means, it is *good*. The organ sound is captured close-up, and the ambience of its surroundings is also captured, *as part of the organ*, the two as one large instrument. That is exactly the tradition of all early organs, French, German, or what have you. It was the 19th century that took things elsewhere, striving for organ hugeness but even more, a symphonic sound, like an orchestra. It worked, but the unique organ virtues lie elsewhere, as we now understand. Here, at last, they are applied to ultra-current musical ideas out of electronics and synthesis. That's exciting.

It is almost unnecessary to say that John Grew, the organist, does an immensely competent job with this difficult music, including all the tricks with sliders and switches and half-activated keys. The composer, who also plays, must have known he could do it.

A Balanchine Album: The New York City Ballet Orchestra; Robert Irving **Nonesuch 79135-1,** digital, two-record set.

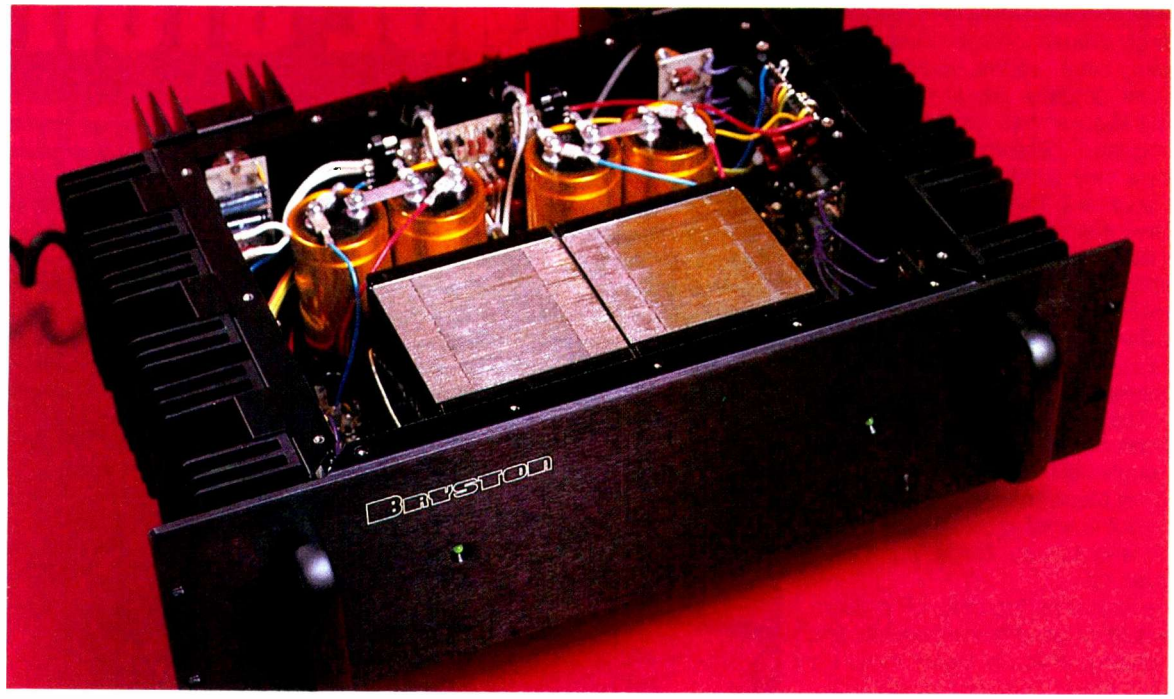
This interesting double-gatefold album would be worth a lot even without the two LPs inside, not only for a wealth of good pictures but notably for the first-hand accounts, direct from the source, by those who knew and worked with Balanchine.

But this is, of course, mainly a sonic presentation, ballet music minus the dance, and so must be considered in that sense. As you can guess, it is good—and does much to strengthen the thought that in ballet we have the ultimate equality of sound and sight at the highest classical level.

Ballet music isn't always viable on its own. A lot of it is merely trivial, if pleasing to the ear. But Balanchine, unusually, was a dedicated and professional musician as well as a choreographer, an expert pianist, skilled in the meaning and structure of music itself, and a true believer in the equality of music and dance. Hence the real appeal of an album like this.

I myself found the two modern works, "The Four Temperaments" by Hindemith and the late-Stravinsky "Agon," of the most interest. The first has a stunning solo piano part and a solo violin; the second is both atonally dissonant and full of those grunty,

BRYSTON



Bryston 4B Power Amplifier

Bryston's Critical Acclaim

- *"I have heard quite a few preamplifiers costing 3 times as much as this Bryston .5B, and not only would few of them sound better or be more acoustically accurate, but many would suffer by comparison."* **Audio Ideas Guide**

- *"Overall tonal balance of the Bryston .5B preamplifier was beyond reproach, and I was particularly pleased with the clean, smooth reproduction of high frequencies."* **Audio Magazine**

- *"At the incredibly competitive price of the Bryston .5B preamplifier, we can only strongly recommend its purchase!"* **Son-Hi-Fi**

- *"This Bryston .5B is a high-end product in every sense of the word, even in its simplicity, and it deserves to be known as the bargain of the decade in state-of-the-art preamplifiers."* **Audio Ideas Guide**

- *"Speed, huge transient attack, and powerful bass response were our first subjective impressions. This Bryston 4B has dynamic range to burn."* **Audio Magazine**

- *"The new 3B is neutral and self-effacing, with little character."* **Hi-Fi Sound Magazine**

- *"The Bryston TF-1 is superb, in fact the very best transformer we can recall hearing."* **Hi-Fi Sound Magazine**

- *"The Bryston TF-1 is the best MC transformer I have yet heard, and is so well shielded that its signal-to-noise figure matches any other step-up device on the market, and probably exceeds most."* **Audio Ideas Guide**

- *"I would say that the LP playback qualities of the 12B with either moving coil or moving magnet cartridges are state of the art."* **Audio Ideas Guide**

In Canada:
BRYSTON MARKETING LTD.
57 Westmore Dr., Rexdale, Ontario, Canada M9V 3Y6
(416) 746-0300

In the United States:
BRYSTON VERMONT
RFD #4, Berlin, Montpelier, Vermont 05602
(802) 223-6159

Enter No. 7 on Reader Service Card

seemingly coarse tone combinations—squawks, blats, slides, musical pratfalls—that actually are of the highest sophistication in this unique composer's language. (Stravinsky merely substitutes a new subtlety for the old, familiar sounds.) The other two pieces also have their points and will please. I have never heard the Tchaikovsky "Serenade," for strings only, played so persuasively. Credit must go not only to the dance-like sprightliness coming out of this dance orchestra, but also to that veteran dance conductor Robert Irving. That doesn't necessarily mean perfection in the ensemble; things are a bit rough here and there if you look only at the blend. As for Fauré's "Emeralds," it is the least of these works, very smooth and syrupy, but it won't bore you, even so.

Nonesuch is on top of its LP production, which is uniformly excellent, and its recording, which is clean and clear and transparent both for the blatty, dissonant solo effects of Stravinsky and the all-string ensemble of Tchaikovsky.

Elliott Carter: Piano Concerto, Variations for Orchestra. Cincinnati Symphony Orchestra, Michael Gielen; Ursula Oppens, piano.
New World NW 347, digital and analog.

Elliott Carter, born in 1908, is now almost the dean of American contemporary composers (Aaron Copland is 87, born in 1900). Ever so clearly, he is one of our most profound and independent workers. His chamber music has been gradually spreading far and wide; as the New World liner notes point out, this extremely difficult and complex music needs a lot of rehearsal, and smaller groups can give it the time it needs. The big orchestral works, on the other hand, are nearly impossible under present conditions—not enough time to learn the notes, let alone come to an understanding of what it is all about.

So we are mainly just beginning to hear "big" Carter, even though there have been a good many forceful performances—time allowing or no—of works that the music people just felt had to be played somehow. The "Variations for Orchestra," luckily for this reviewer, is a work I know and recognize in all its parts. It was commissioned by the St. Louis Symphony and recorded in their memorable series of early LPs, and thereby appeared on one of my New York radio programs. I remember inviting the audience to join me in a first listen-through, neither audience *nor myself* ever having heard the music before. I began to hear things and commented on them; the audience, perhaps, also heard them. To my astonishment, so did Elliott Carter, who was listening! He wrote me a most kind letter of approval.

Now, years later, comes a full-fledged stereo version, along with the later piano concerto, and instantly I remembered the music. It does make sense. It grows easily on you. For the casual record listener, I would suggest that it is nearest to a sort of neo-Bartók,

but less ferocious, more suave and urbane, more polished. It really makes fine listening.

The piano concerto is denser, more abstruse, a wholly "different" work with the piano more of a percussion instrument for single-note patterns rather than the usual melody-maker. There is an opposing orchestra and also a sort of connecting solo group, seven solo instruments, to bring the piano and orchestra together. Not easy to record.

A curious audio note: The same performers, in the same venue, are here recorded for one work in digital and the other in analog! And the analog recording was made a year *after* the digital. I made myself "forget" which is which, and I noted emphatically that the "Variations" seemed to me the better recording, the more persuasive in sonic terms. Is this merely the difference between the two works, which is considerable? I rather suspect so. Frankly, I do not think most of us, other things being exactly equal, can tell the difference between top-level digital and the same in analog. The sheer sound is *not* the main virtue of digital recording, as we ought to understand.

P.S.: I peeked. Both recordings were done for radio, WGUC-FM, by engineer Brent Reider. The "Variations" was the analog recording. Was it a case of a now common disease, Digital Disgust?

Elgar: Music for Strings. The English Chamber Orchestra, Yehudi Menuhin. **Arabesque ABQ 6563,** digital.

Sir Yehudi, once the boy prodigy on the violin (I can remember that), is now around 70 and as vigorous as ever in his new and varied role as conductor. The expert and experienced English Chamber Orchestra, here all strings, plays Elgar almost reverently under the maestro (if I dare call him that). You won't find the composer treated in better fashion.

Menuhin has long since settled into England, and perhaps this choice of music reflects his very sincere loyalty to things British (note that "Sir"). But it is curious how different are English and American tastes in relation to this music of the post-Gilbert & Sullivan era. We all know "Pomp and Circumstance" and fashionably deplore it, as do the English. But they, unlike ourselves, keep a healthy respect for their own turn-of-the-century composers, of whom Elgar was the most forward and successful. We, on the other hand, know next to nothing of such music and generally tend to dislike it as too sweet and sticky.

Well, it *is* sweet, and a bit gooey. That sort of thing still hits the British heartstrings. At the same time, it is *good* music, perhaps excellent. Elgar was no boor; he was a genuine craftsman and an inspired musical cook, so to speak. The sounds and textures are on a very high level—if sticky-sweet.

Here's a splendid chance to try the man out on your own ears; the digital sound gives the strings their best possible impact. I really enjoyed it, this very best British marmalade.

While The Beatles altered just about every sound on *Sgt. Pepper*, nowhere does the album seem gimmicky.

albums.) George Martin, overseeing the production of The Beatles' CDs, says that he was tempted to put both tracks on this Compact Disc but decided it would be too disconcerting. He did include, however, two items found at the end of the original recordings: The 18-kHz signal designed to either amuse or annoy your dog, and the infamous run-out groove of Beatle chatter and laughter which could be heard when played on turntables without automatic tonearm returns.

This CD has been packaged with a 28-page full-color booklet that is a small treasure in itself. Along with the song lyrics and lots of pictures, it includes a short guide to how the album was made; notes by George Martin, engineer Geoff Emerick, and album designer Peter Blake, and even an outline key showing who and what are surrounding The Beatles on the album cover.

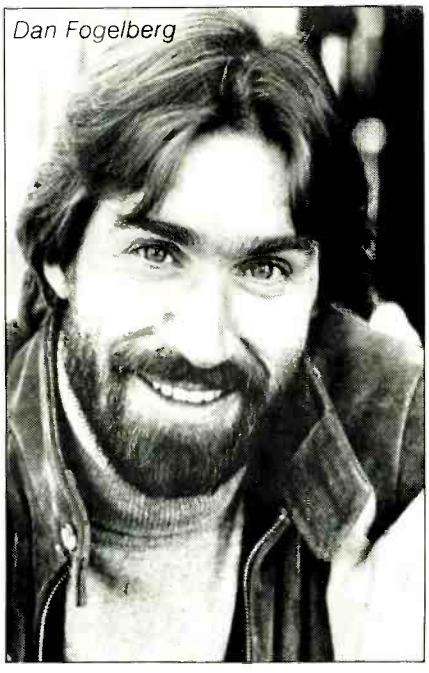
Today, when push-button miracles in the studio are taken for granted, it's great to have on hand a document as spotless as *Sgt. Pepper* to remind us of where, and when, some of these miracles were born. *Susan Borey*

Exiles: Dan Fogelberg
Full Moon/Epic EK 40271.

The crying edge Dan Fogelberg carries in his rich, sweet voice on sad songs of lost love never fails to bring me to my knees. Fogelberg is one of the rare survivors of the once-thriving singer/songwriter school. He's had an on-again, off-again career, and, praise be, it's mighty good to have him back.

Exiles, his latest album, is a mixed benison of rockers and tender love songs. On the former, Fogelberg's vocals are tougher than those of his past hits. He goes for a harder, bluesier sound, most notably on "What You're Doing." These full-throttle cuts pull his voice back into the mix and obscure the traits that make his sound distinguishable from hordes of other decent rock singers. Further, these cuts bear a thin aural film that dulls the sound quality of an otherwise splendidly produced album.

Dan Fogelberg



I prefer this disc's lost-love songs, in which the singer is placed up front and naked to expose that beautiful crying edge. The sheer quality of Fogelberg's pipes and his subtle but moving emotional readings inspire cuts like the beautiful "Lonely in Love," "Seeing You Again," and "Hearts in Decline," in which a gorgeous solo acoustic piano sets up the vocal like a rich offering on a polished marble altar.

Contributing to the generally high quality of this CD are well-known behind-the-scenes guys like drummer Russ Kunkel (who coproduced with Fogelberg) and bassist Mike Porcaro. Michael Brecker takes a turn on a mellow, sexy tenor sax and on the delightfully named Weirdophone. Fogelberg himself plays a passel of instruments, and he wrote every cut but the familiar Stephen Stills/Chris Hillman "It Doesn't Matter."

Lots of nice, sad, sweet stuff on this CD. It's got more than a prayer of hitting the charts, if there's any justice in the world. Amen. *Paulette Weiss*

Whoopin': Sonny Terry, Johnny Winter, Willie Dixon
Alligator ALCD 4734.

Sound: A Performance: A

Ice Pickin': Albert Collins
Alligator ALCD 4713.

Sound: A Performance: A

Strike Like Lightning: Lonnie Mack
Alligator ALCD 4739.

Sound: A Performance: A

This trio of Alligator CDs features some of America's best blues artists, whose styles bear the influence of everything from traditional country to modern, rip-roarin' rock.

Foot stompin' is the order of the day when Sonny Terry pulls out his famous mouth harp and whips up some mostly acoustic, down-home blues on *Whoopin'*. This session features some tasty playing by Willie Dixon and Styve Hornick, and from producer Johnny Winter, who supplies sweet acoustic dobro and slithery slide guitar reminiscent of Brownie McGhee. But there's no doubt

Yamaha's new FFT speakers do the same for your ears.

Before you listen to a pair of FFT Series™ speakers, close your eyes. Yamaha's about to take your favorite music into a whole new dimension.

A sonic dimension of greater acoustic imaging, creating a soundstage purely and precisely articulated. Where instruments and voices are clearly defined in their own space, yet always in proper balance.

You hear the music the way it was meant to be heard: Horns stage left. Percussion stage rear. The singer's voice center stage and up front. And each distinguishable from the other.

You also hear more of each instrument's true range: Violins are rich and full. A flute riff ascends the scale. The acoustic bass thumps its lowest possible note.

The imaging becomes so dimensional, you'll swear you can "see" the performers on stage. While the emotions the music contains become even more powerful.

A truer picture of what you're hearing emerges, because we had a truer picture of the FFT Series in its design stage. A computer program called the Fast Fourier Transform (FFT) made this expanded soundstage and greater musicality possible. And helped our U.S. engineers create speakers using the most sophisticated drivers, crossover networks and cabinet design. All integrated for optimum performance.

What's more, each model has the power handling capacity to meet the expanded dynamic range of today's digital audio sources.

So listen to the new Yamaha FFT Series at any authorized Yamaha FFT dealer today. Discover how our world-renowned expertise in the creation and re-creation of fine music has been applied to the FFT Series. Then close your eyes, and watch your music come alive.

Yamaha Electronics Corporation, USA, P.O. Box 6660, Buena Park, CA 90622

100

YAMAHA 1887-1987

Cho-Liang Lin shows a very secure technical mastery of his instrument, as well as a good deal of musical sensitivity and expression.

Terry's the star, with classic vocals and particularly notable harmonica/guitar duets. *Whoopin'* creates a magic Mississippi Delta atmosphere that'll take you altogether out of time.

With its slinky Telecaster guitar lines and an inspired performance by Texas blues great Albert Collins, *Ice Pickin'* is essential listening. Capturing the feel of an intimate club performance, Collins moves smoothly from slow grooves to funky shuffles to the driving abandon of "Avalanche." Collins' great talent is his wonderful wry irony, which includes the knack for picking just the right details to make his song tales human and believable. Check out the hilarious "Master Charge" and the delightful guitar argument in "Conversation with Collins." *Ice Pickin'* demonstrates why Collins is such a legend. As you listen, expect to wear a grin from beginning to end.

On the intense guitar heaven of *Strike Like Lightning*, Lonnie Mack and his coproducer Stevie Ray Vaughan team up to unleash electric bolts of modern blues. Showcasing Mack's frenetic solo style, wonderful raspy vocals, and eclectic influences, *Strike* bounces from slow country rockers to rollicking rave-ups. Highlights include the title cut, the scorching instrumental duet of "Double Whammy" (one of several pairings with Vaughan), and the delicate slide accompaniment on the amusing "Oreo Cookie Blues." *Strike Like Lightning* is probably Mack's best work to date. If you like guitars and the blues, it's first-rate entertainment.

Michael Wright

Max Bruch: Violin Concerto No. 1, Scottish Fantasy for Violin and Orchestra, Op. 46. The Chicago Symphony Orchestra, Leonard Slatkin; Cho-Liang Lin, violin.
CBS MK-42315.

In three other recordings, this Bruch violin concerto is coupled with a Mendelssohn violin concerto. Here, it is more logically paired with Bruch's interesting "Scottish Fantasy."

Young virtuoso Lin has a violin tone that is leaner and more sinewy than that of Itzhak Perlman on the latter's Angel/EMI recording of the Bruch concerto. However, Lin more than holds his own in terms of musical sensitivity and expression, and his technical mastery of his instrument is very secure. Lin's splendid music making is most ably supported by Leonard Slatkin and the great Chicago Symphony Orchestra.

CBS engineer Bud Graham chose to record these works in Chicago's Medinah Temple rather than in Orchestra Hall. Using a combination of B & K, Neumann, and AKG microphones, he has achieved a very full, highly detailed sound, nicely rounded with hall ambience. He has Lin's violin just forward enough to ensure clean articulation without obtrusive spotlighting.

If you are a bit jaded by the staples of the violin repertoire, try these well-performed, excellently recorded Bruch pieces.

Bert Whyte

Viennese Bonbons. The Vienna Volksoper Orchestra, Franz Bauer-Theussl.
Philips 416 819-2.

This CD features a melodic melange of music from the prolific output of the Strauss family. Appropriately, we get off to a flying start with the overture to "Die Fledermaus," followed by the lilting waltzes of "Artist's Life," "Viennese Bonbons," "Voices of Spring," and "Morning Papers." A touch of spice is added with the "Pizzicato-Polka," and the program concludes with a rousing rendition of the "Radetsky-March."

Conductor Franz Bauer-Theussl and the Vienna Volksoper Orchestra have this music in their blood, so the performances are authentic, to say the least, the playing and the sound as sweet as a Viennese pastry. In short, this is a delightful, tuneful confection for easy listening.

Bert Whyte

BEYOND CONVENTIONAL AUDIO

THE ONKYO INTEGRA TA-2058
REAL TIME COUNTER, HX PRO, 3 HEADS, ACCUBIAS PROVIDE PROFESSIONAL QUALITY RECORDINGS

The ONKYO Integra TA-2058 combines the recording quality of a professional deck with an array of sophisticated control features. Our 3 head record & playback system includes a wide gap recording head for superior frequency response and increased headroom. The playback head features a narrower gap, resulting in extended high frequency response, and improved S/N ratio. The third head enables tape monitoring, permitting instant comparison of the source material and your recording.

A computer-controlled Real Time tape counter provides a digital read-out that indicates in minutes and seconds the amount of tape consumed or remaining, eliminating the possibility of running out of tape in the middle of a selection.

Freedom from tape saturation, even at the highest recording levels, is assured by Dolby HX Pro. ONKYO's exclusive Accubias circuit fine tunes recording bias for the flattest and widest response, and an adjustable preset function lets you customize your recordings for playback in other tape machines, like car stereo or portables.

Professional recording and playback qualities are finally available in an affordable deck—the ONKYO Integra TA-2058.

Artistry In Sound

ONKYO®

200 Williams Drive, Ramsey, N.J. 07446

Dolby B, C, and Hx Pro are registered trademarks of Dolby Laboratories, Inc.

Enter No. 23 on Reader Service Card

MICHAEL TEARSON
JON & SALLY TIVEN

VOX POP

Photograph: Richard Avedon

Whitney: Whitney Houston
Arista AL-8405.

Sound: B Performance: B

It's difficult to ignore mega-platinum sales. With the radical success of Whitney Houston's debut album, the task of a follow-up is pretty well defined: Do the same thing all over again or face the consequences.

We would like to propose an argument against this line of thinking. Whitney Houston is an incredible singer, first and foremost. She got an amazing range, and she's able to inject emotional content into material that has none of its own. And she is on a label that has a history of success with great black female singers, such as Aretha Franklin and Dionne Warwick. So why play it safe? Even if Whitney were to sing Jimi Hendrix songs produced by Steve Lillywhite, she would still have a good shot at selling millions of records. People are buying the voice, the beautiful face, and, at this point, the success that Whitney Houston stands for.

Of course, this is a bit of an exaggeration—every singer needs *some* great songs. But we don't readily acknowledge that her debut album was a collection of great songs, nor is this new LP. There are some clever phrases turned into catchy numbers—"Love Is a Contact Sport" on this album, "You Give Good Love" on the last one. But most of the songs on both records are beneath this singer, both lyrically and as a showcase for her voice.

The first single, "I Wanna Dance with Somebody Who Loves Me," is a harmless rewrite of "Girls Just Wanna Have Fun." The Isley's "For the Love of You" and the Wildhorn/Jackson composition "Where Do Broken Hearts Go" are pretty good pieces of work, but they're buried toward the end of side two. The rest of the record is pretty much devoted to lowest-common-denominator pop—music that exists only for the sake of filling up an album, with no reason of its own. It's generic, faceless music that now has a face and voice to peddle it.

Production-wise, the record is average, factory-line music—no trailblazing sonic accomplishments and no mind-blowing arrangements. It is, in a word, workmanlike.

Yeah, Whitney sings great. And Dustin Hoffman's a great actor, but what's he doing in *Ishtar*? Don't blame Whitney; she's young, and still swept up in the wave of massive early success. But if we are to consider her an artist as well as a singer, she'll have to come up with more than volume three of this formula pap next time around.

Jon & Sally Tiven

Sentimental Hygiene: Warren Zevon
Virgin 90603-1.

Sound: B– Performance: A

Nobody will call *Sentimental Hygiene* a pretty album. Warren Zevon was never one to shrink from nitty-gritty topics for his songs, and here he covers everything from the life of a former boxer to celebrities taking cures at a "Detox Mansion" to various forms of heartache. And it is all done in a brash, bracing, bruising manner.

First out of the chute is the title song, about fatigue, isolation, and safe sex. After a verse and a chorus, a stinging guitar solo comes on. Yes, that's Neil Young's signature sound on the solo. Next up is "Boom Boom Mancini," about a second-generation boxer who got hit a lot on the way to winning his title. Here the lead guitar and piano are by Zevon, a gutty stick-and-jab job. The song neither endorses nor condemns the sport; it's just sharp reportage. "The Factory" is a Springsteenish portrait of a 24 year old with a wife, a kid, and another on the way, working a tough factory job and starting to ask why. The harmonica is by Bob Dylan.

Zevon and J. D. Souther cowrote "Trouble Waiting to Happen," a mid-tempo, light-flavored, dark-humored song about the worst day ever. Musical spice comes from Brian Setzer's lead guitar and Don Henley's harmonies. Together with "Reconsider Me" and "The Heartache" (which features some sweet vocals from Jennifer Warnes), "Trouble Waiting to Happen" provides respite from the blistering energy level of the rest of the album.

"Detox Mansion," "Bad Karma," and "Even a Dog Can Shake Hands" form a wickedly ironic sequence about the price of screwing up when you're famous and in the public eye. David Lindley appears on the first two, adding some nice lap-steel guitar to "Detox" and exotic bowed saz on "Bad Karma," where the presence of sitar completes the joke. The finale, "Leave My Monkey Alone," pictures white colonials watching their way of life fall to

ruin at the hands of the Mau Mau rebellion. George Clinton's arrangement is the nerviest of the album—the song is startling even in this wild company.

Supporting Zevon on all but two tracks are three members of R.E.M. (guitarist Peter Buck, drummer Bill Berry, and bassist Mike Mills). They give Zevon the most sympathetic backing he has ever enjoyed. The sound is that of raw, up-close, in-your-face rock 'n' roll, played with just the right amount of hostility. Niko Bolas justly receives credits for recording, mixing, and co-producing (with Zevon).

With its heady mix of superb, stimulating songwriting, spot-on playing, and powerful sound, *Sentimental Hygiene* warrants serious attention. It is a potent package. *Michael Tearson*

Coming Around Again: Carly Simon
Arista AL-8443.

Sound: B Performance: B

Letters Home: Wendy Waldman
Cypress 661 114-1.

Sound: B Performance: B

Two of the very best confessional songwriters return to prime form on their latest releases.

Coming Around Again is Carly Simon's best album in a decade. For much of the set she is reunited—to fine effect—with Paul Samwell-Smith, who produced her first several albums. Richard Perry, who produced "You're So Vain," here handles a hot cover of the Joe Tex song "Hold What You've Got," while Bryan Adams checks in to oversee his own song, "It Should Have Been Me." John Boylan, Rob Mounsey, and the team of Russ Kunkel, Bill Payne, and George Massenburg also make producing contributions. Still, despite the variety of producers, *Coming Around Again* has a unified feel.

Carly sometimes gets too cute for her own good, but her sincerity and confidence ultimately carry the album. Give a lot of credit, too, to Frank Filipetti, who engineered and mixed most of the album, giving it a warm, friendly, and outgoing feel.

Wendy Waldman has never received the commercial success or the acclaim that Carly Simon has, but she is a fine songwriter nonetheless, and *Letters Home* is as strong an album as she has ever done.

Here Wendy actually rocks out on songs like "Living in Hard Times" and "The Longest Summer." In the course of the album there emerges a theme of breaching barriers between people and making contact. The title song, for instance, is about someone ending a long estrangement with her mother. The finale, "Crossroads," is a prayer reaching out to offer support. This may sound melancholy, but in the end *Letters Home* is quite optimistic.

Wendy produced *Letters Home* herself, using a small, tight little band. Engineer John Wiles has delivered a lively sound, at once well rounded and spunky, with fine digital mixing.

Michael Tearson

Carly Simon

Kate Bush

The Whole Story: Kate Bush
EMI America PWAS 17242.

Sound: B+ Performance: A–

Kate Bush is generally considered to be an acquired taste. If one hasn't taken the time to penetrate her world, it can be discomforting. Her brand of originality takes effort to appreciate: It requires suspension of all notions about what music should be, acceptance of a unique voice whose character can change from angel to seductress to squalling brat in the breath of a melisma, and willingness to be enchanted by finely spun yet often only half-told tales.

The Whole Story is a palatable first course in Bush. A compilation of singles released over the last 10 years, it includes much of her most accessible material. Included are the catchy "Running Up That Hill," the title cuts from 1985's *Hounds of Love* and 1982's *The Dreaming*, and a resung version of her first single, "Wuthering Heights," first released when Bush was 18 years old.

The biggest drawback to this collection is that it yanks the songs out of the

The finest sounding receivers in the industry... are available only at the finest retailers:

ALASKA
Pyramid Audio
(907) 272-9111

ALABAMA
Audition
(205) 871-2187
Southern Sound
(205) 350-5801
(205) 350-1582

ARIZONA
Audio Emporium
(602) 881-7121
Smith Electronics
(602) 445-1020
Sound Advice
(602) 955-8800
Warehouse Stereo
(602) 782-9551

ARKANSAS
Stereo One
(501) 452-9969

CALIFORNIA
Bananas Hi Fi
(209) 225-2011
Paradyme Audio/Video
(209) 521-1780
Ametron
(213) 462-1200
C. Hansend Ltd.
(213) 858-8112
Dimensions in Stereo
(213) 542-8521
GNP Showcase
(213) 577-7767
Hollytron
(213) 464-2532
LA Sound & Comm.
(213) 473-9756
Marconi Radio
(213) 240-1090
Reference Audio Systems
(213) 398-4205
Rogersound Labs
(213) 829-7119
Rogersound Labs
(213) 594-9646
Rogersound Labs
(213) 371-2411
Rogersound Labs
(213) 594-9646
Royal Sound
(213) 933-3094
Safe & Sound
(213) 392-3031
Supervision
(213) 652-9510
Century Stereo
(408) 998-7474
Catania Sound
(415) 461-1170
Century Stereo
(415) 573-9644
Hermary's
(415) 592-9480
Pro Audio Electronics
(415) 654-6630
Sounding Board
(415) 843-7031
Stereo Plus
(415) 861-1044
Stereo Plus
(415) 828-3210
Western Audio Imports
(415) 494-2552
World of Sound
(415) 383-4343
World of Sound
(415) 928-3101
Desert Stereo
(619) 346-1733
Stereo Design
(619) 573-0060
Stereo Unlimited
(619) 223-8151
Warehouse Stereo
(619) 353-0680
Catania Sound Inc.
(707) 526-7555
The Music Hut
(707) 462-8417
Audio Exposure
(714) 240-0742
Audio Today
(714) 891-7575
Executive Sound
(714) 759-1520
Rogersound Labs
(714) 380-8778
Solid State TV-Audio
(714) 557-7370
Audio Video Concepts
(805) 541-5778
Calif. Audio & Video
(805) 687-5799
Casa Moore Stereo
(805) 323-8341
Casa Moore Stereo
(805) 832-6311
Dexter's Camera & Hi Fi
(805) 643-2172
Northridge Audio Ctr.
(818) 993-1016
Rogersound Labs
(818) 351-5421
Rogersound Labs
(818) 882-4600
Rogersound Labs
(818) 787-6863
Sound Center
(818) 883-2811
Sound Center
(818) 991-2685
Paradyme Electronics
(916) 481-3900

COLORADO
Gramophone Shop
(303) 744-1283
Soundings
(303) 759-5505
Soundtrack
(303) 425-6700
Soundtrack
(303) 671-9399
Soundtrack
(303) 442-3600
Soundtrack
(303) 759-5401
Soundtrack
(303) 979-8900
Soundtrack
(303) 450-6677
Soundtrack
(303) 779-5003
Soundtronix
(303) 356-1588
Soundtronix
(303) 545-1097
Soundtronix
(303) 574-2900
The Sound Shop
(303) 636-1684

CONNECTICUT
Audiotronics
(203) 838-4877
Carston Stereo
(203) 744-6421
Hi Fi Stereo House
(203) 666-4740
Hi Fi Stereo House
(203) 674-9755
Take 5 Audio
(203) 777-1750
Zinno Music
(203) 755-3696

DELAWARE
Sound Studio
(302) 678-0100
Sound Studio
(302) 731-1024
Sound Studio
(302) 478-9300

FLORIDA
Absolute Sound
(305) 629-1930
Audio Advisors
(305) 586-8497
Fox Audio
(305) 287-4335
Sound Design & Eng.
(305) 562-7210
Sound Plus Wood
(305) 391-1843
Stereo By Design
(305) 232-1812
Stereo By Design
(305) 344-3700
Verns Electronics
(305) 391-3259
Audio Workshop
(813) 748-3868
Cooper For Stereo
(813) 527-6863
Maurice Stereo
(813) 876-1951
Stereo Garage
(813) 775-5900
Behren's Audio Lab
(904) 721-1860

GEORGIA
Hi Fi Buys
(404) 266-1694
Stereo City of Georgia
(404) 736-0189
Hi Fi Sales & Service
(912) 229-0093

HAWAII
Audio Shoppe
(808) 537-1931
Bose Entertainment Ctr.
(808) 533-4122
Bose Entertainment Ctr.
(808) 533-6738
Hilo Audio
(808) 935-7146

ILLINOIS
Audio Enterprises
(312) 754-6056
Audio Visions
(312) 980-4946
Columbia Audio-Video
(312) 394-4770
Columbia Audio-Video
(312) 433-6010
Media Room
(312) 966-5590
Mills Recording
(312) 332-4116
Sounds Deluxe
(312) 887-9818
Stereo Systems
(312) 934-5544
Stereo Systems
(312) 885-4144
Team Electronics
(312) 658-8600
America's Best Audio
(815) 338-0565
Columbia Audio-Video
(815) 964-4886
Stereo Systems
(815) 741-1350
The Shoppe
(815) 939-4014

INDIANA
Audio Radio Specialst.
(219) 255-6434
Classic Stereo
(219) 483-0553
Classic Stereo
(219) 483-0553
Classic Stereo
(317) 282-5264
Classic Stereo
(317) 662-9344
Ovation Audio
(317) 849-7729
Tom Doherty's Audio
(317) 848-7503
Alan Audio
(812) 332-2192
Audio Connection
(812) 232-1663
Risley Electronics
(812) 479-8787
Risley Electronics
(812) 886-9543

IOWA
Spencer Sound Syst.
(319) 354-1448
Wright's Sight & Sound
(515) 437-4814
Pfanz Electronics
(712) 252-4507

KANSAS
Audio Visions
(316) 681-1751
Hayes Audio Elect.
(316) 792-8139
Hayes Sight & Sound
(316) 662-2791
Audio Electronics
(913) 381-8585
Nelson's
(913) 267-2200

KENTUCKY
Audio Video By Design
(502) 425-3333
Risley Electronics
(502) 685-2264
Risley Electronics
(502) 321-5620
Risley Electronics
(502) 443-4444
Audio Connection
(606) 432-8132
Ovation Audio
(606) 278-0335
Sight n Sound
(606) 371-4036
Sounds Around Town
(606) 528-0556
Sounds Around Town
(606) 864-6437

LOUISIANA
J's Sound Center
(318) 387-6044
Sterec & Record Cent.
(318) 861-2636
Sterec & Record Cent.
(318) 865-6223

MARYLAND
Discerning Ear
(301) 494-8990
Myer-Emco
(301) 468-2000
Sounc Studio
(301) 546-3131

MASSACHUSETTS
Taylor'd Sound
(413) 499-1420
The Music Store
(413) 774-2836
Audio Video Environ.
(617) 864-8001
Electric Gramaphone
(617) 443-3703
Encore Audio
(617) 236-4646
High Fidelity House
(617) 799-9737
Nantucket Sound
(617) 231-3131
Nantucket Sound
(617) 532-5777
Nantucket Sound
(617) 734-0700
Nantucket Sound
(617) 771-4434
Nantucket Sound
(617) 348-6622
Nantucket Sound
(617) 826-2344
Sounc II
(617) 996-5454
The Music Box
(617) 235-5100
The Music Forum
(617) 343-9393
The Music Forum
(617) 632-0660
The Music Forum
(617) 534-4431
Trolley Stereo
(617) 484-7847
Audio Concepts Inc
(619) 599-8819

MICHIGAN
Stereo Center
(313) 239-9474
Video Alternative
(313) 549-3100
Classic Stereo
(616) 957-2130
Classic Stereo
(616) 381-6049
Langlois Stores
(616) 733-2528

MINNESOTA
Team Electronics #163
(218) 739-3874
Amalgamated Audio
(507) 286-1328
Amalgamated Audio
(507) 452-1965
Midwest Satellite A & V
(507) 238-2233
Audio By Design
(612) 475-1443
Entertainment Designs
(612) 339-8616
First Tech
(612) 377-9840
First Tech
(612) 378-1135
Top Tech
(612) 780-9707
Top Tech
(612) 920-4817
Top Tech
(612) 544-7412
Top Tech
(612) 636-5147
Top Tech
(612) 451-1765

MISSISSIPPI
Audio Advantage
(601) 328-4500
Audio Advantage
(601) 841-2400
Automotive Audio
(601) 956-8158
The Sound Circuit
(601) 445-2377
The Sound Circuit
(601) 638-6033

MISSOURI
Hi Fi Fo Fum
(314) 647-3606
Wright's Sight & Sound
(816) 665-7208

MONTANA
Sound Pro
(406) 449-4945
Sound Pro
(406) 453-4364

NEVADA
Import Audio
(702) 731-2000
Import Audio
(702) 731-4918

NEW HAMPSHIRE
Audio Of New England
(603) 225-3313
Audio Of New England
(603) 524-1532
Cuomos
(603) 893-1904
Soundsations
(603) 778-1402

NEW JERSEY
AC Audio Video
(201) 526-1777
Atlantic Stereo
(201) 390-0780
Elite Audio Video
(201) 884-0044
J S Audio
(201) 292-2799
Landes Audio
(201) 879-6889
Leonard Radio
(201) 251-5525
Monmouth Stereo
(201) 842-6565
Samm Sound
(201) 575-8910
Stereo City
(201) 561-5577
The Sounding Board
(201) 445-5006
Soundworks
(609) 751-1900
Sound Waves
(609) 645-1222

NEW MEXICO
The Sound Room
(505) 524-7080

NEW YORK
Audio Exchange
(212) 964-4570
Audio Exchange
(212) 982-7191
Audio Salon
(212) 249-4104
Custom Media Design
(212) 689-5916
Music Masters
(212) 840-1958
New York Video
(212) 755-4640
Park Avenue Audio
(212) 685-8102
Audio Exchange
(516) 334-7077
Audio Exchange
(516) 295-2100
Designatron's Stereo
(516) 822-5277
Designatron's Stereo
(516) 473-4242
The Sound Approach
(516) 499-7620
Sound Insights
(516) 536-9160
Audio Sound Systems
(518) 783-0938
Great Northern Stereo
(518) 561-8909
Chemung Electronics
(607) 962-4606
Chemung Electronics
(607) 733-5531
Chemung Electronics
(607) 272-2225
Rowe Photo/Video
(716) 442-8230
Stereo Shop
(716) 442-2879
Stereo Shop
(716) 621-4050
Stereo Shop
(716) 424-1820
The Sterec Advantage
(716) 632-8038
Clone Audio
(718) 987-2850
Continental Sound
(718) 459-7507
Leonard Radio
(718) 803-1111
NYC Media Room
(718) 783-2113
Sound On Wheels
(914) 471-9880

NORTH CAROLINA
Audiohaus
(704) 256-6911
Mac's TV
(704) 437-2494
Anderson Audio
(919) 633-3611
Microwave Audio World
(919) 446-1200
Stereo Sound
(919) 942-8546
Stereo Sound
(919) 782-4111

OHIO
B & B Appliance
(216) 842-5600
B & B Appliance
(216) 261-5600
Far East Audio
(216) 264-2161
Hammond Electronics
(216) 497-0070
Classic Stereo Of Ohio
(419) 228-9422
Sight In Sound
(513) 474-4776
Sight In Sound
(513) 931-7601
Sight In Sound
(513) 772-6500
Sight In Sound
(513) 471-5602
Sight In Sound
(513) 248-1110
Stereo On Wheels
(513) 898-4590
Stereo On Wheels
(513) 866-4131
Stereo On Wheels
(513) 253-3113
Hammond Electronics
(614) 237-2504
Hammond Electronics
(614) 278-9292
Hammond Electronics
(614) 522-8467

OKLAHOMA
Contemporary Sounds
(405) 755-0795
Sound Station
(918) 336-2240
The Phonograph
(918) 665-6363

OREGON
Focus Electronics
(503) 364-3289
Hawthorne Stereo
(503) 234-9375
Sheckell's Stereo
(503) 476-5282
Sheckell's Stereo
(503) 773-3732
Stereo Plant
(503) 382-9062

PENNSYLVANIA
Sassafras Audio
(215) 776-1941
Sassafras Audio
(215) 527-3656
Sassafras Audio
(215) 357-7400
Sassafras Audio
(215) 884-0292
Sassafras Audio
(215) 627-2913
Sassafras Audio
(215) 362-2180
Sound Shack
(412) 224-7000
The Listening Post
(412) 443-6160
The Listening Post
(412) 681-8433
The Listening Post
(412) 856-1199
Soundworks
(609) 751-1900
Hi Fi House
(717) 564-7688
Hi Fi House
(717) 737-7775
M & M Stereo Equip.
(717) 524-9182
Summit Audio-Video
(717) 283-2770

SOUTH CAROLINA
Frawley Electronics
(803) 771-7340

SOUTH DAKOTA
Western Stereo
(605) 332-5535

TENNESSEE
Hi Fi House
(615) 693-4331
Lindsey Ward
(615) 331-4434
Nicholsons Stereo
(615) 327-4312
The Sound Room
(615) 928-9233
New Wave Car Stereo
(901) 346-3444
New Wave Car Stereo
(901) 668-6711

TEXAS
Hillcrest High Fidelity
(214) 528-0575
Hillcrest High Fidelity
(214) 352-9757
Home Entertainment
(214) 934-8585
Preston Trails Audio
(214) 248-9104
Stereo & Record Ctr.
(214) 757-3500
Stereo & Record Ctr.
(214) 297-1933
Stereo & Record Ctr.
(214) 938-9401
Stereo & Record Ctr.
(214) 561-7455
Texarkana Audio Ctr.
(214) 793-2866
Audio Video
(409) 696-5719
Brock Audio
(409) 832-0276
Bjorn's Audio Video
(512) 646-6991
Discovery Audio Video
(512) 396-2333
Metex International
(512) 727-8933
Showery Stereo
(512) 682-1221
Tape Town Audio Video
(512) 851-2392
Groove Audio Video
(713) 523-2900
Sheffield Audio
(713) 789-1180
Hi Fidelity of Lubbock
(806) 794-4507
Soundroom
(806) 353-9171
Sound Idea
(817) 277-1924
Sound Idea
(817) 346-4500
Sound Idea
(817) 284-4503
The Sound Room
(915) 594-8201

UTAH
Broadway Music
(801) 355-1110
Hi Fi Shop
(801) 621-5244
Lynns TV & Stereo
(801) 752-6564

VERMONT
Mountain Music
(802) 775-2308

VIRGINIA
Contemporary Sounds
(703) 371-4815
Earlwod Fine Audio
(703) 665-0199
Excalibur
(703) 548-3113
Myer-Emco
(703) 536-2900
The Audio Center
(703) 982-8793
Audio Exchange
(304) 282-0438
Digital Sound
(304) 424-5850
Sounds Unlimited
(304) 792-6717

WASHINGTON
Brown's
(206) 457-4150
Desco Electronics
(206) 943-1393
The Sound Authority
(206) 577-0900
Home Entertainment
(206) 881-1265

WASHINGTON D.C.
Myer-Emco
(202) 293-9100

WEST VIRGINIA
Pied Piper
(304) 733-2030
Pied Piper
(304) 529-3355
Pied Piper
(304) 255-0235
Stereo Video Unlimited
(304) 752-2265

WISCONSIN
General Electronics
(414) 964-7660
General Electronics
(414) 281-6651
Gene's Sound/Camera
(414) 458-2141
Wisconsin Electronics
(414) 921-5555
Wisconsin Electronics
(715) 423-2910

WYOMING
Murphy Sight & Sound
(307) 682-4771
The New Music Box
(307) 742-3774

LUXMAN

Ultimate Power.

With a worldwide reputation for sonic excellence, the new Luxman Receivers also deliver more power than ever before.

For over 60 years, Luxman audio components have been internationally recognized for their superb sonic quality.

However, the recent introduction of compact discs with wide dynamics and high-accuracy loudspeakers with low impedance ratings has created a need for receivers with "real" output power.

With the tremendous dynamic power of the new Luxman receivers, our reputation for *"Ultimate Fidelity"* is likely to change to *"Ultimate Power."*

LUXMAN

A Division of Alpine Electronics of America, Inc. (213) 326-8000

Enter No. 18 on Reader Service Card

Carlos Alomar comes up with some well-recorded tracks, but it sounds like he's just fooling around, without a real concept.

contexts in which they originally appeared. The songs on Bush's albums are often linked by lyrical themes and always unified by the distinct production tone that colors each album. Pulled apart from each other, they lose some impact.

Still, there's much to enjoy. Bush, who has come to produce herself, creates whole atmospheres by selectively using the studio's processing equipment on her sidemen, her keyboards (including a Fairlight), and her four-octave soprano. For all the effects and the dense orchestrations, Bush never comes off gadget-happy; every delay, backwards loop, and wet or dry measure is a careful brushstroke in the impressionistic portraits she paints.

Susan Borey

Boi-ngo: Oingo Boingo
MCA 5811.

Sound: B Performance: B–

Like Rodney Dangerfield, Oingo Boingo has often had trouble when it comes to respect. Under the direction of frontman/singer/songwriter Danny Elfman, the band's tight, energetic presentation has usually been written off as uncontrolled mania. Their wry social

Oingo Boingo

commentary has been called adolescent pathology, and the fact that their music is rooted in an inventive blend of rock, R & B, jazz, reggae, and Balinese and West African music is consistently overlooked. The big question of whether this band can ever rocket off its plateau probably depends on the reception of *Boi-ngo*, their fifth album in seven years.

With a cast of sidemen seemingly chosen for their eccentric looks as much as for their musical ability, Elfman rips through the nine songs of *Boi-ngo* with fierce determination and creative breadth that is reminiscent of early Steely Dan. Throughout, careful production adds an extra dimension to songs such as the a cappella-rich "Where Do All My Friends Go"; the stop-and-go, punching "New Generation," and one of the best pop songs I've ever heard, the sober but sweet "We Close Our Eyes." *Susan Borey*

Dream Generator: Carlos Alomar
Private Music 2019-1P, digital.

Sound: B+ Performance: B–

Carlos Alomar is best known for being David Bowie's guitar player, but with a style that aims more at adding texture than taking a lead, he has always seemed to lurk in the shadows, behind names like Stevie Ray Vaughan, Peter Frampton, and Nile Rodgers.

Now, Carlos has decided to step out and make an album primarily of instrumental pieces for a label that specializes in New Age music. From a technical standpoint, he has come up with a bunch of well-recorded tracks which sound like they could have been worked into good songs if they were given a sense of structure. But as a piece of art, the album sounds rather incomplete. It's not hypnotic enough to give Vollenweider a run for his money; in fact, it just sounds like some guy fooling around, without a real concept. In other words, Carlos Alomar is trading off his name, and we'd like to think that he could do better.

Jon & Sally Tiven

KBC Band
Arista AL 8440.

Sound: B Performance: D+

Jefferson Stardreck. For all the combined talents of Paul Kantner, Marty Balin, Jack Casady and four compatriots, the KBC Band's initial disc sounds like Journey rehearsing. The good points: Balin's high, sweet voice. An overall high energy level. The stereo separation. (I mean it. Really.)

The bad points: Most of the music and the lyrics. For instance, "Mariel" is about a mythic goddess who'll stir the oppressed Chileans to democracy. Forget it, guys—it'll take a lot more than that to oust the regime, but you seem too cowardly to go into it. "Hold Me" is only Yuppie love. "Dream Motorcycle" sounds like the Mormon Tabernacle Choir gettin' down. And truth-in-advertising laws should have changed the title of "No More Heartaches" to "One More Earache." The last song here is "Sayonara." How appropriate. And not a moment too soon.

Frank Lovece

WDS

WISCONSIN DISCOUNT STEREO
2417 W. BADGER RD.
MADISON, WI 53713

MasterCard VISA
OR COD

HOURS
M-T 8-8 FRI 9-8
SAT 9-5

NOW PAY LESS!

"THE WORLD'S LARGEST ELECTRONICS INVENTORY AT THE BEST DISCOUNTS."

DISCOUNT HOTLINE

(IT'S EASY TO SAVE—CALL!)

1-800-356-9514

OR CALL 1-608-271-6889

JVC DDVR77 $239

★ AUTO-REVERSE CASSETTE
★ DOLBY B + C, 2-MOTOR
★ 4-WAY DIGITAL COUNTER

SHERWOOD CRD301 & SCA240 $169

★ DIGITAL CAR STEREO
★ DOLBY, AUTO-REVERSE
★ 20 WATTS x 4

SHERWOOD CRD350 $189

★ DIGITAL DIN CAR STEREO
★ DOLBY B + C, AM STEREO
★ HIGH-POWER

JVC XLC30 CALL!

★ CAR AM/FM CD PLAYER
★ 20 PRESETS
★ 15 TRACK PROGRAMMING

TEAC R888X $399

★ 3-HEAD CASSETTE
★ BI-DIRECTIONAL REC/PLAY
★ DOBLY B + C + dbx

CLARION 8825 $239

★ DIGITAL CAR STEREO
★ DOLBY, 18 PRESETS
★ HIGH-POWER

TEAC ZD5000 $599

★ ZERO DISTORTION
★ DUAL D/A CONVERTORS
★ AUDIOPHILE DISC PLAYER

TEAC AD-7 $579

★ CD/CASSETTE COMBO
★ WIRELESS REMOTE
★ DOLBY B + C + dbx

TEAC R606 $219

★ AUTO-REVERSE CASSETTE
★ DOLBY B + C + dbx
★ BIAS FINE TUNING

SHERWOOD S2770 CALL!

★ AUDIO/VIDEO RECEIVER
★ 70 WATT/CHANNEL
★ SURROUND SOUND

PANASONIC VHS HIFI $399

★ FULL HIFI SOUND
★ SLOW-MOTION
★ WIRELESS REMOTE

VHS MTS HIFI $379

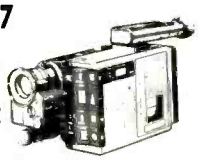
★ HQ CIRCUITRY
★ FULL HIFI SOUND
★ MTS STEREO TUNER

JVC DDVR9 $319

★ 3-HEAD CASSETTE
★ QUICK AUTO-REVERSE
★ DOLBY B + C

JVC GRC7 CALL!

SPECIAL PURCHASE



★ VHS-C CAMCORDER

TECHNICS SLQD33 $119

★ QUARTZ D.D. TURNTABLE

GE VHS HIFI $349

★ FULL FUNCTION REMOTE
★ FULL HIFI SOUND
★ 4 EVENT TIMER

TEAC W660 $259

★ HIGH SPEED DUBBING DECK
★ DOUBLE AUTO-REVERSE
★ DOLBY B + C

SONY KV1380 $349

MONITOR/RECEIVER
★ MTS STEREO TUNER

SONY SSU370 $49 EA.

50 WATT

★ FLOOR-STANDING SPEAKERS

GE TOP OF THE LINE $479

★ 4-HEAD VHS HIFI
★ 8 EVENT / 21 DAY
★ 169 CHANNEL TUNER

TEAC V770 $289

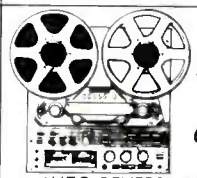
★ 3-HEAD CASSETTE
★ DOLBY B + C + HX PRO
★ BIAS FINE TUNING

TOSHIBA XRP9 $169 WIRELESS

★ PORTABLE DISC MAN

TEAC X-2000R $899

6 HEAD dbx



★ AUTO REVERSE REEL-REEL

HITACHI VT1710 $489

★ 3-HEAD VHS HIFI
★ REMOTE PROGRAMMING
★ MTS TUNER

WHISTLER SPECTRUM 2 $189

★ COBRA 3110 ..... $99
★ BEL 874 ..... $119
★ BEL 844 ..... $159

WDS CONFIDENCE CHECKLIST

1. ALL UNITS FACTORY FRESH WITH FULL WARRANTY
2. ALL ORDERS PROCESSED WITHIN 12 HOURS
3. 95% OF ALL ORDERS SHIPPED WITHIN 48 HOURS
4. WE CAN SHIP COD
5. NO EXTRA CHARGE FOR MASTERCARD OR VISA
6. BUYER PROTECTION PLAN ON EVERY PRODUCT SOLD
7. ALL SALES REPRESENTATIVES FULLY FACTORY TRAINED
8. EXTENDED WARRANTIES AVAILABLE
9. ESTABLISHED 1954
10. TOLL FREE WARRANTY SERVICE 800-448-3378
11. SOME ITEMS LIMITED QUANTITIES

SHURE V15 V MR $129

★ ORTOFON OM20 ..... $69
★ ORTOFON TM7 ..... $29
★ STANTON 500A $15

CLASSIFIED ADVERTISING

CLASSIFIED ADVERTISING RATES

BUSINESS ADS—$1.85 per word, MINIMUM charge PER AD, PER INSERTION $45. All centered or spaced lines $16.

NON BUSINESS ADS—$1.30 per word, MINIMUM charge PER AD, PER INSERTION $30. All centered or spaced lines at $13.

ALL LINE ADS—First line set in bold face type at no extra charge. Additional words set in bold face at $2.00 *extra* per word. One point ruled box is $15.

CLASSIFIED LINE ADS ARE PAYABLE IN ADVANCE BY CHECK OR MONEY ORDER ONLY. (Sorry, we cannot accept credit cards or bill for line advertising.) **ALL LINE ORDERS** should be mailed to:

AUDIO/CBS Magazines
P.O. Box 9125
Dept. 346V
Stamford, CT 06925

ORDERS WILL NOT BE PROCESSED WITHOUT ACCOMPANYING CHECK OR MONEY ORDER FOR FULL AMOUNT.

CLOSING DATE—First of month two months preceding the cover date. If the first of the month falls on a weekend or holiday, the closing date is the last business day preceding the first. ADS RECEIVED AFTER THE CLOSING DATE WILL BE HELD FOR THE NEXT ISSUE UNLESS OTHERWISE STATED.

FREQUENCY DISCOUNTS—3 times less 5%, 6 times less 15%, 12 times less 20%. These discounts apply to line ads only. Ads submitted for a three-time frequency are unchangeable. Frequency discounts not fulfilled will be short-rated accordingly. Agency discounts do not apply to line advertising.

BLIND ADS—Audio box numbers may be used at $8 extra for handling and postage.

GENERAL INFORMATION—Ad copy must be typewritten or printed legibly. The publisher in his sole discretion reserves the right to reject any ad copy he deems inappropriate. **ALL ADVERTISERS MUST SUPPLY:** Complete name, Company name, Full street address (P.O. Box numbers are insufficient) and telephone number. Classified LINE ADS are not acknowledged and do not carry Reader Service Card Numbers. **AGENCY DISCOUNTS** do not apply to line advertising. **FREQUENCY DISCOUNTS** not fulfilled will be short rated accordingly. Only those advertisers who have prepaid for their entire contract time will be **RATE PROTECTED** for the duration of that contract, in the event of a rate increase.

CLASSIFIED DISPLAY RATES

1 col × 1 inch	$316
1 col × 2 inches	$498
1 col × 3 inches	$713
2 cols. × 1 inch	$567
2 cols. × 2 inches	$958

One column width is 2⅛". Two columns wide is 4¼". For larger display ad rates and 6, 12, 18 and 24 times frequency rates call (212) 719-6338.

DISPLAY ADVERTISERS should make space reservation on or before the closing date. Ad material (film or velox) may follow by the tenth. DISPLAY ADVERTISERS MUST SUPPLY COMPLETE FILM NEGATIVE READY FOR PRINTING OR VELOX. PRODUCTION CHARGES WILL BE ASSESSED ON ANY AD REQUIRING ADDITIONAL PREPARATION.

ALL DISPLAY CORRESPONDENCE should be sent to:

Laura J. Lo Vecchio, AUDIO MAGAZINE,
1515 Broadway, New York, NY 10036

FOR ADDITIONAL INFORMATION: CLASSIFIED LINE ADS: Mary Jane Adams—(212) 719-6345. **CLASSIFIED DISPLAY ADS:** Laura J. Lo Vecchio—(212) 719-6338

ANNOUNCEMENTS

FOR SALE

FOR SALE

FOR SALE

AA#1 RATING !!

Our **WONDER CAPS®** and **WONDER SOLDER™** have been rated **BEST** in the world by reviewers and professional experts. What do they say? Write **TRT**, Box 4271, Berkeley, CA 94704.

ACCESSORIES
HARD-TO-FIND AUDIOPHILE ACCESSORIES.

1.) Audioquest (AQ) Tonearm Lifter	$39.50
2.) AQ Super Reflex Clamp (Delrin)	$39.50
3.) AQ Sorbothane Turntable Mat	$29.50
4.) AQ Sorbothane Sheet 6"x6"	$12.50
5. AQ Sorbothane Foot	$8.95
Set of Four	$34.50
6.) AQ Record Brush	$7.95
7.) AQ Tube Damper Rings	$2.50
8.) AQ Electronic Stylus Brush	$29.50
9.) Compact Disc Dampers	
Mod Squad CD Damper	$19.99
extra disc Rings (50)	$9.95
Monster Cable Discus 2 (very thin)	$35.00
AQ CD Stabilizer Rings (35 w/locator)	$39.50
extra rings (50)	$55.00
10.) DB Cartridge Alignment Protractor	$24.50
11.) Magnavox CDB-650 CD Player	$369.00
12.) Magnavox CDB-465 CD Player	$219.00
13.) NYAL Super It Tube Phono Preamp	$169.00
14.) Sumiko Fluxbuster FB-1	$114.50
15.) **SUMIKO TWEEK EXTRA SPECIAL**	**$9.99**
16.) Tip Toes/Counterfeet	
C-3 3/4"	$4.50
C-4 1½"	$6.50
17.) VPI HW-5db "Magic Brick"	$34.50
shipping: one item	$3.95
each extra item	$1.25

Charge it! VISA/MC/AMEX/OPTIMA/DISCOVER. **616-451-3868.** Audio Advisor, Inc., 225 Oakes SW Grand Rapids, MI 49503. Fast Delivery available.

ACOUSTAT AND PS AUDIO—SUPERB!
Free shipping! Fast service! Also Sota, Thorens, Talisman, Audire, Hafler, CWD, Proton, Quad, Sony, Spica, Superphone. READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403. (803) 723-7276.

ACOUSTAT SPECTRA 3
defines a new state-of-the-art in electrostatic loudspeaker. Free demonstration in your home! (Some restrictions apply.) WORLDWIDE EXPORTING. Free delivery in USA. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

ADCOM GFA-555/MUSICAL CONCEPTS
Musical Concepts modified Adcoms sound sweet, dynamic, open and fatigue free! Our customers are delighted! M-555GX $175/installed, Musical Concepts, #1 Patterson Plaza, Florissant, MO 63031, 314-831-1822, 1-5PM CST. Dealer inquiries invited.

ALABAMA-WEST GEORGIA
Audioquest, Alphason, Creek, Futterman, Garrott, Grado, Hafler, KEF, Klipsch, McLaren, Meridian, MIT, Monster, MOSCODE, NAD, Oracle, Premier, Promethean, Quad, Rauna, Signet, SME arms, Spectrum, Soundstream, Souther, Thorens, Tube Traps, VPI, Zapco and more. **ACCURATE AUDIO** 110 E. Samford Ave, Auburn, AL 36830. 205-826-1960.

ALL THE BEST EQUIPMENT, expert advice and outstanding prices! Apogee, SOTA, Klyne, Eminent Technology, Mietner, MIT-Cable, Quicksilver, Koetsu, Sonographe—more! Galen Carol Audio: 512-494-3551.

ALTEC, JBL, ELECTRO-VOICE speaker components and speaker systems. JBL Studio Monitors. AKG, Sennheiser headphones. Tascam, Revox, Carver, Crown professional amps. Microphones. Beta Hifi. Free flyer, Low Prices! Rick Marder, AHCo. (201) 561-8123.

AR, PROAC, SOTA, PERREAUX, CJ, BEYER, STAX, CONCORD, DENON, ENERGY, HK, KEF, NAD, **NAKAMICHI** HOME & AUTO, NITTY GRITTY, NILES, ORTOFON, PARSEC, POLK, PROTON, SOUNDCRAFTSMEN, SUMIKO, GRACE, THORENS, VPI, CWD, AND MORE. PROFESSIONAL CONSULTATION AND INSTALLATION. NO MAIL ORDERS, PLEASE. THE LISTENING ROOM, 1305 COURT ST, SAGINAW, MICHIGAN 48602. (517) 792-3816.

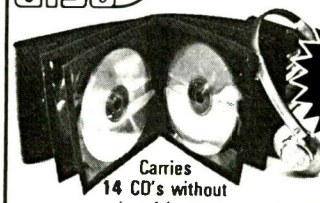
ACTIVE ELECTRONIC CROSSOVERS
MODEL 120 CABINET & NEW 120-R "RACK AND PANEL" DESIGNS
Made to order in Butterworth bi-amp, tri-amp, or quad-amp configurations with optional level controls, subsonic filters, or summers. Filters, regulated power supplies, equalizers, are also available.
New catalog and price sheet. Free!
DeCoursey **Eng. Lab.**
11828 Jefferson Bl. Culver City, CA 90230
PHONE (213) 397-9668

FOR SALE

BEAT THE PRICE FIXERS WITH low discount prices and full U.S.A. manufacturers warranties on: Nakamichi, Revox, Carver, Bang & Olufsen, ADS, Kyocera, HK, Crown, Hafler, B&W, NAD, Tandberg, Polk. Island Audio, Inc., 1122 Riverside Drive, Holly Hill, FL 32017. (904) 253-3456.

"BEST IN BOSTON" said Consumer Electronics Magazine. Apature, Aragon, British Fidelity, Creek, Fried, Grace, Grado, Luxman, Mirage, Mordaunt-Short, Parasound, Spendor. Used components bought and sold. **ENCORE! AUDIO,** 225 Newbury Street, Boston, Mass. 02116. 617-236-4646.

Carry Disc™ The Go Anywhere CD Carrier as seen on TV



Only $15.95
Carries 14 CD's without jewel boxes
plus $1.50 shipping/handling
PA residents add 6% tax
• Light • Durable • Soft Velour Lining •
Call Toll Free 1-800-331-4315
in.PA.215-860-9015 MC/VISA
P.O. Box 1463 Southampton, PA 18966

FOR SALE

AUDIO BEST: LA, ORANGE, SAN BERNARDINO, CALIFORNIA, DEMONSTRATES PREAMP BEST BUYS: CONRAD-JOHNSON, AUDIBLE ILLUSIONS, PS, ADCOM, SUPERPHON, B&K, MOSCODE, MUSIC REFERENCE, CD BEST BUYS: SONAGRAPH, PS, AUDIOQUEST. ALSO, ACOUSTAT, PALANTIR, VORTEX, SPICA, SPECTRUM, RAUNA, SOUNDLAB, VELODYNE, WELL-TEMPERED-LAB, VPI, MAPLENOLL, SYSTEMDECK, MAGNUM, PREMIERE, GRADO, ALPHASON, GARROTT, VDHUL MIT, MONSTER, RANDALL, STRAIGHTWIRE. (714) 861-5413, appointment.

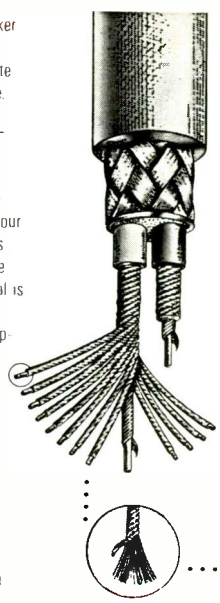
POWER PLAY.

Introducing the New Monster "*M*SERIES"
Sonic Reference Standard Audio Cables

Thrilling! Dynamic! Exciting!
Like a new component, our M1 Speaker Cable and M1000 audio interconnect cables lets you hear all of your favorite recordings as a new sonic experience.

Time compensated cable windings with a totally new development. "MicroFiber™".
The heart of the M•Series is our new MicroFiber insulation combined with our sophisticated new cable constructions. We've found that second only to cable windings, dielectric insulating material is *the* most influential factor in how an audio cable sounds. By precision wrapping MicroFiber around selected conductors, we've enabled the audio signal to travel faster, cleaner, with less signal loss, and more uniformly through the cable than with other materials.

The M•Series gives you 5 significant advances in cable technology.
Soundstage. Ultra precise. Ultra wide.



Quiet. Less "intertransient noise" so quiet passages are even more quiet.
Fast. Transients are audibly quicker, razor sharp and incredibly clear.
Deep Bass. Bass you can *feel.* Earth shaking if your system goes down low.
Dynamics. More powerful. More precise. More like real music.

Available for immediate audition at your Monster M•Series dealer:
The Monster M1. Our most advanced speaker cable design that will put you back into your listening chair.
The Interlink M1000. Featuring our renowned "Bandwidth Balanced™" technology along with our latest cable construction using MicroFiber for a new level of audio interconnect cable performance.
Together, they are the world's most exciting cables to listen to and are sure to make a sonically rewarding addition to your sound system.

MicroFiber dielectric precision wrapped around each conductor group.

MONSTER CABLE®

Monster Cable Products, Inc.
101 Townsend, San Francisco, CA 94107
Tel 415 777 1355 Telex 470584 MCSYUI

FOR SALE

ANNOUNCING THE MUSICAL CONCEPTS MC-2 TEFLON

TEFLON® circuit boards??? Yes!!! The MC-2 is an improved version of our highly acclaimed MC-1, rated "best solid state Preamp" by Audiogram. The MC-2 phono/line stage has adjustable gain. MC-2 Teflon offers astounding inner detailing and delicacy. You'll know what transparency means with the MC-2T! Many audiophiles with expensive tube preamps have switched to the MC-2T. Mil glass/epoxy version of MC-2 available. MC-2 retrofits into Hafler DH-100, DH-101, DH110, Dyna PAT-4/5, others. MC-2T (Teflon®) $400/kit, MC-2 $269/kit. Musical Concepts, #1 Patterson Plaza, Florissant, MO 63031, 314-831-1822 1-5PM CST. Dealer Inquiries invited.

FOR SALE

AMAZING? ISN'T IT

The amount of nonsense that gets thrown around in the audio world. If you are sick of being treated like a 5-year-old child by shoe salesmen masquerading as audio experts, you owe it to yourself to give us a call. Our opinions are based on a solid foundation of experience with the components we sell as well as those sold by our competitors. Most importantly we don't simply sell the finest audio equipment available, we arrange it in complementary systems designed to extract the greatest benefit from your audio dollars chosen from among the following lines we represent:

ACOUSTAT • ADCOM • AIR-TANGENT • AKROYD • APOGEE • ARAGON • AUDIOQUEST • AUDIO NOTE • AUDIO RESEARCH • BRITISH FIDELITY • BULLET • CALIFORNIA AUDIO LABS • CAMBRIDGE AUDIO • CARNEGIE ONE • CLOSS NOVABEAM • CREEK AUDIO • CWD • DUAL • GRACE • GRADO • HARMAN-KARDEN VIDEO • HEYBROOK • HI-PHONIC • KISEIKI • KOETSU • KRELL (INCLUDING KRS BALANCED) • KYOCERA • LINN SONDEK • LIVEWIRE • MEITNER • MONDIAL • MONSTER CABLE • NITTY GRITTY • NYAL (MOSCODE) • ONIX • PIONEER VIDEO • PROAC • PS AUDIO • QUAD • RANDALL RESEARCH • REGA • REVOX • ROKSAN XERXES • SILTECH • SME (IV & V) • SNELL ACOUSTICS • SSI • STAX • SYMDEX • TALISMAN • TARGET • VANDERSTEEN

SOUND BY SINGER

165 E. 33RD STREET
New York, NY 10016
(212) 683-0925
WE SHIP ANYWHERE

AMERICA'S LARGEST dealers in **HIGH END USED** stereo. We **BUY** and **SELL** by **PHONE. STEREO EXCHANGE** 687A Broadway, between 3rd and 4th St. (opposite Tower Records) NYC 10012. (212) 505-1111 and (800) 833-0071.

ATTENTION! FREE UPS SHIPPING

Nakamichi, B&K, Sony ES, Superphon, Meitner, P.S. Audio, Magnat, Hafler, AR ES-1 & ETL-1, Syrinx, Grado Signature, Ortofon X3MC, H/K Citation, Onkyo, Apogee, Carver, & Adcom in-store only. DEMO SPECIALS - Nakamichi CA-7A preamp $1799, Nakamichi PA-7M $1349, Hafler XL-280 $459, Superphon Revelation Basic DM preamp $349, Magnat MSP-300 $899/pr, Meitner STR-50 amp, $1095. Expert consultation - ask Cliff or Ward. THRESHOLD AUDIO: 409 South 22nd St., Newark-Heath, Ohio 43056, 614-522-3520. MOST ORDERS SHIPPED IN 24 HOURS.

AUDIO CLASSICS Buys-Sells-Trades Precision Audio Components including **Accuphase, Audio Research, conrad-johnson, Krell, Marantz (USA),** and **McIntosh. FREE** Catalogue. 8AM-5PM EST Mon.-Fri., POB 176AC, Walton, NY 13856. 607-865-7200.
—Audio Advertiser Since 1979—

AUDIO COMPONENTS BY; ADCOM - BERNING - CLEARAUDIO - COUNTERPOINT - DECCA - ENTEC - GRADO - JSE - KINDEL - MAGNUM DYNALAB - MICRO SEIKI - MOORE FRANKLIN - PREMIER - REGA - SHINON - SME - SPICA - STRAIGHTWIRE - STAX - VPI - WELL TEMPERED LAB - XSTATIC SYSTEMS.
NEW & DEMONSTRATORS WITH WARRANTY; ADCOM GFT-555 $225(D) GFA 555 $510(D), ACCUPHASE AC-2 $255(N), AUDIO INTERFACE CST-80II $240(N), BERNING TF-10HA $1265(D) EA-2100 $1865(D), BEVERIDGE 2SW-2 $4300(D), COUNTERPOINT SA-4 $3920(D) SA-5.1 $1345(D), KINDEL PLSA $1395(D) P-200 MKII $410(D), KOETSU EMC-1 $495(N) MIT MH-650 6' PAIR $110, MI-330 25' PR $360, NEC CD-803E $375(D), ORSONIC AV-101 $23(N), PREMIER MMT $190(N), PRECISION FIDELITY M7A $590(N), SIDEREAL ACOUSTIC IV, $720, STAX ESL-F83 $3600(D), CPY/ECP-1 $375(N).
GREENFIELD EQUIPMENT, River Forest, IL. 312/771-4460 • By appointment • MC/VISA.

B&K AMPLIFIERS, PREAMPLIFIERS: High performance electronics you can afford. AUDIO NEXUS, NJ (201) 464-8238.

B&W 808 ROSEWOOD. $4995 PR. W/NICKED CABINET. 5 YEAR U.S.A. WARRANTY. 916-345-1341.

FOR SALE

AUDIO ENCOUNTERS SUMMER CLEARANCE SALE
DEMO EQUIPMENT

Naim 135	$1150 ea.
Naim 32-5	$510
Naim Hi-Cap	$480
Naim Nait	$325
Linn Saras	$795 pair
Martin Logan CLS	$1650
Mark Levinson ML-9	$2300
Belles XLM Pre amp	$315
Belles 200 Amp	$495
Kyocera DA 910 CD	$950
Kyocera C-910 Pre amp	$665
Kyocera B-910 Amp	$1150
Kyocera DA-810 CD	$495
Magnat Gama Speakers	$1450
Teac ZD-5000	$750
Teac ZD-3000	$650
Teac W880RX	$495
Revox B-215	$1250
Kloss Mod. 100 6½	$3450

USED EQUIPMENT

Mark Levinson ML-2	$1850
ARC D250 MK-2 servo	$3250
ARC D150	$1650
JBL S8R w/equip cab	$1500
Linn Saras	$695
Magneplanar T-IIIA	$595

AUDIO ENCOUNTERS
4271 W. Dublin-Granville Rd., Dublin, OH 43017
614-766-4434

B&W BUMPS & BRUISES SALE! WE HAVE HUNDREDS OF B&W HOME & CAR LOUDSPEAKERS WITH SCRATCHES, DENTS, DINGS AND OTHER COSMETIC BLEMISHES AT SAVINGS UP TO 50%! ALL SPEAKERS HAVE BEEN PERFORMANCE TESTED BY B&W AND CARRY THEIR 5-YEAR U.S.A. WARRANTY. CALL TOLL-FREE 1-800-222-3465 FOR PRICES & AVAILABILITY. HCM AUDIO: (916) 345-1341. VISA/MC/AMEX.

CABLE TV CONVERTERS. Scientific Atlanta, Jerrold, Oak, Zenith, Hamlin. Many others. "New" **VIDEO HOPPER** "The Copy Killer". Visa, M/C & Amex Accepted. Toll Free **1-800-826-7623.** B&B Inc., 10517 Upton Circle, Bloomington, MN 55431.

CALL TOLL FREE! 1-800-826-0520 FOR; NAD, PROTON, H.K., HAFLER, B&W, TANDBERG, AUDIOCONTROL, DAHLQUIST, dbx, NITTY-GRITTY, 3D, CWD, REVOLVER, STAX, M&K, BELLES, MOSCODE, FRIED, AUDIOQUEST, THORENS, MONSTER, SNELL, ORACLE PRO-AC, GRACE, GRADO, DCM, TALISMAN, TIPTOES, FREE CATALOG. SOUND SELLER, 1706 MAIN ST., MARINETTE, WI 54143. (715) 735-9002.

CASH for your **USED AUDIO EQUIPMENT. WE BUY** by **PHONE. CALL FOR** the **HIGHEST QUOTE. (215) 886-1650.** The Stereo Trading Outlet, 320 Old York Road, Jenkintown. Pa 19046.

CENTRAL PA'S AUDIO SHOP
FOR THE DISCRIMINATING LISTENER
PRIVATE LISTENING ROOM FOR HIGH END PRODUCTS
(APPOINTMENTS PREFERRED)
Vandersteen, Martin Logan, Spica, Polk Audio, Infinity, Threshold, PS Audio, Conrad-Johnson, Adcom, NAD, Merrill, VPI, Sonographe, Magnum Dynalab, E.T., Souther, Sumiko, Audioquest, Monster Cable, Grado. **THE STEREO SHOPPE,** 21 N. Market St., Selinsgrove, PA. 717-374-0150.

COUNTERPOINT ELECTRONICS
Can make a significant improvement in the reproduction of music in most audio systems. We offer a full line of Counterpoint components starting at only $595. Demonstrations by appointment. Visa and MasterCard. WORLDWIDE EXPORTING. Free delivery to ALL zip codes. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

CROSSOVER AUDIO: Here you'll be treated with respect and genuine concern for your best interests. Featuring: Counterpoint, SOTA, PS AUDIO, Well Tempered Lab, Vacuum Tube Logic, Eminent Technology, SME, Spica, Meridian, Sonographe, Van Den Hul, MIT, Pearson Audio, Premier, B&K, Talisman, Monster Cable, Sumiko, Magnavox, Lazarus and more. Free Shipping within New England. CROSSOVER AUDIO, 10 Tate's Brook Rd., Somersworth, NH 03878. Call (603) 692-5452.

INTRODUCING MUSIC RIBBON 32 SPEAKER CABLE (9 Ga. at $5.00/FT.)

FLAT, Low-Inductance Design with Polypropylene encapsulated OFC Conductors. Produces the most accurate amplitude and phase response resulting in superior dimensionality, resolution and focus. Color choices of tan or white to suit any decor. AVAILABLE as MUSIC RIBBON 16 (12-Ga. @ $2.50/FT.)

STRAIGHT WIRE 1909 HARRISON ST., SUITE 208 • HOLLYWOOD, FL 33020 • (305) 925-2470

FOR SALE

DBX 5BX-DS RARE 5-BAND EXPANDER, compressor with impact restoration, memory, rack mount, wireless remote etc . . . $1120. DBX 4-BX: $425. Micro Seiki DQX-1000: $750. All original factory sealed cartons, warranty. Wanted: Nakamichi 610 preamplifier, black, excellent condition. For info: John, P.O. Box 34773, Los Angeles, CA 90034. (213) 837-2731.

DIGITAL AUDIO PROCESSORS—SONY 501ES available now! Make your own digital 2-track masters. Also Hafler PRO amps for ultimate monitoring capability. ACOUSTICAL CONCEPTS, INC., 708 Ashland Ave., Eddystone, PA 19013. (215) 328-9450.

DYNACO KIT BUILDERS—225,000-LB BUYOUT! Tubes, transistors, metalwork, raw drivers, circuit boards, etc. Complete 200/200w "Black Box 410" transistor power amp kit, $299. Owner/repair manuals (any), $6 each. Stamp for list. SCC, Box 551AM, Dublin, OH 43017; (614) 889-2117. VISA/MC.

FM ACCESSORIES
MAGNUM/DYNALAB FM SIGNAL BOOSTER
Signal Sleuth 105 FM 99.00-(orig. 190.00)
Signal Sleuth 2002 (mobile) 99.00-(orig.190.00)
MAGNUM/DYNALAB FM ANTENNAS
ST-2 Omni-directional — 69.00
SR-100 Silver Ribbon turnable —17.00
TERK AMPLIFIED ANTENNA 69.00
MAGNAVOX CD PLAYER SALE
CDP 650 — CALL CDP560 —209.00

AUDIO OUTLET (914) 666-0550
P.O. Box 673
Bedford Hills, New York 10507-0673

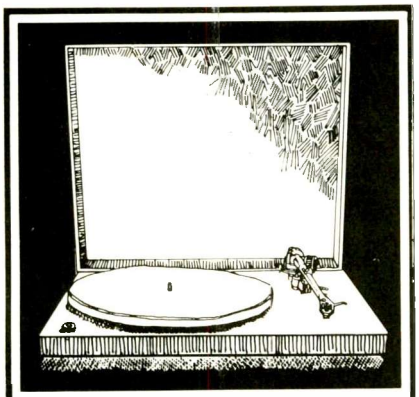
Superlative components for music lovers on a budget.

The model 1 pure class A power amplifier. Rated into 8 or 4 Ohms. Effortless sound from 30 peak amperes per channel capability.

The model 2 preamplifier. Vanishingly low noise. Class A operation throughout. Accepts MC or MM cartridges with selectable loading. Five high level inputs including tape recorder.

Designed by Nelson Pass and manufactured in the U.S.A.

audition Forté at selected audio specialists.
for a list of these specialists write:
forté audio 1945 Industrial Drive, Auburn, California 95603



rega

REGA products reflect a splendidly simple British design philosophy: use only what is necessary & make it of the highest quality. The result is a handsome source of beautiful music, at a proper price.

REGA dealers will encourage you to listen to your favorite recordings and judge for yourself. For information:

import audio
3149 shenandoah, st. louis, mo. 63104 • 314-773-1211

FOR SALE

LAST RECORD & TAPE CARE PRODUCTS AT LOW PRICES! CALL TOLL-FREE FOR ORDERING & PRICES 1-800-222-3465. HCM AUDIO: (916) 345-1341.

CARTRIDGES & NEEDLES IN STOCK

• ORTOFON • SIGNET •
• SHURE • AUDIOQUEST •
• DYNAVECTOR • AUDIOTECH •
• GRADO • STANTON • GRACE •
• SUPEX • TALISMAN •

CALL FOR PRICE **1-800-342-9969** 8344 MELROSE AVE., LOS ANGELES, CA 90069 **M & Y CO.**

FOR SALE

ELECTRONIC CROSSOVERS: 6, 12, 18 DB/OCTAVE. Kits available. Transient-Perfect, $175. Subsonic/Bandpass Filters. Free Flyer w/reviews. ACE AUDIO, 532-5th Street, East Northport, NY 11731-2399.

ELECTROSTATICS—$398/PAIR. EPI Stat 450s (see February AUDIO review). $700 retail; 5-year warranty. UPS shipping extra. Sound Values, POB 551, Dublin, OH 43017. VISA/MC: 1-800-HIFIKIT.

EXCEPTIONAL AUDIO REPRODUCTION SYSTEMS ADCOM, ALPHASON, AR, ARCAM, AUDIOQUEST, AUDIOSOURCE, AUDIRE, BRITISH (MUSICAL) FIDELITY, CHICAGO, CREEK, DUAL, GRACE, GRADO & SIGNATURE, GOLDRING, FRIED, HEYBROOK, KENWOOD BASIC, KYOCERA, LINN, LOGIC, MAS, MORDAUNT-SHORT, NITTY GRITTY, PREMIER, QED, RATA, REGA, ROTEL, SHINON, SPECTRUM, SPENDOR, SUPERPHON, SUPEX, TALISMAN, TARGET along with LAST, LIVEWIRE and others. EARS, P.O.BOX 658-U, W.COVINA, CA 91790. 818/961-6158 EVENINGS, WEEKENDS. MC/VISA, MANY MONTHLY SPECIALS, PREPAID SHIPPING-SEND STAMP!!

HAFLER IN THE SOUTH!
In stock, the superb Hafler pre-amps, amplifiers, tuner and equalizer. Immediate FREE shipping. Also Acoustat, Audire, CWD, Fried, Mirage, Monster Cable, PS, Proton, Quad, Sony, Sota, Spica, Superphon, Talisman, Thorens. READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403. (803) 723-7276.

LINE DRIVE

Less Signal Processing = More Natural Music

LINE DRIVE—a system control center designed specifically for your line level components: CD players, tape decks, tuners, VCR audio.

LINE DRIVE—the flexibility of a preamplifier without the inherent colorations. Compare it with the best preamplifier you can find and be thrilled with how clean and accurate the Line Drive sounds.

Available from Mod Squad Dealers everywhere. Or direct from The Mod Squad, Dept. A, 542 Coast Highway 101, Leucadia, CA 92024, (619) 436-7666. For a complete catalog send $2 (refundable with order). Ask about our 2-week money-back guarantee.

The Mod Squad Inc

FOR SALE

EXPERIENCE, INTEGRITY AND THE LOWEST PRICES ANYWHERE. Authorized dealers for Yamaha, Denon, McIntosh, Canton, Tandberg, M&K, Sumo, Infinity and many more. Audio/Video Exchange, Since 1951. 57 Park Place, NY 10007. Call 212-964-4570.

FRIED SPEAKERS & KITS
State-of-the-art sound. Amazing price/performance! Free shipping. Also Hafler, PS, Thorens, Sota, Proton, Audire, CWD, Monster, Sony, SAE. READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403. (803) 723-7276.

HAFLER PREAMPS, POWER-AMPS, TUNERS & ACCESSORIES. MOST MODELS IN STOCK. CALL TOLL-FREE 1-800-222-3465 FOR ORDERING & PRICES. WE CAN'T BE BEAT! HCM AUDIO, 1600BB MANGROVE, CHICO, CA 95926. (916) 345-1341. VISA/MC/AMEX.

HAFLER—XL-280 KITS & NEW PRICES!
Hafler's bold new amplifier, the XL-280, is so accurate that it can be directly compared with the ultimate reference—a straight wire with gain. We are stocking: XL-280K $525, XL-280 $600, DH-100K $200, DH-100 $250, DH-110K $375, DH-110 $450, DH-120K $325, DH-120 $375, DH-220K $400, DH-220 $500, DH-330K $325, DH-330 $385, DH-500K $725, DH-500 $850. Export units and accessories in stock. Three year warranty on assembled units (no suffix). Visa and MasterCard. WORLDWIDE EXPORTING. Free delivery to ALL zip codes (PR and APO/FPO too). OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

High-end and hard-to-find audio components. Low, low prices! Audio America (Virginia). Call 1-804-797-5861 today!

CARVER, NAKAMICHI, BANG & OLUFSEN, A.D.S., CROWN, REVOX, TANDBERG, HAFLER, ADCOM, MISSION, N.A.D., HARMAN/KARDON, KYOCERA, YAMAHA, LUXMAN, DENON, KLIPSCH, B & W, KEF, D.C.M., E-V, J.B.L., INFINITY, D.B.X., AKG, AND OTHER QUALITY COMPONENTS. BEST PRICES—PROFESSIONAL CONSULTATION. ALL PRODUCTS COVERED BY MANUFACTURERS' U.S.A. WARRANTY. AMERISOUND SALES, INC., JACKSONVILLE, FLORIDA 32241. EAST: (904) 262-4000 WEST: (818) 243-1168.

LINN—IMPROVED PRODUCTS & LP12 MODIFICATION
We have in stock the IMPROVED AND MORE POWERFUL LK1 and LK2, NEWER Index Speaker, Axis turntable, and more. LP12 modification—tremendous improvement at low cost, $8. Demonstrations by appointment. Visa and MasterCard. Free delivery to ALL zip codes. OXFORD AUDIO CONSULTANTS, INC., Box 145, Oxford, OH 45056-0145, 513-523-3333, TLX427791.

LP SOUND REJUVENATION & PRESERVATION SERVICE. After your records have been cleaned and treated they will have a restored vitality and clarity. Unplayed records will actually sound better than "right out of the package". Precision Audio Utilization by Laletin. (212) 874-6904.

MARANTZ, MCINTOSH AND OTHER TUBE amps and Tannoy, JBL, and old Jensen speakers, bought and traded. Highest prices paid for clean equipment. Selling EV Patrician 800 speakers mint b/o over $2400. R.J.R.—DR1 speakers $1100. Other high-end electrostatics for sale Lux 44 two arm table w/2 SAEC arms $500. Levinson ML9 $1800. Also want interesting prewar radios. N.Y. Sound Investments. Noon-3PM. (718) 377-7282.

MCINTOSH: C34V + MC7270, $3,500, C33, $1,450, MC2500, $2,400-$2,700, MC2255 B/O, MC2205 B/O, C11, Marantz 9. Lot more !! Dayton Wright XG10 Speaker system $1,600
• Trade Welcome All guaranteed. Buy Mcintosh tube & solid state & other brand Amplifier. (303) 344-1583.

MCINTOSH, MARANTZ (USA), **conrad-johnson, Audio Research, Accuphase, Krell** and other Precision Audio Components Bought-Sold-Traded. **FREE** Catalogue, **Audio Classics** 8AM-5PM EST Mon.-Fri. POB 176MM, Walton, NY 13856 607-865-7200.
—Audio Advertiser Since 1979—

FOR SALE

MCINTOSH

WANTED: MCINTOSH, MARANTZ, AUDIO RESEARCH, DYNACO, LEVINSON, KRELL, ALTEC, JBL, TANNOY, CJ, SEQUERRA, WESTERN ELECTRIC, **TUBE** & SOLID STATE, **BUY-SELL-TRADE,** MAURY CORB, (713) 728-4343, 11122 ATWELL, HOUSTON, TX 77096.

MCINTOSH MC-240 $425, MC-225 $300, 1700 $300, 1900 $450, MX-110's $250-400. Premier-Tapesonic (tubed) $600. Crown D-75-IOC $275, D-150-IOC $350, SL"C" phono modules $100. Nakamichi 700/2 w/remote $550. ADS-10 perfect $700. Phase 4000 $200, 400 $350, 700 $300. Sansui demo: AU-G55X $200. Kenwood KF-8011 de-noiser $150. Harman-Kardon demo: HK65C table $345. Lux M120A poweramp $300, C120A preamp $200. Gold Aero exceptional tubes (numerous types) stocked. Complete retube kits shipped fast! Mogami Neglex 2534 interconnect cable $.60', 2513 speaker cable $2.50', Sonex acoustical foam. R.C.A. ribbon microphones: 77DX $475, BK-11A $190. Handpicked tubes 1963 vintage many types. Boothroyd-Stuart Meridian amplifier system $400 w/ moving coil. Onkyo sealed TX-35 $185. Sony LC90-FeCr $11, LC60-FeCr $6, LC90-SLH $9, LC60-SLH $4.50 elcaset tape. Teac AL-700 elcaset recorders factory sealed $1,100 originally, $299, RX-10DBX DBX sealed $225, remotes $50. QUAD: Panasonic SH-3433 $300, EV 7445 encoder $475. Pioneer RTU22 recorder w/remote $750, Sony TC854-4S w/selsync, new capstan motor!, remote $1,200, TC-765 w/remote $600. Ortofon transformers STM-72 $25, T-10 $60. Mitsubishi DA-R8 $150. 900 prerecorded r/t/r $7, ½ track $18. Require collections pre-recorded openreel, McIntosh, Marantz (tube) units, Sony, Teac, Advent Dolby units, oddball pieces, accessories. Desire preeminent consignment items. Money back guaranty. Mailorder Specialist! Shipping worldwide. Martin Gasman: 779 Worcester Street, Wellesley, Mass. 02181. Telephone: 617-CEL-TICS, 617-235-8427.

MCINTOSH PARTS, over 16,000 pounds in stock, including hard to find Transformers, Front Panels, Chassis parts, Electrical parts, Appearance parts, Speakers, Etc . . . Great for Home Brew Projects, **FREE** catalogue. **Audio Classics** 8AM-5PM EST Mon.-Fri., POB 176MP, Walton, NY 13856 607-865-7200

—Audio Advertiser Since 1979—

MCINTOSH SOLID STATE COMPONENTS, J.B.L. used Alnico components, and systems. Bought, sold, and traded. 313-229-5191 7-11PM EST.

MONSTER CABLE PRODUCTS AT LOW PRICES! CALL TOLL-FREE FOR ORDERING & PRICES 1-800-222-3465. HCM AUDIO: (916) 345-1341. VISA/MC/AMEX.

MUSICAL CONCEPTS CD PLAYERS & MODIFICATIONS. THE BEST THERE IS! CALL TOLL-FREE FOR ORDERING & PRICES 1-800-222-3465. HCM AUDIO: (916) 345-1341.

MUSICAL CONCEPTS CD-1/CD-2 COMPACT DISC PLAYER

Analog like performance from a CD player! Excellent three dimensionality and soundstaging. Unrestrained dynamics and musical precision. Sweet, delicate high end! Philips 16 bit, dual DAC technology. Musical Concepts CD-1 is a treat for the most sophisticated ear. Complete CD players with one year warranty! Musical Concepts CD-1 $495, CD-1R (with remote) $575, CD-1/650 $699 delivered. CD-2 has tighter bass, images even better and is sweeter from top to bottom. Add $150 for CD-2. Dealer inquiries invited. Musical Concepts, #1 Patterson Plaza, Florissant, MO 63031, 314-831-1822 1-5pm CST.

MUSICAL CONCEPTS GX TOPOLOGY MODIFICATIONS

NOW AVAILABLE, GX MODIFICATIONS FOR HAFLER AMPLIFIERS! This optimized inductorless design achieves great sweetness and transparency. And yes, it works great with electrostatics. Tubelike three dimensionality and harmonic richness combine with superb inner detailing and clarity. Why are so many former tube lovers using Musical Concepts amplifiers? Your ears will tell you! Musical Concepts GX series modifications for all Hafler, Adcom amps. Hafler: $149/kit, $224/installed. Adcom $175 installed only. Dealer inquiries invited. Musical Concepts, #1 Patterson Plaza, Florissant,MO 63031, 314-831-1822 1-5PM CST.

FOR SALE

MUSICAL CONCEPTS AUDIOPHILE SERVICES

Outstanding modifications for Hafler products! Smooth, sweet sound for Adcom amplifiers! Toroid outboard power supplies, LIPS II ultra fast regulators, and MusiCap capacitors! SuperConnect II, the best performance/price interconnect-guaranteed! Compact disc mods for Magnavox, Revox, ETC.

MC-2 and MC-2T preamplifier can be installed into all Hafler preamps, Dyna PAT-4/5, others! For Hafler, Adcom and Dyna amps: toroid power transformers, high performance filter capacitors and total dual mono installations. Finally, our Dyna tube modifications are nearing completion. Musical Concepts, #1 Patterson Plaza, Florissant, MO 63031, 314-831-1822 (1-5PM CST) Dealer inquiries invited.

NITTY GRITTY RECORD CLEANING MACHINES & SUPPLIES. MOST ITEMS IN STOCK. CALL TOLL-FREE FOR ORDERING & PRICES 1-800-222-3465. HCM AUDIO, 1600BB MANGROVE, CHICO, CA 95926. (916) 345-1341. VISA/MC/AMEX.

NO DEALER IN YOUR AREA? Call Electronic Creations for: B&W, Canton, Conrad Johnson, DBX, Dual, Energy, Grado, Harman Kardon, Kyocera, Magneplanar, MIT Cable, Monster Cable, Nitty Gritty, PS Audio, Sony/ES, SOTA, Spica, Sumiko, Stax. Competitive Prices. Visa, MC. 305-331-5830.

The Best Price on Sound Advice

At SOUND STAGE you can talk to a knowledgeable salesperson who will advise you on the best audio or video equipment that meets your needs and budget. From our large selection you can compare performance specifications and prices.

ALL SOUND STAGE equipment includes:
- 30-day best price protection
- free 3-year warranty with parts & labor
- free delivery

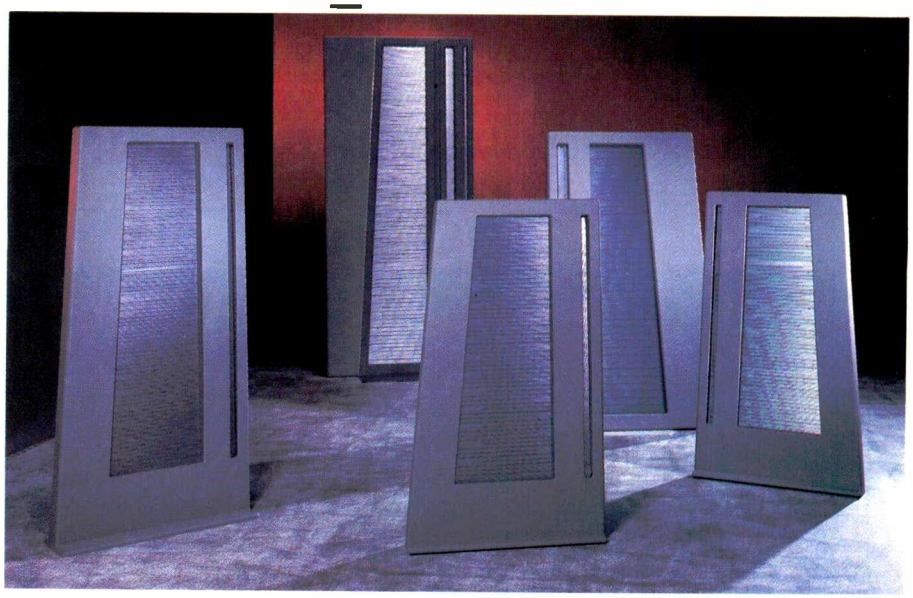
PLEASE, NO MAIL ORDER

NAD	ALPINE	DENON	KLOSS	BANG & OLUFSEN
ADS	CARVER	ALLISON	STAX	DBX SOUNDFIELD
M&K	HAFLER	ENERGY	TERK	THE UNGO BOX
NEC	LUXMAN	SIGNET	TALISMAN	AUDIO CONTROL
DCM	PROTON	GRACE	NITTY GRITTY	SURROUND SOUND

Call for store hours
(718) 961-9888
173 Broadway
NYC, NY 10007
(NW corner of B'way & Cortlandt
Enter on Cortlandt
One flight up)
OR
184-10 Horace Harding Expwy
Fresh Meadow, NY 11365 (Exit 25 L I E)

SOUND STAGE AUDIO+VIDEO

DIVA
The Next Step



APOGEE ACOUSTICS
35 York Ave.
Randolph, MA 02368
(617) 963-0124
Telex 928121
APOGEE RAND.

AUDITION THIS ACCLAIMED LOUDSPEAKER AT YOUR NEAREST HIGH END DEALER.

—APOGEE ACOUSTICS, INC.

FOR SALE

NEW ENGLAND LISTENERS: CROSSOVER AUDIO in New Hampshire provides world class sound at many price points. We offer: Counterpoint, SOTA, PS Audio SME, Eminent Technology, Well Tempered Lab, Meridian, Vacuum Tube Logic, Sonographe, Carnegie, Van Den Hul, MIT, Pearson Audio, Spica, Premier, B&K, Talisman, Magnum, Monster Cable, Sumiko, Magnavox, Lazarus, Mogami and more. Free shipping within New England. Call or write for free newsletter/advice. CROSSOVER AUDIO, 10 Tate's Brook Rd., Somersworth, NH 03878. Call (603) 692-5452.

FOR SALE

MUSIC BY THE SEA

Southern California's premier audio salon offering music lovers exceptional products: ROWLAND RESEARCH • SOTA • MOD SQUAD • ET 2 • VIRTUOSO • SME • VANDERSTEEN • MIT • COUNTERPOINT • VAN DEN HUL • B&K • SPICA • ORACLE • WELL TEMPERED LAB • STAX • RAUNA • NITTY GRITTY • AUDIOQUEST • GRADO • HARMAN/KARDON • SUPERPHON • MIRAGE • KOETSU • STRAIGHTWIRE • MAGNUM • VACCUM TUBE LOGIC • TUBE TRAPS • POLYPHASORS • Custom cables, expert turntable set-up, in-home auditions, system installation and a 2 week satisfaction guarantee. **MUSIC BY THE SEA (619) 436-7692;** 542 North Highway 101, Leucadia, California 92024. Open Tuesday-Saturday 11-6 pm. Call for your **MUSICAL NOTES** newsletter.

STRAIGHTWIRE SPEAKER & INTERCONNECT CABLES IN STOCK. WE SHIP ANYWHERE! CALL TOLL-FREE FOR ORDERING AND PRICES 1-800-222-3465. HCM AUDIO: (916) 345-1341. VISA/MC/AMEX.

PAUL HEATH AUDIO

Audible Illusion, B&K, Convergent Technology, Eagle, Grado, Dahlquist DQ-20, Kinergetics, Lazarus, Melos, Merlin, MIT, Magnum Dynalab, Onkyo Integra, PS Audio, Quicksilver, Rega, Sonographe, Spica, Ram Lab, Music Reference, Line Drive, Vandersteen, VPI, Well Tempered table & arm. 217 Alexander Street, Rochester, NY 14607. 716-262-4310.

NORTHERN CALIFORNIA! IN THE BEAUTIFUL NORTH VALLEY YOU CAN FIND ACOUSTAT • B&O • B&W • BOSE • BOSTON ACOUSTICS • HAFLER • HARMAN KARDON • KENWOOD • KLIPSCH • NAD • SONY • SOTA & MORE. APPOINTMENTS WELCOME. GOLDEN EAR HI-FI. 1600A MANGROVE, CHICO. (916) 345-1762.

ORDER TOLL-FREE 1-800-222-3465. ACOUSTAT • ALCHEMIST • AR • AUDIOQUEST • JBL • BOSE • BOSTON • GRACE • GRADO • HARMAN/KARDON • HAFLER • KENWOOD • LAST • LIVEWIRE • MONSTER CABLE • NITTY GRITTY • PREMIER • SONY • SOTA • SPICA • STAX • STRAIGHTWIRE • SUPERPHON • THORENS • TALISMAN • VAN DEN HUL. CALL FOR LOW PRICES. MOST ITEMS IN STOCK. HCM AUDIO, (916) 345-1341. VISA/MC/AMEX.

SOTA TURNTABLES & ACCESSORIES. MANY ITEMS IN STOCK. ORDER TOLL-FREE 1-800-222-3465. HCM AUDIO (916) 345-1341. VISA/MC/AMEX. AUTHORIZED DEALER.

FOR SALE

PREMIER MMT & FT-3 TONEARMS & ACCESSORIES BY SUMIKO. PLUS TWEEK • COUNTERFEET • COUNTERPARTS • FLUXBUSTER • SOUNTRACTOR • NAMIKI. MOST ITEMS IN STOCK. CALL TOLL-FREE 1-800-222-3465 FOR ORDERING AND PRICES. WE CAN'T BE BEAT! HCM AUDIO, 1600BB MANGROVE, CHICO, CA 95926. (916) 345-1341. VISA/MC/AMEX.

CARVER, NAKAMICHI, BANG & OLUFSEN, A.D.S., CROWN, REVOX, TANDBERG, HAFLER, ADCOM, MISSION, N.A.D., HARMAN/KARDON, KYOCERA, YAMAHA, LUXMAN, DENON, KLIPSCH, B & W, KEF, D.C.M., E-V, J.B.L., INFINITY, D.B.X., AKG, AND OTHER QUALITY COMPONENTS. BEST PRICES—PROFESSIONAL CONSULTATION. ALL PRODUCTS COVERED BY MANUFACTURERS' U.S.A. WARRANTY. AMERISOUND SALES, INC., JACKSONVILLE, FLORIDA 32241. EAST: (904) 262-4000 WEST: (818) 243-1168.

ROWLAND RESEARCH: Golden sound for golden ears. AUDIO NEXUS, NJ (201) 464-8238.

SAN FRANCISCO AREA—Irresistibly priced audiophile components. Ship/deliver, list available recent models. (415) 898-1464. 1548 Center Rd., #25, Novato, CA 94947.

SIDEREALKAP

THE SIDEREALKAP WAS DESIGNED FROM ITS INCEPTION TO BE THE FINEST SOUNDING CAPACITOR AVAILABLE FOR AUDIO TODAY.
FIND OUT WHAT THE MUSIC LOVER'S CAPACITOR DOESN'T SOUND LIKE. CALL (619) 722-7707, OR WRITE TO: SIDEREAL AKUSTIC, 1969 OUTRIGGER WAY, OCEANSIDE, CA 92054.
FREE LITERATURE AND PRICE INFORMATION UPON REQUEST.
DEALER INQUIRIES INVITED.

SONY MX 1000ES 4IN/2OUT MIC/LINE Mixer for great live recordings. Reg. $330 Now $149 While Supplies Last. OPUS ONE: 800-441-2327. In PA. (412) 281-3969.

SOUNDCRAFTSMEN CX4100 PREAMP/EQ $250. D.A.L.I. IV speakers w/stands—new in boxes $250 pr. Call Gary (803) 571-2406.

SOUND OF NAKAMICHI REFERENCE CASSETTES INDIVIDUALLY DUPLICATED IN REAL-TIME ON THE FINEST TDK METAL TAPES, FROM THE FINEST ANALOG AND DIGITAL MASTERS. SOUND OF **NAKAMICHI REFERENCE CASSETTES,** THE ONLY CHALLENGE TO THE COMPACT DISC. LABELS REPRESENTED: TELARC, A&M, DELOS, SHEFFIELD LAB, GOOD VIBES, & GRP. ALL TITLES ARE AVAILABLE IN DOLBY B OR DOLBY C. FOR A CATALOG OR MORE INFORMATION CONTACT **PACIFIC CASSETTE LABORATORIES:** P.O. BOX 6248, TORRANCE, CA. 90504 (213) 618-9267. DEALER INQUIRIES WELCOME.

NAIM NAP120 AMPLIFIER AND NAC32 preamplifier. Excellent condition. Sell as pair only $995 firm. (304) 599-8033.

NH, VT, RPM AUDIO OFFERS select high-end components. For information call (603) 675-6166 or write: Box 157, Cornish, NH 03746.

SUMO ELECTRA $289, DENON PMA770 $395, SAE X10A $549, MACINTOSH C29 $599, JSE 1.8 $949, COUNTERPOINT SA7 $249, MAGNAPLANAR MG2A $699, CONRAD JOHNSON PV6 $499, ORACLE DELPHI $649, THORENS TURNTABLE $249, MITSUBISHI DA7DC & DAC20 $495, ACCUPHASE AC2 $69, MAGNAVOX 650CD $289, Adcom, PS, SUPERPHON, B&K, AUDIBLE ILLUSIONS, ACOUSTAT. (714) 861-4830 Evenings.

UHER, Sennheiser, Sony, AKG, (Shure), Electro-Voice, Audio-Technica, Beyer, Bose, etc. Portable Recorders, Microphones, Mixers, Cine, A/V. Carpenter (GHP), P.O. Box 1321, Meadville, Pa. 16335-0821

LOUDSPEAKERS

SPEAKER BUILDER

The world's only magazine for people who love building all kinds of loudspeakers—from bookshelf kits to electrostatics to horns. A rich mix of how-to-do-it and theory. Only $25 for 2 years (8 issues), 1 year for $15.

SPEAKER BUILDER
Box 494, Dept A78, Peterborough, NH 03458 USA
(Outside USA add $4/year postage. US $ only.)

ABSOLUTELY UNPARALLED IN EXCELLENCE: Audition these remarkable, patented **JSE** Infinite Slope loudspeakers in your own home on our 7 Day—**NO RISK AUDITIONING** Policy. We'll pay shipping and offer a **FREE 1 YEAR** subscription to Audio. Authorized JSE, Fried, Spectrum, Kingergetics, B&K, Hafler, Magnum Dynalab, Thorens, Apature dealers. **SOUND UNLIMITED,** 169 Church St., Bristol, Conn. 06010. Est 1959. (203) 584-0131.
MC/VISA AMEXP ACCEPTED

AMERICA'S LARGEST dealers in **HIGH END USED** stereo. We **BUY** and **SELL** by **PHONE. STEREO EXCHANGE** 687A Broadway, between 3rd and 4th St. (opposite Tower Records) NYC 10012. (212) 505-1111 and (800) 833-0071.

A&S SPEAKERS IS NOW CARRYING COMPLETE audiophile loudspeakers systems from ProAc, Morel, VMPS, Euphonic Audio, and Nelson-Reed. Also available is the widest selection of speaker components and kits from Scan-Speak, Focal, Audax, Dynaudio, Peerless, Becker, Jordan, SEAS, others. Featuring Dick Olsher's Dahlia/Debra. Free Catalog. A&S SPEAKERS, Box 7462, Denver, CO 80207. (303) 399-8609.

FRIED LOUDSPEAKERS: THE LEGEND GROWS with the unbelievable C/3L minimonitor. AUDIO NEXUS, NJ (201) 464-8238.

IAS LOUDSPEAKERS—Superb craftsmanship, European drivers, LC crossover networks, computerized low frequency tuning, five year warranty. Catalog $1. 3747 Woodcock Place, Sierra Vista, AZ 85635.

JBL, ALTEC, ELECTRO-VOICE, speaker components and speaker systems. JBL Studio Monitors. AKG, Sennheiser headphones. Tascam, Revox, Carver, Crown professional amps. Free flyer. Low Prices! Rick Marder, AHCo. (201) 561-8123.

JSE LOUDSPEAKERS! THEIR SECRET: INFINITE SLOPE CROSSOVERS. Experience them at home. 10-DAY MONEYBACK AUDITIONS, FREE SHIPPING. AUDIO NEXUS, NJ (201) 464-8238.

LOUDSPEAKER COMPONENTS-KITS. Dynaudio, Morel, Eclipse, Focal, Peerless, Eton, Vifa, more! Crossover parts—design books also. Catalog $1. Meniscus, 3275W Gladiola, Wyoming, Michigan 49509. (616) 534-9121.

PROAC LOUDSPEAKERS ARE NOW AVAILABLE nationwide. Write or call for an introduction to the new Tablette, Studio 1 and Super Tower. A&S Speakers, Box 7462, Denver, CO 80207. (303) 399-8609.

LOUDSPEAKER COOKBOOK FROM MADISOUND
The design book you've been waiting for! 1987 edition, by Vance Dickason, with Small-Thiele Analysis; vented, passive radiator, T-Line design; testing procedures; Bullock's crossover application. All this for $14.95 along with the famous MADISOUND Loudspeaker Catalog. MADISOUND, BOX 4283, Madison, WI 53711. 608/831-3433.

CARVER, NAKAMICHI, BANG & OLUFSEN, A.D.S., CROWN, REVOX, TANDBERG, HAFLER, ADCOM, MISSION, N.A.D., HARMAN/KARDON, KYOCERA, YAMAHA, LUXMAN, DENON, KLIPSCH, B & W, KEF, D.C.M., E-V, J.B.L., INFINITY, D.B.X., AKG, AND OTHER QUALITY COMPONENTS. BEST PRICES—PROFESSIONAL CONSULTATION. ALL PRODUCTS COVERED BY MANUFACTURERS' U.S.A. WARRANTY. AMERISOUND SALES, INC., JACKSONVILLE, FLORIDA 32241. EAST: (904) 262-4000 WEST: (818) 243-1168.

• Acoustat • Arogon
• Boston/Acoustics
• B&W • Camber
• Carver • Celestion
• CWD • Dahlquist
• Dual • Hafler
• Infinity • Koetsu
• Krell • Madrigal

Quality Components, Qualified Sales and Service

• Magnum • Meitner
• Meridian • MIT
• NAD • Onkyo
• Ortofon • Revox
• Rotel • SME
• Snell • Sony
• SOTA • Sumiko
• Velodyne

Sound & Music
351 Pleasant St., Northampton, MA 01060 (413)584-9547

LOUDSPEAKERS

THE WAVEFORM LOUDSPEAKER: "The Rolls Royce of loudspeakers is at Absolute Audio. We've got the 1st and only pair in the U.S. Lovingly handcarved in Canada from solid 2" thick black cherry wood, they are as breathtakingly visually as they are sonically. The sound maybe the closet you'll ever hear to the live musical event. They're impressively dynamic, effortless and delicate in sound; and reproduce the biggest soundstage we've ever gotten from any speaker. They weigh over 200 lb each and go for $9000 in black mirror finish lacquer or $17,000 in black cherry with ebony and gold inlays and a raw silk grille". Contact Evelyn Sinclair, Absolute Audio, Orange, CA (714) 538-4434 and now Keith Yates Audio, Sacramento, CA (916) 442-8346 . . . so far. All things in their own time—THE WAVEFORM LOUDSPEAKER—for a long time!

WHY COMPARE LOUDSPEAKER TO LOUDSPEAKER TO LOUDSPEAKER? Listen carefully to REAL sound—music, instruments, voices, then audition a Goetz Systems Loudspeaker for its natural sound. Listen in a home environment in Atlanta or call: 404-441-2190.

Listen...

Before You Buy!

- Time Delay
- Reverberation
- Crossovers
- Noise Reduction
- Compressor/Limiters
- Expanders
- Spectrum Analyzers
- Parametric EQ

Don't have regrets about paying too much for a lesser product. In demos and comparisons, we'll show you why we're Better! Our Factory Direct sales allow us to produce a Superior product and offer it to you at a Lower price. Call or write for a free full-length Demo Album and 24 page brochure.

Write to: **LT Sound, Dept. A-3,** P O Box 338
Stone Mountain, GA 30086
In Georgia Call (404)493-1258

LOUDSPEAKERS

SPECTRUM LOUDSPEAKERS: Highend sound, budget prices. AUDIO NEXUS, NJ (201) 464-8238.

Enjoy the music as well as the convenience.
The SONOGRAPHE SD1 features analogue circuits by conrad-johnson to bring musical accuracy to the compact disc format.

the conrad-johnson group
2800R Dorr Avenue
Fairfax, Virginia 22031
(703) 698-8581

Now, anyone can build a superior loudspeaker from scratch. All the help you'll need.... **$14.95**

OLD COLONY SOUND
Box 243, Dept. LDA, Peterborough, NH 03458

NAME

STREET

CITY ST ZIP

CREDIT CARD TELEPHONE (MC/VISA):
603-924-6371 or 924-6526, (9-4 EST, M-F)

TURNTABLES

MERRILL MODS. AR: (A11)—ACRYLIC LEAD OUTER PLATTER WITH CLAMPING RING $135. ACRYLIC SUBCHASSIS $95 REPLACEMENT MOTOR $65. SPINDLE $25. SPRING KIT $8 and more. **LINN:** ACRYLIC LEAD OUTER PLATTER WITH CLAMPING RING. $135. ACRYLIC LEAD ARM BOARD $48. UNDERGROUND SOUND, 2125 CENTRAL AVE., MEMPHIS, TN 38104. (901)-272-1275.

MERRILL TONEARM DYNAMIC DAMPER $8. Absorbs energy generated by cartridge—increases the tonearm's moment of inertia. Underground Sound, 2125 Central Ave., Memphis, TN 38104. (901) 272-1275.

PCM·DAT·CD

Audio Gallery has an excellent selection of these hard to find, high-end components, new and used.
MICRO SEIKI TURNTABLES, SAEC TONEARMS, HIGHPHONIC CARTRIDGES
Turntable Systems from $500 to $15,000. CALL FOR A FREE LIST!
Audio Gallery • 2718 Wilshire, Santa Monica, CA 90403 • (213) 829-3429

TURNTABLES

SOTA TURNTABLES: BEAUTIFUL CRAFTSMANSHIP & UNSURPASSED SONICS delight your senses. AUDIO NEXUS, NJ (201) 464-8238.

COMPACT DISCS

PREVIOUSLY-OWNED COMPACT DISCS! Buy, Sell, Trade. Free Catalog, Information. The CD LINK, 410-AU Weaver Lane, Simpsonville, SC 29681-8908.

WE'RE MUSIC TO YOUR EARS

- Free Catalog of CD's.
- Same day shipping if you order before 12 noon EDT.
- $1.00 **DISCOUNT** per disc on orders of 10 or more.
- $2.50 for UPS Cont. U.S. shipments.

Call Toll Free to order:
USA 1-800-232-3687
NYS 1-800-537-7303
P O Box 616, Clifton Park, NY 12065
518-664-2550

COMPACT DISC CENTRE

CHECK OUR LOW PRICES!

COMPACT DISCS

COMPACT DISCS AND ACCESSORIES
Call for FREE catalog.
Requests welcome 24 hours a day.
Retailer prices available

ALL DISC MUSIC, INC.
CT call 1-452-0203
1-800-ALL DISC
41 Monroe Turnpike, Trumbull, CT 06611

BEATLES CDS $12.79 LARGE SELECTION—all for less no member fee—free catalog. Send S.A.S.E. We want to be your, CD SOURCE: 227 Plitt Avenue, South Farmingdale, NY 11735.

PROTECT YOUR CD'S JEWEL BOX'S with resealable plastic sleeves. 40 for $5, 100 for $10. Add $2 postage. Also **AUDIOPHILE** CD's and l.p.'s by Mobile Fidelity, Sheffield, Reference Chesky. Chad Kassem, P.O. Box 2043, Salina, KS 67402-2043. 913-825-8609.

GIVE NEW LIFE TO SCRATCHED CD'S. Amazing new product cures skips and dropouts, guaranteed. Send $8.95 plus $2 S&H to: Synergistic Data Systems, Inc., Box 127A, Sierra Madre, CA 91024.

LOW COMPACT DISC PRICES—Schwann CD and COLOR Catalogs via UPS $5—LARGE Classical Inventory—over 9000 titles—Mini-Catalogs $1—Follow-up Service—DUWARS, PO BOX 6662–A, GREENVILLE, SC 29606.

The Best Deserves the Best

SME Series V
"The Best Tonearm in the World."

Talisman Virtuoso DTi
. . . "The best high output MC on the market and one of the best cartridges available regardless of type or price."
—Stereophile Magazine Vol. 9, #4

It should come as no surprise that these two thoroughbreds work so well together. When we saw **SME's** remarkable achievement of rigidity, non-resonance and neutrality, we set about creating a phono cartridge designed to the same parameters.

Separately, each is recognized as the state-of-the-art in its genre. And, of course, the **SME V** will bring out the best in whichever phono cartridge you decide to use, just as the **Virtuoso** will perform superbly in other tonearms.

Together they are the single most faithful instrument for reproducing recorded music. Once you've listened to this combination, we think you'll agree. Call us at (415) 843-4500 and we'll rush literature to you and give the name of an audio specialist who can demonstrate **our best playing your best.**

sumiko inc
P.O. Box 5046, Berkeley, CA 94705
415-843-4500

COMPACT DISCS

CD'S OVER 8000 TITLES!!! LOWEST PRICES & Fantastic Service. All Categories. From $8.99!! Complete Catalog $1. Refundable! Simmons Entertainment P.O. 1782 Dept. A, Orange, CA 92668. (714) 893-6763.

PARTS & ACCESSORIES

BRISSON/MIT CABLES, CUSTOMIZED ATHENA POLYPHASORS, MI-330/Shotgun in any configuration, including tonearm sets, WBT locking RCA, and Camac terminations for Goldmund and Levinson. Brisson hookup wire for audio constructors. MIT wiring harness for INFINITY RS-1, custom threaded Tiptoes for any component, ASC Tube Traps, Wonder Caps & solder, Resistas, connectors, etc., $1 catalog. Michael Percy, Box 526, Inverness, CA 94937. 415 669-7181.

ELECTRON TUBE SALES 6DJ8 6AN8A 6CA7 6L6GC 6550A EL34 KT77 KT88 EF86 Same day shipping from stock Industrial Tube Distributors since 1947. 4000 Types in stock. A R S Electronics, 7110 DeCelis Place, Van Nuys, Ca. 91406, 1-800-422-4250.

SONY, JVC, RCA, PANASONIC, FISHER All major brands of original factory equipment at direct to you prices. Fast service, satisfaction guaranteed! **FREE CATALOG.** Call **800-367-7553;** In NY **516-326-7604.**

TUBES & ACCESSORIES WITH ADVICE on tubes, mods., system design, new & used components. Amperex, EE, GE, Gold Lion, Mullard, Sylvania, Tungsram. Exclusive US rep. Siemens/Telefunken. Great prices. Consultant supplier to manufacturers, dealers, clubs, individuals. Douglas Kent Smith Consulting, 240 W. Pike St., Canonsburg, PA 15317-1163. (412) 746-1210.

CD PLAYERS

COMPACT DIGITAL PLAYERS!
In stock! Fast, FREE shipping. Also: Acoustat, CWD, Fried, PS, Proton, SAE, Sony, Spica. (See our Hafler ad.) READ BROTHERS STEREO, 593 King Street, Charleston, South Carolina 29403. (803) 723-7276.

J.S. AUDIO OFFERS A LARGE selection of CD players at competitive prices. For more information Mon. thru Sat. please call 301-890-3232. J.S. Audio, One Childress Court, Burtonsville, MD 20866. We honor Visa & M/C.

RECORDS

RECORD COLLECTORS SUPPLIES. REPLACEMENT JACKETS, INNER SLEEVES, 78 RPM SLEEVES, OPERA BOXES, LASER DISK BOXES, ETC. FREE CATALOG. CABCO PRODUCTS, BOX 8212, ROOM 662, COLUMBUS, OHIO 43201.

TAPE RECORDERS

AMERICA'S LARGEST dealers in **HIGH END USED** stereo. We **BUY** and **SELL** by **PHONE. STEREO EXCHANGE** 687A Broadway, between 3rd and 4th St. (opposite Tower Records) NYC 10012. (212) 505-1111 and (800) 833-0071.

SONY MX 1000ES 4IN/2OUT MIC/LINE Mixer for great live recordings. Reg. $330 Now $149 While Supplies Last. OPUS ONE: 800-441-2327. In PA. (412) 281-3969.

TEST RECORDS

CBS TEST RECORDS
The CTC Professional Series Test Records to replace the world-famous STR Technical Series Test Records. The records are designed for the audio professional and audiophile who demand the highest level of performance.

CTC-300 PHONOGRAPH TEST RECORD is used for measuring the frequency response, crosstalk, resonance, polarity, compliance and tracking ability of a phonograph cartridge. $30

CTC-310 DISTORTION TEST RECORD has been designed to evaluate any type distortion produced by a phonograph cartridge due to factors such as non-linear relationships between the stylus motion and the cartridge output, vertical tracking angle error, or poor coupling between the stylus and the record groove. $30

CTC-330 STUDIO TEST RECORD was developed to assist in evaluating the performance of audio disc playback equipment. It provides the range of frequencies and levels necessary to measure sensitivity, frequency response, separation, phase and turntable speed. $30

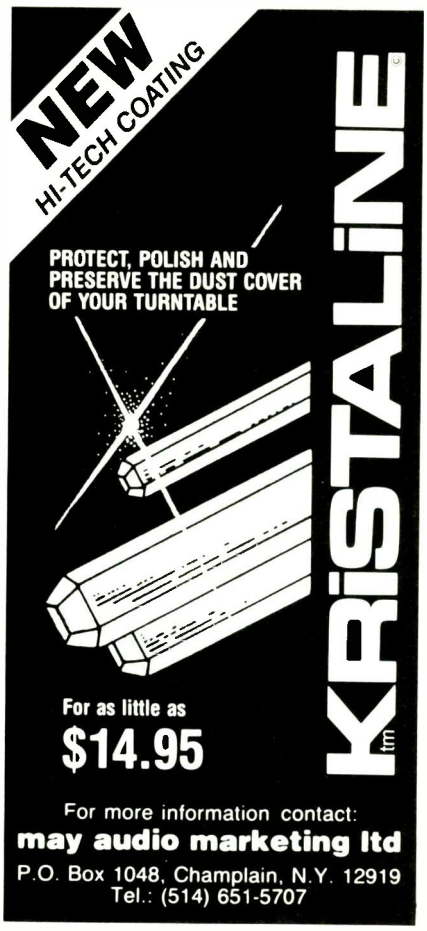
CTC-340 ACOUSTICAL TEST RECORD is intended to be used for measuring the performance of an entire stereo system, including the loudspeakers. $30

CTC-350 TURNTABLE AND TONE ARM TEST RECORD provides the signals necessary to measure key performance parameters of turntables and tone arms. $30

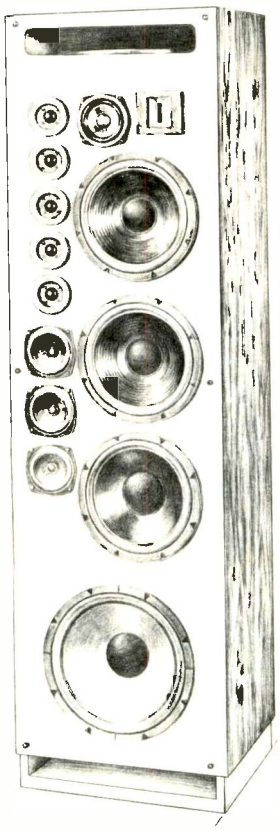
Payment must accompany order and be either a check or money order in U.S. funds. Add $3 for handling with each order. Allow four to six weeks for delivery.

Please write or call:

AUDIO TEST RECORDS
CBS, INC.
Columbia Special Products
8th Floor
51 West 52nd Street
New York, NY 10019
(212) 975-4321



LOWEST LOUDSPEAKER DISTORTION



The VMPS Super Tower IIa/R Special Edition: $1399-$1499ea kit, $1838-$1938ea assem. 76x21½x17" 300lbs

The VMPS Super Tower IIa/R is a very large, floor standing, ultra low distortion, high efficiency speaker system designed for audiophiles seeking high output levels and dynamic range, extremely low levels of coloration, and the most extended bass response available in production loudspeakers.

The STIIa/R is now available in a **Special Edition**, featuring four of our most requested luxury options at only a small premium in price. Standard on the Special Edition are the new 200W Superdome ferrofluid softdome tweeters, for total power handling of 1000W; crossovers of 100% IAR Wondercaps; internal wiring with the highly regarded Powerline II; and the single amp conversion kit which permits switchable biamp or single amp operation at any time. Performance is enhanced even above the level about which **Stereophile** (9/3 Ap 86) commented: "The issue is not whether the VMPS are 'digital ready'; it is, rather, whether digital (or analog) is VMPS Super Tower IIa/R ready." (Anthony Cordesman).

Hear VMPS at the dealers listed below, or write for **Stereophile's** full reviews. Other models include the **MiniTower II** ($329ea kit, $439ea assem), **Tower II** ($439ea kit, $599ea assem), **Super Tower/R** ($699ea kit, $969ea assem), our three **Subwoofers** (Smaller, $229ea kit, $299ea assem; Original, $299ea kit, $375ea assem; Larger, $439ea kit, $549ea assem), the **TPC 1 Electronic Crossover** ($449), and the **QSO Series** of bookshelf systems. All prices include free shipping in USA and kits are supplied with fully assembled cabinets.

VMPS AUDIO PRODUCTS
div. Itone Audio
3412 Eric Ct El Sobrante CA 94803
(415) 222-4276

Hear VMPS at The Listening Studio, Boston, Par Troy Sound, Parsippany NJ Dynamic Sound, Washington DC, Deltacom Audio, Tampa Fl, Audio by Caruso, Miami Fl, Arthur Morgan, Altamonte Springs Fl, Shadow Creek Ltd, Minneapolis Mn, Mountaineer Telephone, Beckley WV, Encore Audio, Lee's Summit Mo, The Long Ear, Coeur d'Alaene Id, Efficient Stereo, Torrance Ca, Ultimate Sound, San Francisco Ca, Sounds Unique, San Jose Ca, Reference Sound, Eagle Rock, Ca, Custom Audio, Novato Ca, Eclectic Audio, Livermore Ca, Itone Audio, El Sobrante Ca

Audio·Video Car Stereo

Lowest Prices on All Major Brands of Audio, Video & Car Stereo
FULLY WARRANTEED
GET IT FREE!
Free Delivery Anywhere in the U.S.
Major Credit Cards Accepted
The SOUND Approach
6067 Jericho Tpke., Commack, NY 11725
"Call Us" (516) 499-7680

TEST RECORDS

SEVEN STEPS TO BETTER LISTENING, FROM CBS TECHNOLOGY CENTER, is a high-precision test record for the novice. Set up your hi-fi system and tune it to the specific acoustics of your listening room. Make certain your equipment functions properly. Includes 16-page booklet by AUDIO's Edward Tatnall Canby which shows you how to perform the following "ears only" tests: Proper identification of left and right channels, phasing, loudspeaker balance, tone control settings, elimination of buzzes and rattles, proper adjustment of vertical and lateral-tracking forces, and much more. Send $8.98 in check or money order in U.S. funds only; payment must accompany order. Add $3 for handling with each order. Allow four to six weeks for delivery. Please write or call:

AUDIO TEST RECORD
CBS, Inc.
Columbia Special Products
8th Floor
51 West 52nd Street
New York, NY 10019
(212) 975-4321

CARTRIDGES & TONEARMS

THE ORIGINAL G.A.S. SLEEPING BEAUTY MOVING COILS super elliptical—list $240., special $79., Thalia II preamp—list $299., special $149. SAE hi-output moving coils, Shibata-tip 1000LT—list $260., special $99., elliptical 1000E—list $240., special $79. Visa/MC/Money Order, (213) 726-9999, S.A.E., Inc., 1502 Gage Road, Montebello, CA. 90640.

REMOVES VOCALS FROM RECORDS!
Now **You** can sing with the world's best bands! The **Thompson Vocal Eliminator** can remove most or virtually all of a lead vocal from a standard stereo record and leave most of the background untouched! Record with your voice or perform live with the backgrounds. Used in Professional Performance yet connects easily to a home component stereo system. Not an equalizer! We can prove it works over the phone. Write or call for a Free Brochure and Demo Record.
LT Sound, Dept. AU, P.O. Box 338, Stone Mountain, GA 30086 (404) 493-1258
24 HOUR PHONE DEMO LINE: (404) 493-6879

AUTO SOUND

CARVER, NAKAMICHI, BANG & OLUFSEN, A.D.S., CROWN, REVOX, TANDBERG, HAFLER, ADCOM, MISSION, N.A.D., HARMAN/KARDON, KYOCERA, YAMAHA, LUXMAN, DENON, KLIPSCH, B & W, KEF, D.C.M., E-V, J.B.L., INFINITY, D.B.X., AKG, AND OTHER QUALITY COMPONENTS. BEST PRICES—PROFESSIONAL CONSULTATION. ALL PRODUCTS COVERED BY MANUFACTURERS' U.S.A. WARRANTY. AMERISOUND SALES, INC., JACKSONVILLE, FLORIDA 32241. EAST: (904) 262-4000 WEST: (818) 243-1168.

BLANK TAPE

AUDIOPHILE RECORDS

AUDIOPHILE ALBUMS! The purest recording techniques are still implemented at **MOBILE FIDELITY SOUND LABS, SHEFFIELD LAB, REFERENCE RECORDINGS** and **WILSON AUDIO. SOUND ADVICE** offers, largest inventory, U.H.Q.R.'s, collections, out-of-prints, Nautilus, much more. Visa, Mastercard. 8215 Grand, Kansas City, MO 64114. (816) 361-2713. Remember! Progress isn't achieved when quality is compromised!

MOBILE FIDELITY and other **AUDIOPHILE ALBUMS** at **WHOLESALE!** Also Sheffield, Nautilus, Sweet Thunder, M&K, Reference Chesky, Direct-to-Disc, JAP's. MFSL Stones collection $175. MFSL Sinatra collection $200. UHQR's $25. Chad, P.O. Box 2043, Salina, KS 67402-2043. 913-825-8609.

REFERENCE RECORDINGS
"SERENDIPITY" is making waves! Jazz radio programmers have discovered its appeal, and have put it near the top of the chart. If your local dealer is missing out, get it from the source (see below). MICHAEL GARSON, keyboard wizard with Free Flight, has put together a tasty program of upbeat, tuneful, mainstream acoustic jazz with Stanley Clarke on standup bass, Gary Herbig giving great sax, and more. Pure Analogue 33 1/3 rpm LP ($15.98) or Digital Master compact disc ($16.98) available now at most fine audio and record stores, or postpaid directly from Reference Recordings, Box 77225X, San Francisco, CA 94107. (415) 355-1892. Visa/MC accepted. Free catalogue/reviews. Dealer inquiries invited.

WANTED TO BUY

ACOUSTAT MODEL 1 AND 1 + 1 NON MEDALLION OK. Call Jeff: (215) 628-2000; 9-5.

ALWAYS PAYING TOP $$ FOR MCINTOSH solid state components, JBL loudspeakers (the older the better), McIntosh MC 3500 or MC 350 for personal use. 313-229-5191, 7-11PM EST.

ALWAYS PAY TOP FOR: Tubes, Tuners, Amps, Speakers, Drivers, Horns, by M-Levinson, Mcintosh, Marantz, Audio Research, Tannoy, JBL, Altec, E.V., Jensen, Western Electric, Westrex, Langevin, RCA. Tel: 818/576-2642. David Yo: P.O. Box 832, Monterey Park, CA 91754.

AMERICA'S LARGEST dealers in **HIGH END USED** stereo. We **BUY** and **SELL** by **PHONE. STEREO EXCHANGE** 687A Broadway, between 3rd and 4th St. (opposite Tower Records) NYC 10012. (212) 505-1111 and (800) 833-0071.

WANTED TO BUY

CASH PAID! for your used high end stereo components. Call for a quote. **AUDIO CLASSICS** 8AM-5PM EST Mon.-Fri., POB 176CP, Walton, NY 13856 607-865-7200.
—Audio Advertiser Since 1979—

LUX T-310 AM/FM TUNER. Call Jeff (215) 628-2000; 9-5.

MCINTOSH, MARANTZ TUBE, MCINTOSH S.S. equipment, Western Electric, Tubes, Speakers, etc. TOP CA$H. Scott Dowling, 9908 Daines Drive, Temple City, CA 91780. (818) 286-9122, evenings/weekends.

NAKAMICHI 610 PREAMPLIFIER, black, excellent condition, reasonable. Sanyo Plus E-55 timer. Sansui RX-50/100/150, SAE DR-1 rack drawers. John, P.O. Box 34773, Los Angeles, CA 90034. (213) 837-2731.

NEW/MINT SONY: TC 164SD, TC4550SD, ELD8. Elcaset units, tapes, or complete shells only. JAC/MS/DS, P.O. Box 1321, Meadville, PA 16335-0821.

QMI (QUATRE) WILL PAY $50 for GC500 scematic/parts list or ledgible copy. (312) 894-0677.

REL PRECEDENT FM mono tube tuner made by Radio Engineering Laboratories c. 1956. Scott Multiplex Adaptor. Stephen Guglielmi, P.O. Box 66154, Houston, TX 77266-6154. (713) 524-5361.

SERVICES

AMPLIFIERS and PREAMPS modified by **GEORGE KAYE** former Chief Engineer of NY Audio Labs and inventor of the **"MOSCODE"** amps. **AUDIO CLASSICS,** POB 176GK, Walton, NY 13856, 607-865-7200, 8AM-5PM EST Mon.-Fri.
—Audio Advertiser Since 1979—

AUDIO PULSE SERVICE. Factory trained technicians. Write us about new units and Model One update kits. White Labs, 10528 Lower Azusa Rd., Suite 192A, El Monte, CA 91731. (818) 446-5346.

MARANTZ Tube Equipment repaired by original factory personnel. **AUDIO CLASSICS,** POB 176TC, Walton, NY 13856, 607-865-7200, 8AM-5PM EST Mon.-Fri.
—Audio Advertiser Since 1979—

MCINTOSH TUNERS & Tuner-Preamps **Modified** by **RICHARD MODAFFERI,** the DESIGNER of the MR77 & MR78. **AUDIO CLASSICS,** POB 176RM, Walton, NY 13856, 607-865-7200, 8AM-5PM EST Mon.-Fri.
—Audio Advertiser Since 1979—

PUBLICATIONS

AUDIO TRANSFER
MONTHLY CLASSIFIED ADVERTISING

BUY, SELL, OR TRADE USED STEREO, musical instrument amplification, test, or antique radio equipment at 25 cents a word for subscribers. Special interest and How to articles. Free 20 word advertising with $15 ($21 foreign) yearly subscription. Audio Transfer, P.O. Box 6413, Titusville, FL 32782-6413.

WALT JUNG'S CLASSIC, Audio Op Amp Applications, 3rd Edition, only $18.50 postage paid. OCSL, PO Box 243A, Peterborough, NH 03458.

1987 TWEAK MANUAL—150 pages of the best audiophile accessories and components from around the world plus more editorials, how-to articles, technical white-papers, product reviews and helpful hints than you'll ever find in one publication. From interconnects to capacitors, magic bricks to damping materials, platter mats to headshell wires, tube amps to tonearms, beer budget to lunatic fringe, we've got 'em all. Just send $7 to: The Tweak Shop, 3700 Montecito Ave., Santa Rosa, CA 95404.

YOU HAVEN'T HEARD YOUR SYSTEM YET IF YOU HAVE BARE WALLS BEHIND YOUR SPEAKERS

"A significant improvement in the smoothness of the frequency response above 200 Hz or so, much better imaging and depth, and more transparency . . . The Watkins Echo-Muffs are a minor breakthrough in home audio."
Anthony Cordesman, STEREOPHILE, Vol. 10, No. 3

Watkins Audio, 1019 E. Center, Kingsport, TN 37660, (615) 246-3701

MISCELLANEOUS

ESTATE SALE: 6 Quad speakers. 4 amplifiers; stereo equipment cabinet; unused Calrad pickup and cartridge; 1936 Federal Phonograph specs. (201) 744-8875 after 5 p.m.

NEW IDEA? Innovation Center in Washington, D.C. will assist you through Research and Development! Free Kit—1-800-257-7880.

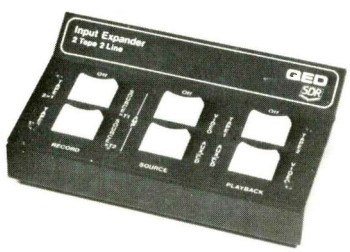
OLDTIME RADIO BROADCASTS . . . Classic programs on high quality tapes. Mystery and adventure! Comedy! Drama! Music! Free catalogue. Carl A. Froelich, 2 Heritage Farm, New Freedom, Pennsylvania 17349.

MAIL ORDER

BEAT THE PRICE FIXERS WITH low discount prices and full U.S.A. manufacturers warranties on: Nakamichi, Revox, Carver, Bang & Olufsen, ADS, Kyocera, HK, Crown, Hafler, B&W, NAD, Tandberg, Polk, Island Audio, Inc., 1122 Riverside Drive, Holly Hill, FL 32017. (904) 253-3456.

Proven Accessories from QED!

C.D. passive pre-amp CD-P



Input expander IX 4

For more information on the whole range of QED Products contact:
may audio marketing ltd
P.O. Box 1048, Champlain, N.Y. 12919
Tel.: (514) 651-5707

MAIL ORDER

BEST PRICES SME V $1295, Rega RB 300 $125, Koetsu Black $425, Celestion SL600 $895, Wharfedale 708 $375, inclusive Airmail delivery. Catalogue $1 bill. Stereo: P.O. Box 774, London, NW7 3ST England.

WHEN YOU SEE THIS...

You are visiting a store that cares about your music.

Audioquest offers 8 speaker cables and 3 interconnect cables to handle any application.

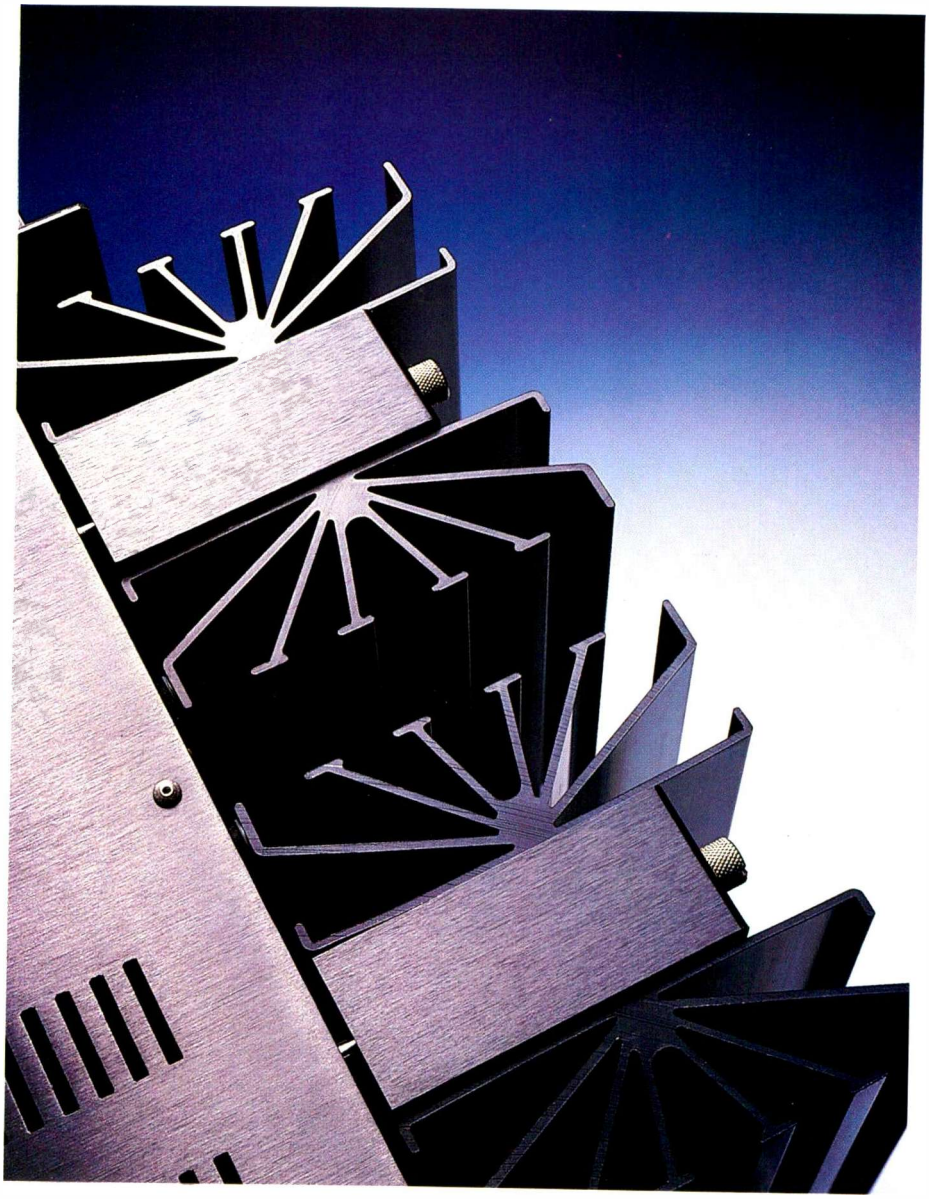
audioquest
"Products that bring your system to life!"

629 Camino Mares #306
San Clemente, CA 92672
(714) 240-0604

MAIL ORDER

AD INDEX

A VIEW FROM THE TOP



HEATSINK—July 1986

Spend some time with a Mark Levinson® component. As every work of art is unique, so it is with Mark Levinson products. The complete range of amplifiers and preamplifiers is crafted for music lovers who appreciate the subtleties within reproduced music and also demand a precise execution of the designer's imagination.

Experience a level of craftsmanship that sets the standard for technical artistry and stands the test of time.

mark levinson.

Mark Levinson® products are manufactured and distributed worldwide by **MADRIGAL, Ltd.,** PO Box 781, Middletown, CT 06457 ITT TLX 4942158

® Dolby is a trademark of Dolby Laboratories.

C&C
Computers and Communications

BOUNDARIES DISAPPEAR. SPACE EXPANDS. EVERYWHERE,
OPENNESS. AND THAT'S ONLY WHAT IT SOUNDS LIKE. HEAR AND SEE
THE NEC 46" PROJECTION TV WITH DOLBY SURROUND SOUND.
CERTAIN THINGS IN LIFE SIMPLY CANNOT BE COMPROMISED.

NEC

For More Information Call: (312) 860-9500 x3210.

NEC Home Electronics (U.S.A.), Inc., 1255 Michael Drive, Wood Dale, IL 60191