

Audio

JULY 1987 • \$2.25

THE R-DAT
STANDARD

WE TEST FOUR
DIGITAL AUDIO
TAPE RECORDERS

SONY CDP-705
CD PLAYER
VELVET-SMOOTH
SOUND



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TECHNICS
CQ-H7500
CAR STEREO
MUCH BETTER
THAN AVERAGE

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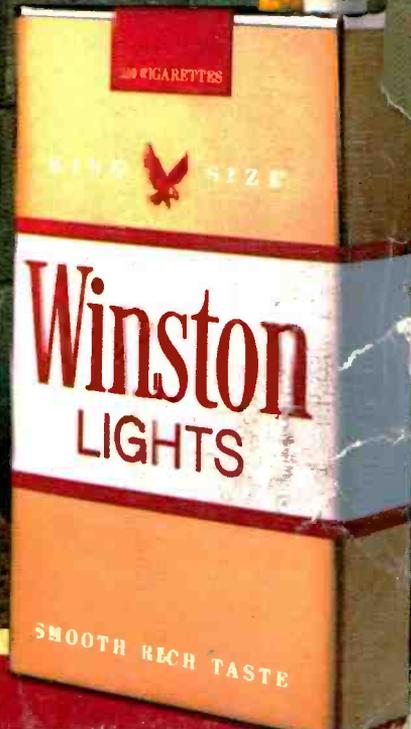


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Real Dreams.



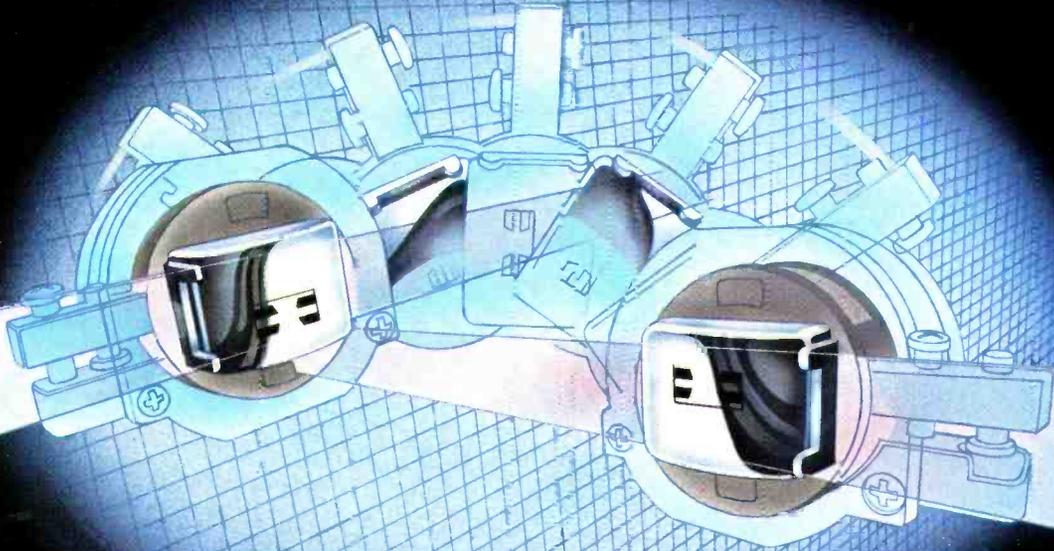
**Real people
want real taste.
Winston**



**SURGEON GENERAL'S WARNING: Cigarette
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GET THE HIGH END. ON THE FLIP SIDE.

INTRODUCING THE FUJITSU TEN DUAL AZIMUTH.



Dual
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Auto-Reverse never sounded better. Only a re-calibrated tape head permits perfect sound

reproduction in Forward and Reverse. Fujitsu Ten's unique Dual Azimuth System automatically adjusts the tape head, *realigning* it with the tape. The result: an enhanced Dolby and the full range of frequency response in *both* directions.

FROM \$250.....TO \$2000



The Dual Azimuth Adjusting System introduced in Fujitsu Ten's incredible \$2000 Compo is now available in the new "M" Series. Features of the M3 auto-reverse cassette receiver include electronic tuning, pre-set scan, Ultra Tuner (for superior FM reception), Dolby NR, automatic tape program search, high power (56 Watts total output), 4 channels amplified, soft green fully illuminated controls and, of course, the *expensive* Dual Azimuth System. Like all Fujitsu Ten car audio products, the "M" Series offers you high-end performance at a reasonable price: \$250-\$350.



FUJITSU TEN
CAR AUDIO

51 MILLION UNITS...34 YEARS EXPERIENCE

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O N E F O R T H E A G E S



THE NO 23 DUAL MONAURAL POWER AMPLIFIER

The No 23 announces a new generation of technical refinement in dual monaural amplifiers. The No 23 amplifier has a power output of two hundred watts per channel at eight ohms, allowing you to realize the full potential of your system at all times.

Experience a level of craftsmanship that sets the standard for technical artistry and stands the test of time

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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.

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Nikko Audio Systems and components are available exclusively through Authorized Nikko Audio Dealers.

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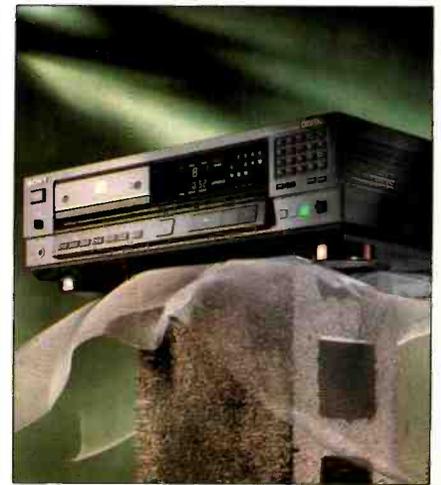
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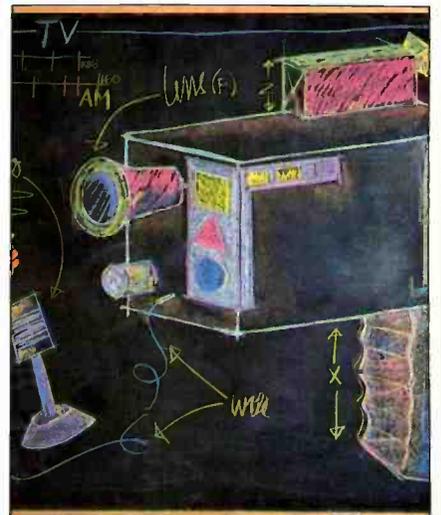
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Admiration from Australia

Dear Editor:

Thank you for offering a reduction in subscription prices. For those of us who live in the more-distant countries and cities, the opportunity to subscribe at a reduced price is most welcome. Perth is the most remote capital in the world, and is a virtual wilderness in the world of hi-fi. Whilst we do have some top brands available, we do not have the plethora of equipment available in your country, the U.K., or even the eastern states of Australia. This leads me to wonder whether or not American audiophiles appreciate the availability of so many brands and models.

Of course, the market in America is monstrous compared with Australia, which in itself leads to an expanded supply. Having such a large domestic market, prices are consequently competitive, and I would shudder to think that there are complaints about prices. For those Americans who lament the price of their dream equipment, it might be of some consolation to learn of the situation here in Australia. For example, a pair of Magneplanar SMGa speakers costs nearly \$2,000 in Australia compared with \$535 in America. Of course, we suffer from a poor exchange rate (U.S. 65¢ equals \$1 Australian), but this does not explain a four-times increase in costs. Such governmental wonders as import duty and sales tax really do the damage, not to mention the mark-up for local distributors and retailers. There are many Australian music lovers who would desperately love to be able to buy American or English equipment without the governmental charges which impose such barriers to listening to high-quality reproduction of music.

One does wonder sometimes, however, how Americans decide between similarly priced equipment. It would be an impossibility to make comparisons between all products in a given price/quality range. For an amplifier up to, say, \$1,500 (U.S.), there would be a mind-boggling comparison of data, plus the difficulty of trying to audition a select number. I wouldn't be surprised if some people use the dart-board system and settle for the brochure with the hole in it. Oh, for such a problem!

Thank you for producing a quality magazine. Not only is it one of the

best-value publications of any nature, but it is well written and authoritatively documented. I especially enjoy the "Equipment Profiles" and "Auricles," which provide tremendous technical detail (none of which I understand) plus subjective information. The notation of ancillary equipment is of interest. The only difficulty is that some of that equipment has not, to my knowledge, been independently reviewed in your magazine—for example, Snell Type A-III loudspeakers.

I look forward to having my own library of *Audio* and wish you well for the continuing publication of your fine magazine.

Bradley J. McIntosh
Bentley, Australia

Antenna Article Accolades

Dear Editor:

I would like to express my admiration to your Technical Editor Ivan Berger, WINZ broadcast engineer Richard L. Edwards, and interviewer Lewis T. Fineman for the article on the operation of multiple FM transmitters driving a single antenna array (January 1987).

With approximately 30 years' experience in military electronics, I can appreciate both the design and performance excellence of this "microwave" engineering feat, as well as the superlative technical writing in making these concepts clear to the general reader. Figures 1 and 2 and the accompanying explanation were particularly well done! The article is but the latest example of *Audio's* preeminence in its field. Congratulations are extended to all concerned.

Robert L. Goodwin
Rockville, Md.

Expression of Sympathy

Dear Editor:

We were saddened to hear of the death of Dick Heyser in March, as we read upon receipt of your May issue. Please accept and convey the sincere sympathy of the Studer Revox staff to the *Audio* "family" and to all those who were close to Mr. Heyser. His work was unique and pioneering, and his death represents a major loss to the audio community.

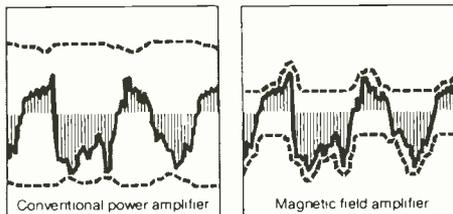
Thomas E. Mintner
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MOBILE MUSICALITY.

THE CARVER CAR AMPLIFIER introduces Magnetic Field Amplifier technology to automotive high fidelity. Finally, the traditional weak link between car stereo decks and modern speaker design has been replaced with Carver technology. Into 1/10th of a cubic foot, Bob Carver has engineered a complete 120 watts RMS per channel amplification system with the fidelity, accuracy and musicality demanded by the most critical reviewers and audiophiles.

ESSENTIAL POWER. Even before the exciting advent of car Compact Disc players, an abundance of power has been necessary to reproduce, without distortion, the frequency and dynamic range produced by modern decks.

Unfortunately, conventional amplifier technology is particularly unsuited to delivering this needed power to the specialized car interior environment. Like their home stereo counterparts, traditional car designs produce a constant high voltage level at all times, irrespective of the demands of the ever-changing audio signal—even those times when there is no audio signal at all! Because automotive amplifiers must, obviously, derive their power from the host vehicle, such an approach results in substantial drain to delicately balanced automobile electrical systems.



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

The Carver Magnetic Field Car Amplifier is signal responsive. Highly efficient, it produces only the exact amount of power needed to deliver each musical impulse with complete accuracy and fidelity. Thus the Carver Car Amplifier not only reduces overall long-term power demands, but produces the large amount of power necessary for reproduction of music at realistic listening levels without the need for oversize power supply components. Important considerations in the minuscule spaces which quality car design allocates to add-on electronics.

INTELLIGENT POWER. A hallmark of all Carver amplifiers is the careful integration of sophisticated speaker and amplifier protection circuitry. The Carver Car Amplifier is no exception.

Speakers are protected with a DC offset internal fault protection design which turns off the power supply at first hint of overload. An overcurrent detector mutes audio within microseconds of a short circuit, as does an output short circuit monitoring circuit. Together, these three circuits eliminate the potential need to replace fuses, revisit your autosound installer, or worse yet, replace expensive speakers due to a moment's indiscretion with your deck's volume control.

ASSIGNABLE POWER. Integrated bi-amplification and bridging circuits, along with The Carver Car Amplifier's compact configuration make it ideal for multiple-amplifier installations.

The built-in 18dB/octave electronic crossover allows use of two amplifiers in a pure bi-amplification mode without addition of extra electronics. Or, at the touch of a button, one Carver Car Amplifier can become a mono amplifier for subwoofers while the other Carver Amplifier handles full range. Or, for astonishing dynamic and frequency response, two Carver Car Amplifiers may be operated in mono mode into 8 ohms for a 240 watt per channel car system which will truly do justice to digital without taxing your car's electrical generation system.

INNOVATIVE POWER. Can 1/10th of a cubic foot of space hold yet more innovations? Yes.

Carver has addressed the ongoing problem of head-end/power amplifier level matching: Output of current car decks varies widely from brand to brand and model to model. The result can be a less than perfect match. The Carver Car Amplifier incorporates circuitry which compensates for variations in head-end output, reducing noise and optimizing signal-to-noise ratio. In addition, Carver has added a subsonic

filter which removes inaudible power-robbing infrasonics before they can tax the amplifier and speakers. Finally, a delayed turn-on circuit activates the Carver Car Amplifier after your head-end unit has powered up, to eliminate starting pops and thumps.

ACCURATE POWER. It goes almost without saying that a product Bob Carver designs for the road carries the same superb electronic specifications that his home audio products are known for.

The Carver Car Amplifier is flat from 20Hz to 20kHz, down -3dB at 16Hz and 30kHz. Not coincidentally, the usual specifications given for Compact Discs. A signal-to-noise ratio of over 100dB means that, in even the most quiet luxury sedan, you will never be annoyed by hiss. The other specifications are equally as impeccable. You may peruse them in our literature or in independent reviews soon to appear.

ACQUIRABLE POWER. The remarkable Carver Car Amplifier is currently available for audition at Carver dealers across the country.

It is worth the journey. Whether you have a car system in need of the sonic excitement possible with abundant power, or are in search of the perfect complement to a new high-performance automobile, you owe it to yourself to experience the logical extension of Carver technology — The Carver Car Amplifier M-240.

Power Output Stereo Mode: (continuous RMS power output per channel, both channels driven, at 13.8 VDC input). 120 W into 4 ohms, 20 Hz to 20 kHz with no more than 0.15% THD.

Power Output Bridged Mono Mode: (Referenced to 13.8 VDC input) 240 W into 8 ohms, 20 Hz to 20kHz with no more than .15% THD.

Input Sensitivity: Variable 250mV to 4V

Signal to Noise Ratio: (Referenced to 120 W. A weighted into 4 ohms) Greater than 100 db

Crossover: 115 Hz, 18 dB/octave

Weight: 4.7 lb.

The Carver Car Amplifier



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Direct-to-Disc Signal Level

Q. I have a Boston Pops direct-to-disc recording. How does its signal level compare with that found on a standard LP that has been mastered from tape?—June E. Thomas, Wampanoag, N.Y.

A. Just as is true of other LPs, direct-to-disc recordings vary in level, depending on the philosophies of the record producers. The two approaches—tape-to-disc and direct-to-disc—have no meaningful effect on groove modulation levels.

Ozone and Electrostatics

Q. Do electrostatic loudspeakers present a possible health hazard? This question occurred to me after reading about a nonaudio product based on the electrostatic principle, namely an air filter/ionizer. These ionizers work by generating millions of negatively charged ions and sending them into the air. Unfortunately, certain brands have been said to release ozone as a byproduct, and ozone can be harmful. I would like to know, therefore, if electrostatic loudspeakers also release ions (positive or negative) and, more importantly, if contamination of the air is even a remote possibility.—Nario Brenes, Brooklyn, N.Y.

A. I do not believe that electrostatic loudspeakers release ions, produce ozone, or generate any other dangerous or harmful elements. There are no sharp points on the surface related to the electrostatic fields. Thus, arcing (which would produce ozone) is prevented. Such arcing would also damage the loudspeaker diaphragms.

Backup Power Supplies

In the November 1986 "Audioclinic," your answer to Steve Dusik, who had experienced power failures while recording, was basically correct, but the terminology was not quite right.

You suggested the use of an "uninterruptible power supply (UPS)," but what you described is a standby power supply (SPS). An SPS is designed to come on line a few microseconds after a power failure. With a UPS, the power is, in fact, truly uninterruptible because the components attached to it are always powered through the batteries and inverter circuitry. When there is a power failure, no switching takes place

because the batteries are already on line. The only condition which has changed is that the batteries are no longer being charged.

As you indicated, the most common use for either the UPS or the SPS is with computers. While an SPS is appropriate for most computers, some cannot tolerate even a few microseconds of interrupted power without losing data in memory and rebooting. In such an instance, a UPS is definitely required. Whether or not a computer or other equipment can tolerate an infinitesimal interruption depends on whether its power supply can continue to supply steady d.c. power to its internal components during the interruption.

For more information on backup power systems, I suggest that your readers look at the September 16, 1986 issue of PC Magazine (Vol. 5, No. 15). It contains an article on backup power systems and test reports on several units of both types.—John T. Wehlitz, Portland, Ore.

Loudness-Control Action

Q. What is the effect of switching in the loudness control when the volume control is well advanced?—Name withheld

A. The purpose of a loudness control is to add bass and treble to compensate for deficiencies of the human ear, which make us perceive a lack of bass and of extreme highs when we listen at low volume. A properly designed loudness control should produce no audible effect when switched in and out while volume is set for loud listening levels. If switching in does have an effect at loud levels, it was not designed properly. To check this circuit's operation, attenuate the level from the program source. Then advance the volume control to the point where the loudness action ceases during high-volume listening. Turning the volume control down from that setting should reveal increasing compensation by the loudness circuit while it is switched in.

Miswired Antenna Input

Q. My receiver is fed by a 300-ohm twin lead transmission line. The antenna is an omnidirectional model, located in the attic of a two-story frame building. I find that I get better recep-

tion from some FM stations when I have one of the two 300-ohm leads connected as it is supposed to be and the other lead connected to the AM antenna terminal. Is it possible that the internal leads are not wired to the right parts of the circuit?—Stan Nesbitt, Annapolis, Md.

A. Of course, a wiring error is always possible, and if you received all stations best with the wrong connection, one might have to conclude that such an error were indeed the problem. However, I think you will find, if you move the FM antenna to a different location in the attic, that some of the stations which you now receive with incorrect connections will be received best with normal connections. Maybe other signals will then be received less well. But you may be able to find a location which provides best reception on all stations with correct wiring.

As is always true, if you can use an outdoor antenna mounted well clear of surrounding objects, your overall reception will improve. A directional array, if aimed properly, will bring about a greater improvement, especially regarding weak signals.

Phono Cartridge Life

Q. I purchased a moving-magnet phonograph cartridge in 1980 and have replaced its stylus a number of times. I would like to know if a cartridge has a finite life expectancy. What are some of the symptoms of a cartridge that is "going bad"?—Cornell Coco, Clifton, N.J.

A. A phonograph cartridge should last indefinitely. When a cartridge does go bad, the problem is usually of a catastrophic nature. In other words, it simply stops functioning.

The most likely causes of failure are either internal wires which come loose from their terminals or coils which open. In this regard, I recall an instance when the varnish which insulated the wire reacted with the copper, finally eating through it. The coil then opened. In any event, there is no remedy for such failures.

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.

Silent Running.

CARVER'S FAMOUS TUNING TECHNOLOGY TAKES TO THE ROAD WITH THE ONLY AM/FM TUNER CASSETTE DECKS CAPABLE OF CUTTING MULTIPATH INTERFERENCE UP TO 92.9%!

The new TX-Seven and TX-Nine audiophile autosound decks employ the same Asymmetrical Charge-Coupled FM Stereo Detector circuitry as Carver's revolutionary TX-11a home tuner. They also incorporate an ingenious automatic computer logic-controlled antenna switching system that further vanquishes multipath distortion.

In point of fact, no other autosound decks in the world — regardless of price — even begin to approach the TX-Seven and TX-Nine's ability to maintain a hiss-free, glitch-free FM listening environment in your car.

COMPUTER LOGIC-CONTROLLED DIVERSITY ANTENNA SWITCHING DRIVES AROUND MULTIPATH.

One way to get temporary relief from interference at home is to move the antenna around slightly. Instead of physically moving your car antenna, the TX-Seven and TX-Nine use computerized circuitry to switch between *two separate antennas*, one out-of-phase, and one in-phase with incoming FM signals.

When multipath occurs, a special "smart" circuit automatically switches (at the speed of light) to the other antenna, automatically correcting phase and eliminating the multipath before you ever hear it. What little multipath distortion gets through this smart antenna system runs headlong into the remarkable tuner innovation *High Fidelity Magazine* described as "... distinguished (by) its ability to pull clean, noise-free sound out of weak or multipath-ridden signals."

Alone, without antenna diversity switching, the TX-Seven and TX-Nine's Asymmetrical Charge-Coupled FM Detector Circuitry delivers a *net noise and distortion reduction of 93.5%*! Together, they set a new standard for clear, clean FM autosound reproduction.

REAL WORLD CONFIRMATION. Both decks were tested on a torturous 6-mile course near the Carver factory which could regularly trigger at least *287 separate multipath occurrences* in conventional autosound FM tuners.

The TX-Seven and TX-Nine with Asymmetrical Charge Coupled FM Detection and diversity antenna system, reduced multipath occurrences to an average of *two* during the same course while listening to the same stations!

FACTORY—LOADED WITH EXTRAS. The fifteen random presets on the TX-Seven and TX-Nine are incredibly easy to set. Just press the button marked BEST and the logic circuitry *automatically* selects the fifteen strongest signals and locks them in on the presets. Plus you can select another fifteen on your own!

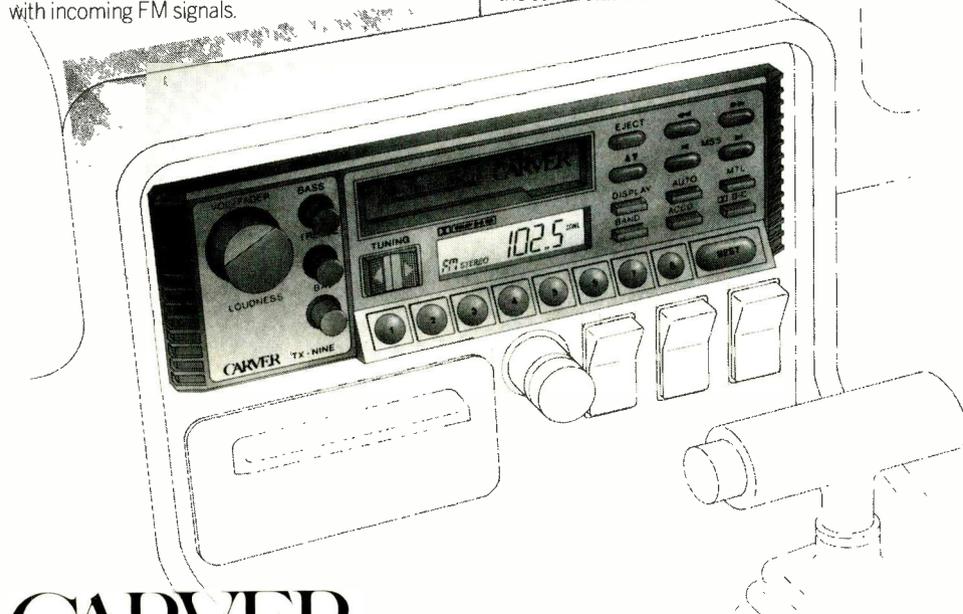


Naturally both decks are metal tape compatible with Dolby® noise reduction and have auto-reverse transports, separate bass, treble, balance and loudness and four-way fader controls. All tuning and transport functions are signalled with a gentle "beep" that keeps your eyes on the road, not on the compact, ergonomically-styled deck.

There's even a security code system that renders the TX-Seven or TX-Nine inoperable to anyone but you, and a quick removal system so you can slip out your TX-Seven or TX-Nine in seconds for storage in trunk or house.

THE BEGINNING OF THE PERFECT AUTO-SOUND LISTENING ENVIRONMENT. Visit your Carver dealer soon and experience the TX-Seven and TX-Nine. Out of hundreds of the only tuner/cassette models available, they are the only ones which can truly put you in the driver's seat of a unique, interference-free musical experience.

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DIGITAL CMOS CONTROL CENTER/PREAMPLIFIER

NEW!



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 **PRO-CONTROL FOUR**, our technologically advanced digital CMOS control center and discrete phono preamplifier!

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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!"

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WAREHOUSE STEREO
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Chico
G&G STEREO
Concord
SOUND DISTINCTION
Goleta
HOUSE OF AUDIO
Mhpitas
AMERICAN VIDEO CENTER
Sacramento
LISTEN HERE
WORLD ELECTRONICS
San Francisco
AUDIO VIDEO CENTER
LISTENING POST
San Jose
L.Z. PREMIUMS
SO. CALIFORNIA
Cerritos
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</p> | <p>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
DEL'S TV
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
Waialuku, Maui
ADRIAN'S ELECTRONICS</p> | <p>IDAHO
Idaho Falls
PHASE 4 STEREO
ILLINOIS
Chicago
MARTROY ELECTRONICS
MUSICRAFT
Dekalb
AUDIO PLUS
Gurnee
OPUS EQUIPMENT
Peoria
ELECTRONICS DIVERSIFIED
Quincy
Merkel's
Springfield
REEL TO REAL DESIGNS
INDIANA
Anderson
ANDERSON ELECTRONICS
Michigan City
AUDIO CONNECTION
New Haven
HJS SOUND
South Bend
TWILIGHT ZONE
West Lafayette
VDH'S ELECTRONICS
IOWA
Davenport
GRIGG'S MUSIC
Mapleton
BRENNER'S
KANSAS
Overland Park
AUDIO ELECTRONICS
Salina
DEL'S TV
Wichita
AUDIO PLUS
KENTUCKY
Lexington
THE STEREO SHOPPE
Louisville
HI-FIDELITY, INC
LOUISIANA
Baton Rouge
NEW GENERATION
Covington
NORTHSHORE AUDIO
Lafayette
NEW GENERATION
Lake Charles
SIGHT & SOUND
ENT. CENTER
New Orleans
SOUTHERN RADIO SUPPLY
TULANE STEREO
MARYLAND
Annapolis
MID SHIPMEN'S STORE
Baltimore
STANSBURY STEREO</p> | <p>Frederick
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Gaithersburg
AUDIO BUYS
Owings Mills
LIGHTING EXPERIENCES
MASSACHUSETTS
Boston
ENCORE AUDIO
Dartmouth
MIKE ROSE ENT.
Sunderland
SCIENTIFIC STEREO
MICHIGAN
Burton
STEREO VILLAGE
Detroit
PECAR ELECTRONICS
Grand Rapids
ELECTRONIC SOUND EQUIPMENT
L'Arvonia
CARTEL DISTRIBUTING
Marquette
AMERICAN TV
MINNESOTA
Duluth
TEAM ELECTRONICS
Litchfield
QUALITY STEREO
MISSISSIPPI
Gulfport
TIPPI'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 states of
CRAZY EDDIE
Belmar, NJ
SOUND SYSTEMS
Bloomfield, NJ
SOUND REPRODUCTION
Bound Brook, NJ
PRANZATELLI'S STEREO
Bronx, NY
BROWN ENTERPRISES
Bronx, NY
VICMARR STEREO
Brooklyn, NY
MAGNA ELECTRONICS</p> | <p>Hawthorne, NJ
THE SPEAKERMAN
Kinnelon
SAMMAN'S ELECTRONICS
Little Falls, NJ
DRUCKERS
Morristown, NJ
DRUCKERS
Newark, NJ
MEG RADIO CORP.
New York, NY
CANAL HI FI
CLONE AUDIO
LEONARD RADIO
S&S AUDIO
STEREO PLAZA
THE LAST DETAIL
VICMARR STEREO
Staten Island, NY
CLONE AUDIO
Whippany, NJ
PRINCE RANGE
Woodbridge, NJ
ORUCKER
Glen Cove, NY
ISLAND, NY
LEONARD RADIO
NEW YORK
—UPSTATE
Plattsburg
Mappleton
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
Goldston
PRO SOUND
Hendersonville
PRO SOUND & ELECTRONICS
Hickory
MC LAUGHLIN'S TV
Raleigh
CREATIVE ACOUSTICS
Shelby
SOUND ADVISE
Wilmington
JUST LO'S
OHIO
Boardman
ELECTRONICS LTD.
Bowling Green
HART AUDIO
Canton
METRODYNE</p> | <p>Cleveland
B&B APPLIANCE
OHIO SOUND
Lima
HART AUDIO
Middleburg Hts
B&B APPLIANCE
Parma
DESIRER 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
Harrisburg
CUSTOM SOUND CO.
McKeesport
HI FI CENTER
Philadelphia
RADIO 437
SOUND OF MARKET
SOUND SERVICE
Pittsburgh
AUDIO JUNCTION
Reading
Shillington
PHOENIX HI FI
Sharon
ELECTRONICS LTD.
Willow Grove
SOUNDX
PUERTO RICO
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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</p> | <p>Corpus Chrsti
B&B VIBRATIONS
El Paso
SOUND ROOM
Fort Worth
SOUND IDEA
Houston
HOME ENTERTAINMENT
Hurst
SOUND IDEA
Midland
FOLGER'S ENTERTAINMENT
San Antonio
CCR 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
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Olympia
OSCO ELECTRONICS
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WISCONSIN
Appleton
AMERICAN TV
Glendale
SOUNDSTAGE
Madison
AMERICAN TV
Oshkosh
AUDIO PLUS
Sheboygan
GENE'S CAMERA & SOUND
Waukesha
AMERICAN TV</p> |
|--|--|--|---|---|--|--|

1987 BUYERS' GUIDE to SEPARATES

19" RACK-MOUNT AUDIO COMPONENTS FOR THE SERIOUS AUDIOPHILE

A CONDENSED GUIDE LISTING FEATURES, SPECIFICATIONS, SIZES AND PRICES...

Power Amplifiers



PRO-POWER FOUR, MOSFET stereo power amp **300** Continuous RMS Watts per channel @ 4 ohms, **205** Continuous RMS Watts per channel @ 8 ohms, **20-20kHz**, **450** Watts RMS @ 2 ohms, **900** Watts RMS @ 4 ohms Bridged. THD < 0.05%, Hum and Noise: -105 dB, Front Panel switching for 2 pair of speaker systems. **40-LED 0-1600 Watt Power Meters**. 19"W x 5 1/4"H x 11"D, 30 lbs. **\$749**

PRO-POWER THREE MOSFET stereo power amplifier, same as Pro-Power Four, except no 40-LED power meters. 30 lbs. **\$649**



PRO-POWER EIGHT MOSFET stereo power amp. **600** watts per channel continuous RMS power into 4 ohms; **375** watts per channel continuous RMS power into 8 ohms, **20-20,000** Hz with no more than 0.05% THD; **900** watts per channel RMS into 2 ohms; Freq. resp. **20-20,000** Hz ± 0.1 dB; S/N -105dB; slew rate **50V/m**.sec; TIM unmeasurable, IM 0.05%. 19"W x 5 1/4"H x 16 1/2"D; 67 lbs. **\$1,399**

PM840 Power Amplifier, MOSFET stereo, features no-current-limiting power supply, **300** w/p/c RMS into 4 ohms; **450** w/p/c RMS into 2 ohms; **205** w/p/c into 8 ohms @ <0.05% THD; Freq. resp. **20** to **20,000** Hz ± 0.1 dB; S/N >105dB; slew rate **50** V/microsec; TIM unmeasurable; damping factor **200**. 8 1/2"W x 5"H x 12"D; 22 lbs. **\$549**

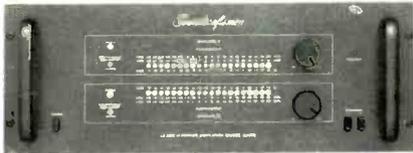
PCX-2 19" Rack Mounting kit for two PCR800 or PM840's, 2 lbs. **\$49**



PCR800 Power Amplifier, MOSFET stereo, **205** watts per channel continuous RMS **20-20,000** Hz into 8 ohms <0.05% THD; TIM unmeasurable; S/N -105dB; 8 1/2"W x 5"H x 12"D; 22 lbs. **\$499**



DDR1200 Power Amplifier, with 100-LED frequency spectrum analyzer display. Features Class-H Vari-Portional circuitry; Autobuffer circuitry for continuous 2-ohm operation; 40-LED power output Meters for up to 2,000 Watts; Truclip indicators for each ch; Mono Bridging switch on rear panel. TIM <0.02%; 250 W/ch into 8 ohms; **375** W/ch into 4 ohms continuous RMS, **20-20,000** Hz, THD <0.09%. 19"W x 7"H x 12"D; 52 lbs. **\$1,199**



A5002 Power Amplifier, Class-H Vari-Portional circuitry and Autobuffer for continuous operation into 2 ohms. Features auto crowbar protection circuit for output protection without current limiting; **40-LED 0-1,000** Watt power output Meters; Front-Panel switching for 2 pairs of speakers; True Clipping indicators; Input Level controls. Output power **250** W/ch into 8 ohms, **375** W into 4 ohms continuous RMS, **20-20,000** Hz at <0.09% THD; S/N >105 dB; slew rate >50 V/microsec; TIM <0.02%. 19"W x 7"H x 12"D, 50 lbs. **\$899**

A5001 Power Amplifier, Same as A5002 except no Meters and no Input Level controls. 50 lbs. **\$749**



A2502 Power Amplifier, MOSFET stereo with **40-LED 0-500** Watt power Meters. Features Front Panel switching for 2 pairs of speakers; Input Level controls; True Clipping indicators. Output power **125** W/ch into 8 ohms, **190** W/ch into 4 ohms, continuous RMS, **20-20,000** Hz at <0.05% THD; S/N >105 dB; damping factor **200**. 19"W x 5 1/4"H x 10 1/2"D, 30 lbs. **\$699**

A2801 Power Amplifier. Same as A2502 except no Meters and no Level Controls, 28 lbs. **\$599**

Signal Processors



AE2000 Real Time Analyzer/Equalizer, World's most accurate (**0.1dB**) Real-Time Analyzer/Equalizer. The first and only analyzer with: Two independent real-time analysis systems, (a Direct **100-LED** display with **2dB** readout and a **0.1dB** readout Differential/Comparator) Pink-noise generator, 10-octave Real-Time Display with Adjustable Decay rate, Mic. preamp, input for analysis for any Signal Processor, Autocan mode. Center frequencies **32, 64, 125, 250, 500, 1k, 2000, 4,000, 8,000, 16,000** Hz; display accuracy **0.1dB**; Auto-Scan sweep rate **0.1-10** secs/octave; Mic. preamp input impedance **2K** ohms; Frequency response **20-20,000** Hz ± 0.1 dB; includes **20-Band** all-Passive-Coil Equalizer, with boost/cut range ± 15 dB, max. **22db, 0.1dB** Differential/Comparator readout accuracy LED's for instantaneous and precise in/out signal balancing, THD <0.01%, TIM unmeasurable, Hum and Noise -114dB at full output. EQ Bypass/Defeat, Monitor and Record selectors on front panel. 19"W x 5 1/4"H x 11"D, 21 lbs. **\$799**



DC4415 Third-Octave Equalizer, stereo with 21 controls/channel. Center frequencies **40, 50, 63, 80, 100, 125, 160, 200, 250, 315, 400, 500, 630, 800, 1,000, 1,600, 2,500, 4,000, 6,300, 10,000, 16,000** Hz: Features EQ defeat; Infrasonic filter; Tape Monitor and Tape Record;

Differential/Comparator[®] circuitry for Unity Gain setting to within **0.1dB** accuracy for highest Dynamic Range capability. THD and IMD **0.01%** at 2 V; S/N **114dB** at full output; input imp **47,000** ohms. 19"W x 5 1/4"H x 11"D, 16 lbs. **\$599**

DC2215 Differential/Comparator[®] Equalizer, Stereo 10-band, with Differential/Comparator[®] True-Unity-Gain circuitry for Input-to-Output balancing accuracy to within **0.1dB**. Equalizer filter circuits use precision wire-wound Passive-Coil inductors for high gain, low noise and distortion. Front panel controls include Tape monitor, LED defeat/EQ defeat and EQ Tape Record. THD and IMD <0.01% at 2 V; S/N ratio **144** db at 10V; boost/cut range ± 15 dB, max **22dB**. Includes Frequency Spectrum Analyzer Test Record, Computone Charts, Cables. 19"W x 5 1/4"H x 11"D, 17 lbs. **\$399**

DC2214 Differential Comparator Equalizer. Same as DC 2215 except equalizer filter circuits have op-amp synthesized inductors. THD and IMD <0.01% at 2 V; S/N ratio **106** dB at 10 V; boost/cut range ± 12 dB, max **18** dB. 19"W x 3 1/2"H x 9"D, 13 lbs. **\$299**

Preamplifiers



DX4200 Preamplifier/Equalizer, with Compact Disc Player and Video/Audio inputs. Phono preamp has Variable Cartridge Loading (**50-800** pF, **100/47,000** ohm); phono level controls for adjustable ± 20 dB gain; MC variable reluctance or MM cartridge inputs; 3-way Tape Dubbing; 2 external Signal-Processor Loops; conventional line outputs plus separate Autobridge Line Outputs for Mono Bridging of Most Amps; EQ S/N **114** dB; Passive-Coil filters with **15** dB boost or cut for each octave, max **22** dB; Differential Comparator circuitry for True **0.1** dB Unity-Gain EQ balancing; includes Frequency Spectrum Analyzer test record and instant reset Computone Charts. 19"W x 5 1/4"H x 11"D, 20 lbs. **\$699**

DX4100 Preamplifier/Equalizer, with built-in conventional line outputs plus separate bridging line outputs for mono bridging of most amps. Features 2 external signal-processor loops; 2 phone inputs; 2 tape inputs with 3-way dubbing; phono S/N **97** dB, THD **0.01%**; **12** dB EQ boost and cut for each octave, max. **18** dB; Differential/Comparator circuitry for **0.1** dB Unity Gain; includes Frequency Spectrum Analyzer test record and instant reset Computone charts. 19"W x 5 1/4"H x 11"D, 19 lbs. **\$599**

DX4000 Preamplifier. Same as DX4100 without graphic equalizer but with 3 external signal-processor loops. 19"W x 3 1/2"H x 11"D, 15 lbs. **\$439**



DX3000 Preamplifier, inputs for CD player, Video/Audio, Tuner, Phono, Two Tape Decks with dubbing, Bass and Treble controls, and signal processor loop. THD **-0.01%**, S/N **95** dB. 19"W x 2 3/4"H x 10"D, 10 lbs. **\$329**

Tuners



T6200 AM/FM Stereo Digital Tuner Digital quartz PLL tuner with 16 Station presets, 5-digit Station Read-out, Auto-Scan tuning, active High Blend filter. Broad-Band AM switch, 19" rack-mount front panel. IHF sens **1.6** μ V; S/N **75** dB; distortion **0.08%**. 19"W x 2 3/4"H x 12"D, 10 lbs. **\$299**

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16-PAGE, FULL-LINE, FULL-COLOR BROCHURE, AND \$19.95 SYSTEM-EVALUATION KIT: 1-12" LP Spectrum Analysis Test Record, 2-sets of Computone 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.

TAPE GUIDE

HERMAN BURSTEIN

NR Transfer

Q. I use a high-speed cassette duplicator which has no noise-reduction circuitry. It seems to me that this is the same as copying a tape from deck to deck with noise reduction turned off on both decks. The manufacturer of the duplicator says that Dolby B NR will be transferred to copies if the master tape is encoded with it. I suspect this is wrong. What do you say? Also, if Dolby B NR indeed transfers from master tapes, what about Dolby C and dbx NR?—Chris Pillar, Anchorage, Alaska

A. The manufacturer of your duplicator is correct. Whatever NR encoding is present on the master tape—whether Dolby B or Dolby C or dbx—will be transferred to the copy.

In the case of Dolby NR, however, the transfer will be correct only if the playback and recording levels are so matched that the copy will have exactly the same magnetic strength (flux density) as the original. Otherwise, Dolby NR systems reading the copy will not “track” properly, causing frequency response to suffer, particularly at the treble end.

Matching the level indications on your duplicator’s meters (if it has separate meters for the original and the copy) may not be accurate enough. It is best to copy a tape containing a continuous test tone, then substitute the copy for the original and make sure that its playback levels read the same as the original tape’s when read on the same meter. You may have to repeat this calibration for each tape formulation (brand and type) onto which you make a copy.

Mass Market or High End?

Q. I have a problem that I’m sure a lot of others share. I have about \$350 to spend on a new cassette deck, and it seems that I must choose between mass-produced decks and those at the bottom of the “high end.” Is there a rule of thumb when dealing with a situation like this? Both types of products look good for the money.—Jim Sarro, Harrison, N.J.

A. My vote tends to be for the bottom of the high-end range. For the same price, such a deck will probably not have as many features and frills as middle-of-the-road equipment, but there is the factor of reliability to take

into consideration. A high-end manufacturer is apt to build the same quality, and therefore reliability, into his lower priced components as into his pricier ones, and is likely to meet the competition’s price by omitting the less essential features. By reliability I mean good, consistent, trouble-free performance even after heavy use.

In answering a question such as yours, we deal with probabilities rather than certainties, and with averages rather than individual cases. It could well be that you might find a middle-of-the-road deck that gives you both plenty of features and high reliability.

Tape-Type Differences

Q. Frankly, I cannot always trust my ears in choosing among tape types, and specs often confuse me. I would appreciate your views on the relative merits of the various tape types available.—Name withheld

A. From the viewpoint of signal-to-noise ratio and distortion, there appear not to be important differences among the three available tape types: Ferric oxide, chrome and chrome equivalents (ferricobalts), and metal particle (Types I, II, and IV, respectively).

The more important thing, with respect to noise and distortion, is the quality of the particular brand one chooses. One type of tape or one particular brand may sound better than others with a given deck because the deck’s bias, equalization, and sensitivity are adjusted to best match that tape. More and more decks have automatic tape-matching systems which adjust these parameters—or bias, at least—to match just about any given tape. Of course, any deck’s bias can be adjusted—sometimes by the user, or else by a technician—to match any given tape. Bias below optimum accentuates the treble, brightening the sound (though at some risk of distortion); bias above optimum enhances the rest of the range but reduces treble, giving a more full-bodied sound.

The chief advantage of metal-particle tape appears to be with respect to headroom—that is, in its ability to guard against saturation of the tape at high frequencies. Saturation is most likely to occur when the signal source contains high frequencies of substantial magnitude. Accordingly, metal-par-

ticle tape tends to provide better high-frequency response than the other types when recording at high levels. With the other tape types, one can avoid or reduce tape saturation and consequent treble loss by lowering the recording level by several dB, but this means a reduction in signal-to-noise ratio.

Under the right circumstances, your ears might be more trustworthy than you think. Try recording the same demanding passages of music on several different brands and varieties of tape, and see what differences you hear in playback. Also, try recording the noise heard between stations on an FM tuner (you’ll need to turn off the tuner’s muting switch, if it has one) at an indicated level of –20 dB. Differences among cassettes in frequency response and dropouts are often easier to hear with interstation noise than with music.

“Line In” for Mikes

Q. Long ago, cassette decks had microphone jacks for live recording. Most of the new models do not have this feature, it seems. I assume that one can plug microphones into the “line in” jacks at the rear by using suitable plug adaptors. Will this yield satisfactory recordings? Does one need an equalizer and/or preamplifier? If a preamp is needed, what about a small mixer, which I have?—John Durand, East Haddam, Conn.

A. If the microphones you plan to use are of the garden-variety ceramic kind, usually costing but a few dollars each, you can feed them into the line inputs of your cassette deck (via suitable adaptors) and obtain more or less satisfactory results. In terms of frequency response and distortion, the results will not be high-fidelity, but they may still be quite acceptable for speech. One of the problems you may face in terms of frequency response is loss of bass because of insufficient load resistance; this may be a blessing for recording speech but quite otherwise for music.

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

CONTROLS EVERYTHING.



THE UNIFIER

Today's modern home entertainment systems consist of an audio receiver, CD player, cassette tape deck, turntable, MTS television with cable TV access, and VCR or Laserdisc player, all of which operate with their own remote controls. Unfortunately, this creates a serious problem. What do you do with all the different remotes?

Introducing "The Unifier," Onkyo's RC-AV1 Universal Programmable Remote that puts an end to all of this clutter and confusion forever!

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The heart of "The Unifier" is an on-board microcomputer that reads and copies all the functions of other remotes, eliminating inter-brand incompatibility forever. Over 100 functions can be stored into audio, video, and auxiliary modes, and it's as easy to program as pressing the matching function buttons.

The real marriage of audio and video equipment has arrived with "The Unifier", the Onkyo RC-AV1 Universal Remote. See your Onkyo dealer or write for full details.

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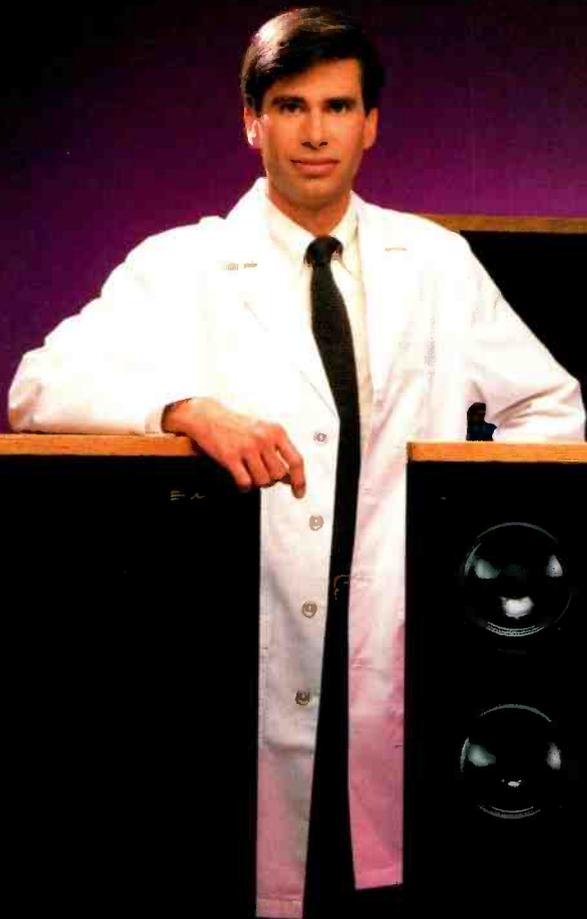
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**Matthew Polk's SDA SRS and SRS 2 have both won
the prestigious AudioVideo Grand Prix Speaker of the Year Award.**

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"Spectacular...it is quite an experience"

Stereo Review Magazine

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

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

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

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

"Exceptional performance no matter how you look at it"

Stereo Review

Listening to any Polk True Stereo SDA* is a remarkable experience. Listening to either of the Signature Edition SDAs is an awesome revelation. Their extraordinarily lifelike three-dimensional imaging surrounds the listener in 360° panorama of sonic splendor. The awe inspiring bass performance and dynamic range will astound you. Their high definition clarity

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

allows you to hear every detail of the original musical performance: while their exceptionally smooth, natural, low distortion reproduction encourages you to totally indulge and immerse yourself in your favorite recordings for hours on end.

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

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

"Literally a new dimension in sound"

Stereo Review

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

Both the SDA-SRS and SRS 2 incorporate:
1.) time compensated, phase-coherent multiple

driver vertical line-source topology for greater clarity, increased coherency, lower distortion, higher power handling, increased dynamic range and more accurate imaging. 2.) a mono-coque cabinet with elaborate bracing and MDF baffle for lower cabinet read-out and lower coloration. 3.) progressive variation of the high frequency high-pass circuitry for point-source

"Literally a new dimension in the sound"

Stereo Review Magazine

operation and wide vertical dispersion. 4.) the use of small active drivers in a full complement sub-bass drive configuration coupled to a large 15" sub-bass radiator for extraordinarily tight, quick and three-dimensional mid and upper bass detail combined with low and sub-bass capabilities which are exceptional. The speakers are beautifully finished in oiled oak and walnut.

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If static charges are the cause of playback pops, try sharply rapping the cassette against a firm object.

If the microphones are of a good grade, usually a dynamic (magnetic) type, there probably will be insufficient gain at the line input to enable you to achieve an adequate recording level. Then you will need a preamplifier, or perhaps a mixer will be able to provide the required gain. (If your mixer does

not, you might try one of the inexpensive models on the market.) Equalization is not needed.

(*Editor's Note:* The presence of microphone inputs is addressed in the "Cassette Deck" section of our Annual Equipment Directory. In the October 1986 issue, approximately 44% of the

listed models have at least one microphone input; of this group, most models have two such inputs.)

Playback Pops

Q. During playback of some of my cassettes, I hear pops at different volume levels. I thought maybe it was the heads of the deck, but I got the same results during playback of these cassettes on other, and pretty expensive, machines. Is this caused by a static buildup, and will it damage my tapes? How can I prevent this noise?—Steve Franks, Wichita, Kans.

A. You fail to say if your offending cassettes are ones which you recorded yourself or if they are commercial, prerecorded tapes. If they are your own recordings, these pops may be due to the phono disc from which the cassette was copied—either your own disc or one played by the radio station whose program you taped.

An alternative explanation is that there are static charges on the tape. The only solution I know of is to rap the cassette against a firm object, sharply but not so hard as to damage the cassette (or the object).

The cassettes in question will not damage your deck. However, if the pops are extremely loud and you are playing at very high volume, you might damage a speaker.

Crosstalk in a Preamp

Q. When I play a tape, with my preamp's selector switch turned to tuner or phono or AUX/CD, I can hear the tape at very low level. Why?—Mike Radonic, New York, N.Y.

A. Ideally, there should be complete separation among signal sources in a preamp. High-quality preamps come close to this ideal, although not all to the same degree, through careful layout, shielding, and other tactics. In less expensive preamps, there may be greater distance between actual performance and the ideal, resulting in audible crosstalk.

It appears the designer of your preamp hasn't taken adequate care to minimize crosstalk. On the other hand, does it truly interfere with your listening to the tape deck or to other sources? If so, shutting off all program sources except the one in use will solve the problem, albeit inconveniently. **A**



Revox B226: Digital at the Vanishing Point

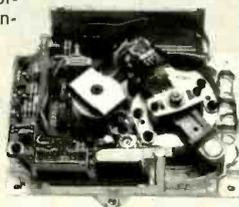
Connect a new Revox B226 CD player to a very high quality home audio system. Load it with a superbly recorded disc. Sit back, press "play" on the IR remote control... and something peculiar happens.

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 or 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.

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

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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.

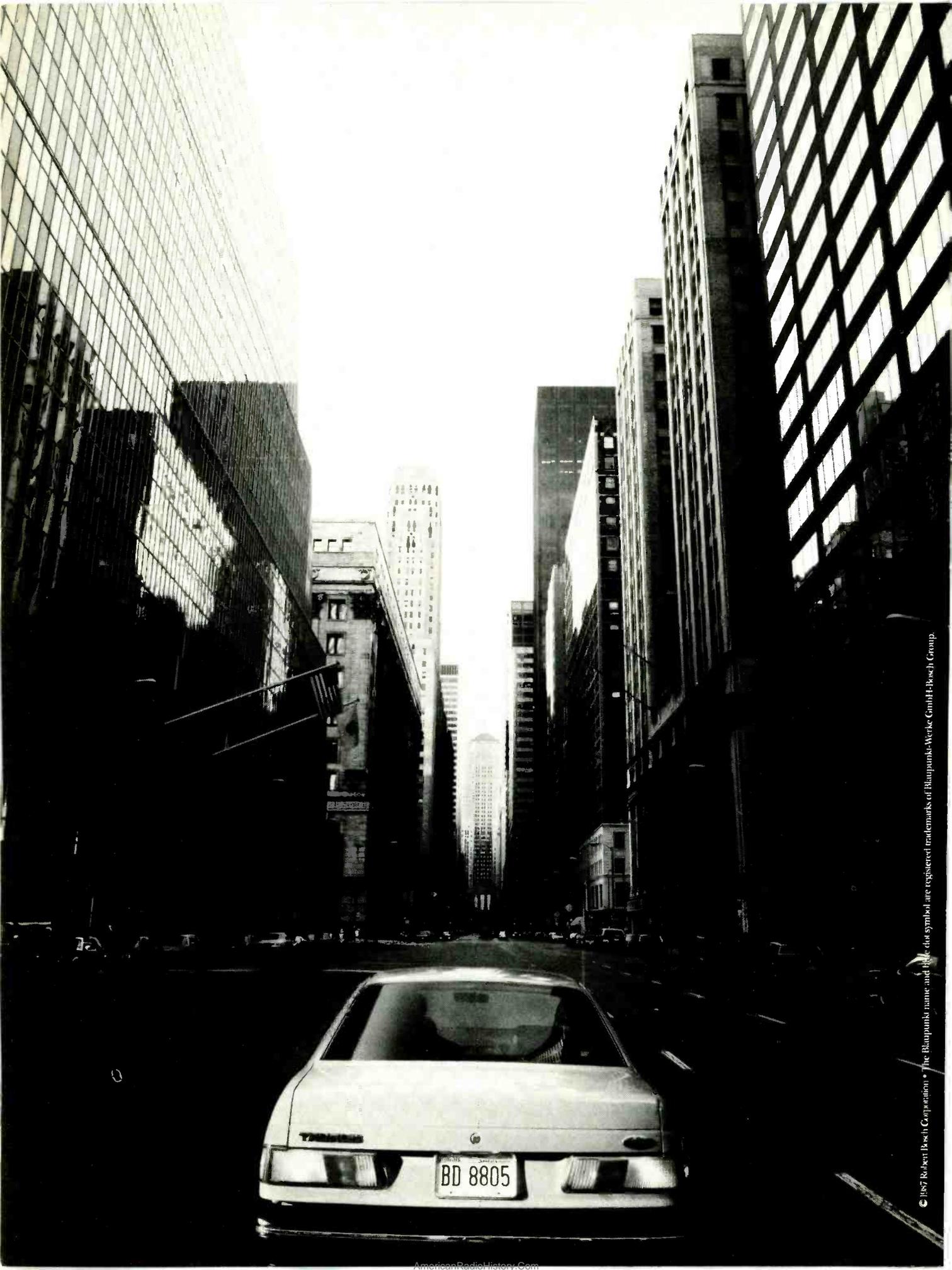
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The Pyrenees.

The Apennines.

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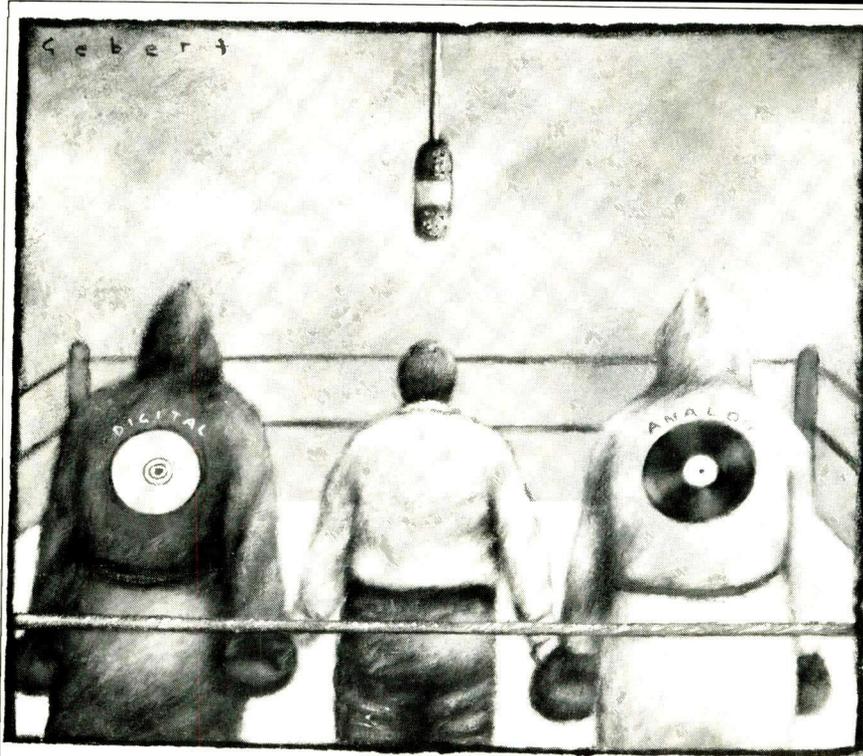
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WAR OF THE WHIRLS



Although we have had digital recording in a number of formats for more than 15 years, it really didn't become the most highly regarded recording method until the launch of the Compact Disc. Since that time, there have been significant developments in digital recording which have brought CDs to their present state of technological refinement. Music reproduced on a state-of-the-art CD player can be stunning in its realism, when it involves a digitally mastered disc that has been recorded by a top-flight engineer using the best digital equipment available.

However, there still are members of the die-hard anti-digital brigade, people who loathe CD and digital recording. It must be remembered that their antipathy to digital recording predates the Compact Disc. For a number of years prior to CD, they were bemoaning the fact that vinyl phonograph records were increasingly being cut from digitally recorded masters. Those in this group who listened primarily to classical music were particularly distressed, because by then most new classical recordings were being digitally mastered.

When the first CD players and Compact Discs appeared on the market, the anti-digital types vehemently dismissed the whole CD concept as "inherently unmusical." While this blanket condemnation of CD was grossly overstated, obviously colored by a dislike of digital recording, I must point out that there were certain sonic artifacts and anomalies in the very earliest CD players and discs. Some CDs did indeed exhibit varying degrees of wiriness and stridency in passages for high strings, and audiophiles with acute ears did notice a slight distortion at very low levels. The stridency of these early CDs, some said, was a consequence of employing steep 90-dB "brick-wall" anti-aliasing filters, which generated high-frequency spurs. By far the most common complaint, however, was of acoustic "dryness" caused by an attenuation of hall ambience and truncation of reverberant decay. Some felt that the loss of ambience and reverberant decay, as well as the low-level distortion, were due to the lack of a dither signal in early digital recorders. Without the dither signal, these recorders could not resolve down to the least signifi-

cant bit, hence the distortion and ambience anomalies.

It should be noted that even in the earliest CDs, the attenuation of reverberation did not frequently occur: At that stage of their development, most digital recorders did employ dither signals in their circuitry. In spite of this fact, the anti-digital forces regularly cited loss of ambience as one of their principal objections to the CD. Digital recordings from 1981 onwards almost certainly will have been made with a dither signal. Thus, any loss of ambience noted by "digiphobes" on current digitally recorded CDs is a figment of their imaginations.

There were other factors said to contribute to the less-than-pleasant sound of some CDs, such as the type and deployment of microphones, distortion and noise originating in mixing consoles, and other diverse noise phenomena. Further, opponents of CD still persist in the notion that if a CD is made from an analog master, it is somehow degraded and does not sound as good as the same recording reproduced as a vinyl phonograph record. Well, there are reasons why the digiphobes may perceive a *difference* between the sound of an analog-mastered LP and an analog-mastered CD, but most certainly it is not a degradation of quality.

In most instances, the digiphobes base their opinion on comparing a vinyl LP and a CD of the same recording. Apart from the fact that an LP's quality will degrade the more it is played, the digiphobe fails to consider the limitations of the phonograph medium and the limitations of stylus cutting geometry. Don't get me wrong! In the hands of a cutting expert like Stan Ricker or Bob Ludwig, truly spectacular sounds have been engraved on a phonograph disc. But these worthy gentlemen would be the first to tell you that certain signals on a master tape cannot be cut onto a lacquer without some sort of technical compromises.

In the case of transferring analog recordings to CD, various record companies have different ideas of how this should be accomplished. Some will just go back to the cutting master for transfer to CD. Generally this cutting master has had considerable manipulation and processing in respect to

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CO Boulder: Soundtrack, Wavelength Stereo • **Colorado Springs**: Sunshine Audio • **Denver** & **Suburbs**: Soundtrack • **Pueblo**: Sunshine Audio

CT Avon: Hi Fi Stereo Store • **Danbury**: Carlson's • **Fairfield**: Audio Design • **Greenwich**: Al Franklin's • **Groton**: Roberts • **Hartford**: Al Franklin's • **New Haven**: Audio Etc. • **Newington**: Hi Fi Stereo House • **New London**: Robert's • **Norwalk**: Audiotronics • **West**: Wilmington • **Bryn Mawr**: Stereo DC • **Myer Emco**

FL Daytona Beach: Stereotypes • **Ft. Myers**: Stereo Garage • **Ft. Pierce**: Sound Shack • **Ft. Walton Beach**: Audio International • **Jacksonville** & **Suburbs**: Audio Tech • **Key West**: Audio International • **Lakeland**: Sound Factory • **Merritt Island**: Southern Audio • **Miami**: Electronic Equipment Co. • **Sebring**: Stereo Advice • **Naples**: Stereo Garage • **Orlando** & **Suburbs**: Audio Spectrum • **Pensacola**: Fidler Hi Fi • **St. Petersburg**: Cooper Lot Stereo • **Sound Advice** • **Tallahassee**: Stereo Store • **Tampa**: Audio Vision, Sound Advice • **W. Palm Beach**: Electronic Connection

GA Atlanta & **Suburbs**: Hi Fi Buys • **Augusta**: Stereo City • **Macon**: Georgia Classic • **Savannah**: Audio Warehouse • **Valdosta**: Stereo Connection

IA Iowa City: Hawkeye Audio

IL Homewood: Stereo Station

ID Boise: Stereo Shoppe • **Coeur D'Alene**: Electracraft • **Pocatelli**: Stokes Brothers • **Sandpoint**: Electracraft • **Twin Falls**: Audio Warehouse

IN Aurora: Stereo Systems • **Bloomington**: Alan's Creative Stereo • **Buffalo Grove**: Columbia • **Carbondale**: Southern Stereo • **Champaign**: Good Vibes • **Decatur**: J.R. Lloyd's • **DeKalb**: Audio Plus • **Hoffman Estates**: Simply Stereo • **Highland Park**: Columbia • **Joliet**: Stereo Systems • **Lansing**: Audio Clinic • **Mt. Pleasant**: Simply Stereo • **Naperville**: Stereo Systems • **Normal**: Glenn Poo's • **Northbrook**: Alan's • **Orland Park**: Simply Stereo • **Peoria**: Team Electronics • **Rockford**: Columbia • **Schaumburg**: Hi Fi Hutch • **Springfield**: Sundown One • **Sterling**: Midwest Hi Fi • **Vernon Hills**: Alan's • **Villa Park**: Hi Fi Hutch • **Waukegan**: Alan's

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ME Bangor: Sound Source • **Camden**: Harbor Audio

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MI Ann Arbor: Absolute Sound • **Birmingham**: Almas Hi Fi • **Dearborn**: Almas Hi Fi • **East Lansing**: Stereo Shoppe • **Farmington Hills**: Almas Hi Fi • **Grand Rapids**: Classic Stereo • **Iron Mountain**: Sound North • **Kalamazoo**: Classic Stereo • **Lansing**: Stereo Shoppe • **Royal Oak**: Absolute Sound • **Saginaw**: Audio Shoppe • **Court St.** Listening Room • **Traverse City**: Stereo Shoppe

MI Detroit: Me's TV & Audio • **Manistee**: Audio King • **Minnetonka**: Audio King • **Rochester**: Audio King • **St. Paul**: Audio King

MS Columbus: Audio Advantage • **Gulfport**: Empress • **Hattiesburg**: McEland TV • **Jackson**: Walters • **Jefferson City**: The Stereo Buff • **Joplin**: The Stereo Buff • **Pascagoula**: Empress • **Springfield**: The Stereo Buff • **Tupelo**: Audio Advantage

MO Cape Girardeau: Stereo One • **St. Louis**: Sound Central

MT Bozeman: Trusy Ear • **Great Falls**: Rocky Mountain Hi Fi • **Missoula**: Aspen Sound

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NE Bismarck: Pacific Sound

NE Lincoln: Stereo West • **Norfolk**: Mid City Stereo • **Omaha**: Stereo West

NH Concord: Audio of New England • **Exeter**: AutoSound & Soundstations • **Lenoir**: Audio of New England • **Salem**: Cuomo's

NJ East Brunswick: Atlantic Stereo • **Frank** • **NJ** Newark: Audio of New England • **Parsippany**: Shade • **Bryn Mawr Stereo** • **Montclair**: Perdue Radio • **Raritan**: AD Audio • **Ridgewood**: Sounding Board • **Shrewsbury**: Moonmouth Stereo • **Toms River**: Bands Camera • **West Caldwell**: Perdue Radio

NM Albuquerque: Real Time Audio • **Alamogordo**: O&R Electronics • **Carlsbad**: Stereo Concepts

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Puerto Rico Rio Piedras: Precision Audio

RI Providence: Eastern Audio

SC Anderson: John Brookshires • **Charleston**: Audio Warehouse • **Greenville**: Mitchell's Stereo • **Greenwood**: Stereo Shop • **Rock Hill**: Tarts • **Spartanburg**: Stereo Shop

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WY Cheyenne: Electronics Unlimited • **Sheridan**: Star Video Library

The blanket condemnation of CD was much overstated by anti-digital types, but there were sonic anomalies in early players and discs.

equalization and possible dynamic compression, in order to accommodate it to the vinyl medium. If the original master was a 16- or 24-track recording, you can imagine the incremental losses in the mix-down to the two-channel cutting master. Some conscientious companies will go to the expense and trouble of transferring the original multi-track recording to digital tape and then use it to prepare their CD masters. CDs made in this manner generally sound much better than the same recording on the digiphone's vinyl disc. Other firms will simply re-equalize the cutting master, and the resulting quality is quite variable.

Drawing on my own experiences with CD and digital recording, I do think that on a few CDs there was a perceptible loss of hall ambience. In fact, I still have several CDs that exhibit this particular anomaly. I also still own quite a few CDs which certainly have steely, international first violins when played on an early CD machine. These same discs, when used in newer CD players, models which employ quadruple oversampling and a much more gentle filter slope, sound far less strident.

As to the digiphones' allegations about CD degrading the sound of analog recordings, I recently conducted a most interesting experiment. I have a CD of Gustav Holst's "The Planets," performed by a major symphony orchestra and conductor. I also have a 15-ips, Dolby A, open-reel copy of the analog master from which the CD was made. I played back the tape on an Ampex ATR100 and played the CD on a Sony CDP-705ESD and an Analogic player, both excellent units employing quadruple oversampling. Although I could not synchronize tape and CD playback exactly, it was close enough for a good A/B comparison through the quick relay switching of a Rowland Research Coherence One preamplifier. I found that the sound of the tape and that of the CD were virtually identical. There were no appreciable differences in frequency response, the full dynamic range of the tape was perfectly mirrored on the CD, and signal-to-noise ratio was well matched. Obviously, an analog master tape recording can be transferred to CD with total integrity of all sonic parameters.

I decided to make another compar-

son. This time, I used two recordings of Mendelssohn and Tchaikovsky violin concertos played by a famous virtuoso. The first was a one-to-one copy of a nine-year-old analog master (it too was a 15-ips open-reel tape, recorded with Dolby A NR); the second was a 1981 digital recording issued on CD in 1983. Once again, I played the CD on the Sony and Analogic machines and played the tape on the Ampex. The A/B comparison between analog and digital recordings was fascinating! Of course, the more recent digital recording confirmed the maturity of the artist, as well as an even more dazzling technique. The digital CD outperformed the analog tape in terms of signal-to-noise ratio and dynamic range. In addition, the CD was a generally cleaner, more well-defined recording, and bass response was more extended and more articulate. Both recordings were made by top-notch engineers, who achieved excellent balances between soloist and orchestra. Both engineers managed to give their recordings a nice, warm ambience. Ah, but what about the string tone? In both cases, the solo violin was well focused; tonal smoothness was equally good. The first violins on the tape were smooth and clean, with a beguiling harmonic richness. The first violins on the CD were very articulate and open, with smooth, accurate intonation.

Did the tape sound more natural, closer to the music than the CD? It really comes down to a matter of taste. There are colorations on the tape which impart a certain mellowness to the overall sound, which many will equate with that much-abused term, musicality. The CD has a more sharply focused sound. I contend it is a more accurate sound and a more sonically exciting sound. Perhaps the best way to describe it is to say that the sound of the tape reminds me of Carnegie Hall, while the CD sound transports me to Avery Fisher Hall.

To wind things up (and offer a capsule curriculum vitae), I gently remind the digital nay-sayers that I have recorded stereo sound for 37 years on virtually every medium. Digital recording is the most transparent medium we have. Used intelligently, it will, in my opinion, give us our closest approach to the live musical experience. A

The **Boston** Acoustics

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1986 Dodge Colt Vista containing the winning Boston Acoustics Installation of the Month—a veritable concert hall on wheels!



Boston 741 two-way component system. 4" copolymer woofer installed in door; Varimount CFT tweeter angle mounted on the dash.



Boston 751 two-way component system. 5 1/4" woofer installed in rear door; Varimount CFT tweeter flush-mounted in rear pillar.



Contest Rules and Requirements

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

The July winner:

Lowell Hallman, Columbia, South Carolina

Clean and powerful wins! Lowell Hallman's 1986 Dodge Colt Vista has a well balanced and cleanly executed system featuring two Boston component speaker systems. This installation demonstrates the placement flexibility of the Varimount CFT tweeter—one pair installed on the dash in their patented angled housings that can be aimed at listeners; the second pair is mounted flush in the rear pillars to provide superb coverage.

The winner's dealer:

Audio Alternative, Columbia, South Carolina

The winner's salesperson:

John Toohey

The winning system:

Boston Acoustics: 741 two-way system up front; 4" copolymer woofers in door panels and 1" Varimount CFT dome tweeters angle-mounted on dash. 751 two-way system in the rear with 5 1/4" copolymer woofers in the doors, and Varimount tweeters flush mounted in the rear pillars.

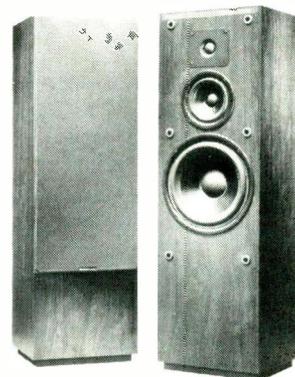
Denon: DCR-5500 cassette receiver installed in the dash, with DCA-3175 amplifier driving the Boston 741 system in the front, and DCA-3250 amplifier driving the Boston 751 system in the rear.

You have 5 more opportunities to win!

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

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

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



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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.

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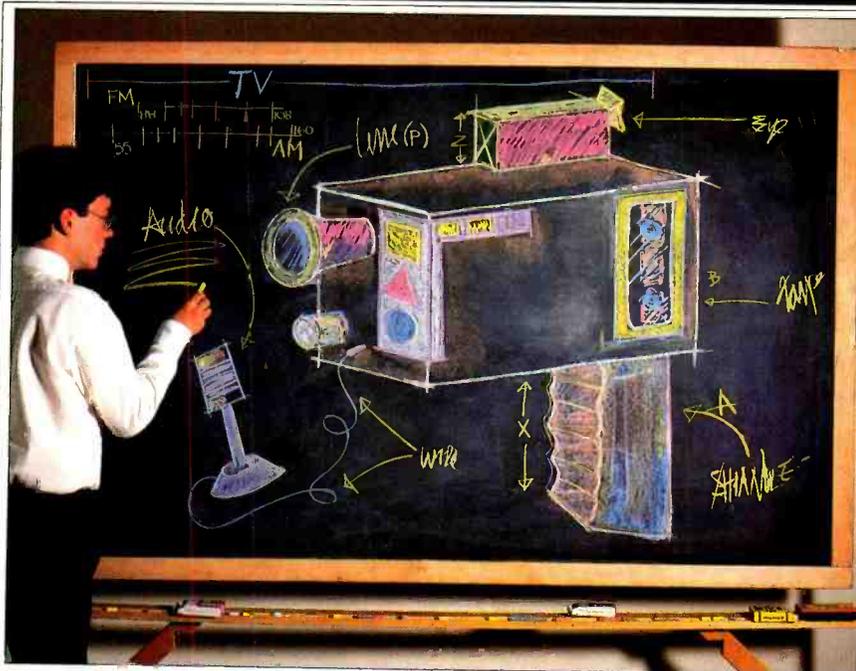
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TIVE PERFORMANCE



LESSON & LEARN



In palmier days, one of my favorite categories in this department was called Oddities and Endities. Resurrected for short items, it is occasionally resurrected when the need is pressing—as it is now. My first oddity will be short and not very sweet. I fell on my face numerically in the March issue. In speaking of FM and TV channels, I produced wrong figures to illuminate a perfectly good point—not a wise procedure, I readily admit. My sin was that I *thought* I knew, like the phone number you so confidently dial, only to get somebody who promptly hangs up on you. I had it wrong, though my point was right.

Yes, TV or video is indeed "voracious" as to bandwidth, compared to any FM or other purely audio signal for the consumer. But the complete FM band, all the stations we can hear, occupies not one but a bit over three TV channels. So my multiplication of the wrong figure tripled the fault. No, we wouldn't have "more than 1,000" FM outlets if FM were to replace all the low-number TV channels. But still, we'd have an awful lot. The ratio between FM and TV bandwidth per channel is thus very roughly 3:100—not an exact figure but a revealing one, I hope. I must repeat that this disproportion between audio-only and video is of great importance in the swiftly developing

interplay between audio equipment and video-plus-audio.

Yes, too, we can hear TV sound off the end of the FM band, as I know from listening. Only at one end, though. FM is plonked in the middle of the TV numbers, between channels 6 and 7, but there is aviation stuff and such attached at one end, between FM and TV. Now I hope I have things in hand.

My principal interest in March, of course, was in the extraordinary lack of television technique, in the artistic sense, in the early proto-broadcasts during the war years, as I know from my own fascinated observation. Understandable! It was the Beginning. But doesn't *anyone* but me remember those broadcasts? Perhaps not, since the number of receivers available was close to nil, probably fewer than the FM sets that had been so vigorously promoted by Major Armstrong. (I remember that we counted on some 400 FM receivers in the entire New York City area.) Practically nobody, the technicians excepted, ever saw that first television on regularly scheduled public air. I was lucky, as usual by sheer happenstance, to have been one of the few.

* * * *

I do hope to live long enough to try out the ultimate and definitive camcorder, when it arrives, to see for my-

self how it works and what can be done with it in comparison to the miles of film I took for years on my 8-mm Cine-Kodak 8, the most beautifully simple movie camera ever made. Yes, I am now pretty sure that the ultimate consumer machine will be an 8-mm device too. That seems abundantly to be the camcorder future, the ultimate in miniaturization as occurs again and again for products in the 20th century. The Beta and VHS camcorders are highly useful today for those who own extensive equipment and videocassettes in those formats, and their reign will continue for a lot longer, with ever more ingenuity. But the smaller, more compact 8-mm videotape has what it takes and will have more. Marvelous to say, its manufacturers seem to have gotten themselves reasonably together ahead of time, so that a degree of interchangeability just *might* persist into a successful future. (These people do share a common cause in challenging the established VHS and Beta systems. That helps a lot.)

It's interesting that the main parameters of the consumer camcorder were essentially set back in the antediluvian or Precambrian times, maybe five or six years ago, when the first sensational heavyweight models came out. I tried one, disastrously. That thing was no camcorder, just a camera, but it weighed over 5 pounds. And it trailed cables. But it had all the many automatic features that are standard on today's camcorders—free-carrying units that weigh just over 3 pounds. Auto focus, auto color balance, auto exposure, power zoom, and all the rest largely imitated the more perfected devices on still cameras. The trouble was, six years ago, that not one of the auto functions worked at a level of competence higher than imbecilic. For instance, the focus, when it stopped oscillating back and forth from front to rear, settled down to "infinity" at 10 feet. I've described this before and will not go on. Well, you have to start somewhere, and praise must go to those who did the agonizing initial development of the camcorder!

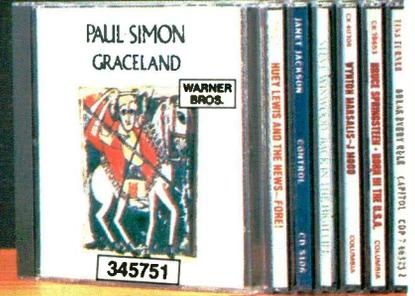
The newest models have exactly these same facilities but, more and more, they tend to work, the way that still cameras work. Pardon me if I suggest that there is still a way to go. But

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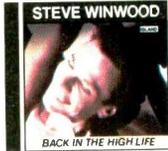
302570. Mussorgsky: Pictures At An Exhibition; Ravel: La Valse—Mehta, cond. (CBS Masterworks)
324822. Ravel: Bolero; La Valse; Rhapsodie Espagnole—Maazel, cond. (Digital—CBS Masterworks)
349324. South Pacific. K. Te Kanawa, J. Carreras, etc. (Digital—CBS)
348458. Dvorak: Cello Concerto—Yo-Yo Ma, Maazel, London Philharm (Digital—CBS Masterworks)
347153. Cyndi Lauper—True Colors. (Portrait)
346643. Andreas Vollenweider—Down To The Moon. (CBS)

349985. Johnny Mathis/Henry Mancini—The Hollywood Musicals (Columbia)
348979. Tina Turner—Break Every Rule (Capitol)
343319. Janet Jackson—Control (A&M)
349571. Boston—Third Stage (MCA)
319541. Elton John—Greatest Hits. (MCA)
347492. Glenn Miller Orchestra—In The Digital Mood. (Digital—GRP)



347955

351338. Eric Clapton—August. (Duck/Warner Bros.)
350736. Rolling Stones—Rewind. (Rolling Stones Records)
219477. Simon & Garfunkel's Greatest Hits. (Columbia)



346957

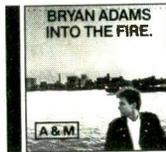
346478. Madonna—True Blue. (Sire)
353458. Bruce Willis—The Return of Bruna. (Motown)

339044. Mozart: Symphony No. 40 & 41 (Jupiter)—Kubelik, Bavarian Symphony Orch. (Digital—CBS Masterworks)
349613. Original Soundtrack—Round Midnight. (Columbia)



346023

308049. Creedence Clearwater Revival Featuring John Fogerty/Chronicle. 20 greatest hits. (Fantasy)
343582. Van Halen—5150. (Warner Bros.)
345553. Branford Marsalis—Romances For Saxophone. (Digital—CBS Masterworks)
339226. Gershwin: Rhapsody In Blue; Second Rhapsody; etc.—M. Tilson Thomas, Los Angeles Phil. (Digital—CBS Masterworks)



353946

344622. Anita Baker—Rapture. (Elektra)
319996-399998. Motown's 25 #1 Hits From 25 Years. (Motown)
345777. Peter Gabriel—So. (Geffen)
334391. Whitney Houston. (Arista)
333286. Phil Collins—No Jacket Required. (Atlantic)
314443. Neil Diamond's 12 Greatest Hits, Vol. 2. (Columbia)
287003. Eagles—Their Greatest Hits 1971-1975. (Asylum)

342097. Barbra Streisand—The Broadway Album. (Columbia)
336222. Dire Straits—Brothers In Arms. (Warner Bros.)
36604. Tchaikovsky: 1812 Overture; Marche Slave; Beethoven: Wellington's Victory—Maazel, Vienna Philharm. (Digital—CBS Masterworks)



354449

352948. Wynton Marsalis—Carnaval. Eastman Wind Ensemble, Donald Hunsberger. (Digital—CBS Masterworks)
348649. The Pachelbel Canon And Other Digital Delights. The Toronto Chamber Orchestra. (Digital—Fontare)

341073. Steely Dan—A Decade of Steely Dan. (MCA)
349373. Beethoven: Symphony No. 9 (Choral)—Bernstein, NY. Phil. (Digitally Remastered—CBS Masterworks)
314997-394999. Stevie Wonder's Original Musiquarium I. (Tamla)
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352245. David Sanborn—A Change Of Heart. (Warner Bros.)



351692

352799. Beethoven: Piano Concertos Nos. 1 & 2—Perahia; Haitink. Concertgebouw Orch. (Digital—CBS Masterworks)
351718. Georgia Satellites. (Elektra)
351122. Europe—The Final Countdown. (Epic)
348318. The Police—Every Breath You Take—The Singles. (A&M)
346312. Billy Joel—The Bridge. (Digital—Columbia)
344721. Lionel Richie—Dancing On The Ceiling. (Motown)
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For most of the audio that accompanies video, mono is sufficient. But if we tout stereo for little TV sets, why not for video cameras?

progress and miniaturization are astonishing—in all aspects except audio.

Alas, there really doesn't seem to be much interest in home-camera audio beyond the mere fundamentals. A mike is built into the camera, the worst possible spot for a decent sound pickup even for plain voice signals. There is mono, to feed into stereo sound equipment. Just maybe there is a facility for external mike(s), which—if you have any sense—you will use whenever you possibly can. True, mono is sufficient for most picture audio (not counting added music backgrounds). But if we tout stereo for little TV sets, why not for video cameras? The reasons are, I suppose, quite practical. Two-channel pickup from a camcorder isn't simple, even with the only practical setup, a tight cross-mike or coincident double microphone. Is the cost worth it? It makes things just that much more difficult, too, in the shielding, so close to the camera's various electronic systems.

I would say yes, it is worth it. The coincident mike pickup can be used pretty much like mono for voice, and if the mike is removable (the double mike), you can take advantage of any stereo possibilities, such as real music, recorded and videographed live. That makes your sound potential a lot more flexible and opens up new possibilities in the way of matching good pictures with really useful and well-placed accompanying sound, on the spot. (Added sound still can be used after the fact, when that is what you want.)

Let's hope that someone will have the enterprise to offer a worthwhile stereo option on a forthcoming camcorder. A compact coincident mike, two channels, on the camera but removable if you choose. Two stereo connectors to match any stereo audio equipment that will follow. And maybe a mono switch, in parallel (but *not*, please, automatic!) for optional use when a mono pickup of voices is desirable. You would then have your choice for a wide range of audio effects.

Where would all this enterprise be forthcoming? Where else but in Japan. Though, just perhaps, one of our own few operators in home video *might* get there first. It would be nice, you know, for the good old U.S.A., for once, to show the primary forward look. **A**

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GOLDEN OPPORTUNITY



When Compact Disc first appeared about four years ago, Philips, its co-inventor, proclaimed it to be the "pure and perfect" audio medium. There was a bit of skepticism, nay-saying, and golden-ears griping, but the biggest problem CD encountered was lack of software to sell. It soon became obvious that Philips' optimism for their new optical medium was justified; the public flocked to record stores and started buying music again. One shudders to think what the music industry would be like today without CD.

Now, Philips is again proclaiming another "pure and perfect" medium. But this time the veneration involves video, a medium already so successful with the public that one may wonder how any kind of advance in technical quality or convenience could possibly improve things. Thus, once again, Philips' enthusiasm is being greeted with some skepticism. Yet when a company has just helped to revolutionize one industry, there's always the chance they might revolutionize another.

Let's take a look at this newest technology treat so that you, the deciding factor, can start forming an opinion prior to passing judgment in the marketplace.

At a recent press conference held in Amsterdam, attention was focused on CD-Video, a combination not only of audio and video, but of Compact Disc and laser videodisc. CD and laser videodisc are similar in that they are both optical storage formats providing high-quality playback, but they differ radically in their success. The CD is a Wunderkind product, whereas the videodisc's potential has remained unfulfilled. On one level, CD-V is an attempt, through marriage, to bring recognition and success to videodisc. If the CD's coattails don't do it, nothing will.

But CD-V also promotes CD-Audio by bringing the dimension of full-motion video to the CD family. (CD-ROM and CD-I have already broken ground in this area.) This will increase the CD's clout by expanding its applications base, thus making CD more immune to threats from DAT and other media that are more limited in their applications horizons.

So, what is CD-V? It is a new kind of player, a new kind of optical disc, and a new retail market as well. Importantly, Philips has managed to achieve all this newness with a large measure of compatibility, that elusive element which often influences acceptance. A CD-V player (Philips calls it a "combi-

player") will play all audio CDs, all 8- and 12-inch laser videodiscs, and one new format (described later in this column). The combi-player looks similar to an audio CD player except that the front-loading drawer is 12 inches across instead of 5 inches. The disc tray itself will accommodate any of the three disc sizes automatically. Of course, in addition to a hookup to your audio system, the player will require connection to your TV.

The digital audio portion of a combi-player will be identical to that of a CD player. (There's also circuitry to play the analog tracks of videodiscs.) The Philips players will use the 16-bit, four-times oversampling, dual-D/A chip set that is found in Philips (alias Magnavox) CD players. Philips has licensed Yamaha and Matsushita to produce hardware too, and those companies will choose their own favorite chips. At any rate, the audio quality of CD-V will match that of an audio-only CD player. Already on the drawing board is a portable CD-V player with a fold-up LCD screen. (I can already see high school kids smuggling these babies into the classroom to catch up on the latest music videos. Boom boxes should be the next to appear. I hope they'll draw the line at car CD-V players.)

The 8-inch disc, called the CDV-EP, and the 12-inch disc, called the CDV-LP, are actually just new names for existing formats of laser videodiscs. In normal, CLV (constant linear velocity) form, they play for up to 20 and 60 minutes per side, respectively. A few CAV (constant angular velocity) discs are also available, with half as much playing time per side but with more capability for slow motion, reverse play, and still-framing. The audio emphasis will be digital, with soundtracks encoded according to the CD Standard, whereas the video signal will use the laser videodisc's Standard. In the NTSC video format, CD-V discs may be encoded with both analog and digital audio; thus, CD-V discs will be usable on existing laser videodisc players, many of which can read only the analog audio tracks.

The mention of NTSC raises an unfortunate issue. When Philips developed the CD with Sony, they were free to start from scratch and to design universality into the product. Thus, any

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The combi-player handles audio CDs, laser videodiscs, and new CDV-Single discs.

CD may be played on any CD player. Not so with video. Two primary world standards exist: NTSC and PAL. CD-V players and discs must be configured for one standard or another. If you buy a CD-V disc in Europe (PAL), its video section won't play on your CD-V player back home in the States (NTSC).

Because of their long playing times, the CDV-LP discs will be able to contain material such as concert videos, classical music videos, and feature films. This is an exploratory marketing move. In the past, the public has not shown a great desire to purchase video material, preferring to rent. Philips hopes that people's willingness to purchase and collect Compact Discs will carry over to CD-V. The hypothesis is that the extremely high quality of these discs will encourage ownership.

There are already combination machines that play videodiscs and CDs. But a CD-V machine will also play a new kind of disc, the CDV-Single. The size of an audio CD, it contains approximately five minutes of video (encoded as an analog signal) with a digital audio soundtrack, as well as an extra 20 minutes of digital audio alone. This audio-only portion of the CDV-Single starts at the disc's innermost diameter, so it may be read by a regular CD player. The portion with video added, on the outer diameter, can be read only by CD-V players. (A CD-V player

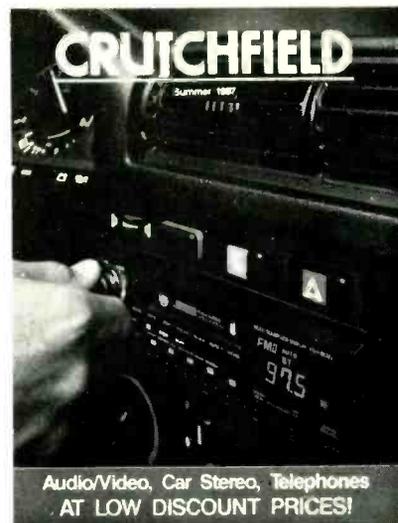
could read the inner initialization tracks, skip to the outer diameter to play the video, then skip back to the inner audio tracks.) To help distinguish a CDV-Single from an audio-only CD, the substrate and top lacquer of the CD-V disc is gold-tinted. It's an effective means of identification and also pretty nifty-looking.

Who will buy the CDV-Single? This question has occurred to Philips, and their answer is the younger set. They envision the CDV-Single as an ideal medium for music videos, along with a few other audio cuts, perhaps alternate mixes or extended-play versions from an album. This is an appealing idea for several reasons. First, it attracts the younger buyer to CD. Moreover, it allows record companies to broaden the market for music videos. Today, those videos are mostly considered promotional material, though many are re-tailed on videocassette. The improved sound, greater convenience, and lower cost of CDV-Singles should increase sales. Not only would this promote the album, but the public would be paying for the record companies' promotion costs too. Nice.

From many standpoints, CD-V is a dream product: It capitalizes on a boom market, enhances that market, opens up entirely new ones, and offers a high degree of compatibility with formats developed earlier. You sure don't see that very often.

Initially, CD-V combi-players should go for \$750 or so. That's not too bad, considering that you're getting a full-blown Compact Disc and laser videodisc player together. Dedicated CD-Audio/CDV-Single players may cost \$500. Of course, prices should drop after a while. The price of a CDV-Single should be \$8 or so (again, not too bad). Laser videodiscs—CDV-LP and CDV-EP in all but name—now cost about \$19.95 to \$59.95 (usually \$34.95) for the 12-inch size and \$10.99 to \$16.95 for the 8-inch.

So, if you *still* haven't bought a CD player, you might want to wait a few months until combi-players arrive. On the other hand, you could wait just a while longer for the CD-VI "omni-player"; it will play the complete family of CD-Audio, CD-Video, and CD-Interactive. That's total versatility . . . until yet another kind of CD comes along!



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BASS MOTIVES



Illustration: Richard Osaka

Weighty Woofers

Woofer size isn't the status symbol that it used to be, but if you still want the biggest woofer on your block, Mitsubishi is ready to oblige. Their Japanese product line now includes the Model D-160 superwoofer, with a 180-cm (71-inch) cone, for about \$150,000. If that's a bit rich for your blood, a mere \$13,000 or so will buy

you the D-80, with a still respectable cone size of 80 cm (31½ inches). The D-160, naturally, goes down lower (to a rated 8 Hz) and handles more power (1,250 watts continuous, 3 kilowatts maximum). But the D-80's 10-Hz response and 700-watt continuous input power rating (2 kilowatts max) should answer for home use. The D-80 would also be

easier to get into the house—it weighs only 1,540 pounds and measures 3.9 × 7 × 3.4 feet. The 3,300-pound D-160, however, measures 7.8 × 7.6 × 4.5 feet. With either of these babies, you'd not only have the biggest woofer on your block but you would also have the only one—everyone else on the block would be sure to move away.

Microphones and Ms. McBroom

Amanda McBroom's two Sheffield albums, *Growing Up in Hollywood Town* and *West of Oz*, are popular audiophile demo recordings. Now Monster Cable is helping to promote her newest album, *Dreaming* (Gecko Records), by sponsoring her in a series of audiophile-oriented concerts.

There were three audiophile angles to the concert I attended at the Ballroom in New York. First was good sound reinforcement, with John Meyer speakers, Beyer mikes, and speaker cables as fat as chipmunks. Another was the use of a viola and cello on some numbers, instead of amplified instruments. Last, but most important, Ms. McBroom sang a few numbers with no amplification at all.

From my fifth-row seat, her voice was far clearer without electronic help. With the sound system on, I was bothered by hearing her voice from the speaker at my right when I could plainly see her ahead and to my left. I also lost some highs because I was far off the speaker's axis.

From farther back, I'd probably have had to listen harder when she sang without amps. However, the problems of amplified sound would have been less severe: The angular discrepancy between singer and speakers would have been smaller (and blurred by reverberation), and



I'd have been more within the right speaker's sound field.

Without reinforcement, some of the excellent percussionist's more subtle effects would not have been heard clearly. The electric guitar and synthesizer that backed Ms. McBroom in some numbers wouldn't have been audible at all without speakers. And the sound system added a pleasant warmth to the singer's voice, though it emphasized her lower tones at the expense of her highest ones. For Ms. McBroom's voice and material, this works fine.

It also helped that Ms. McBroom knows good mike technique, pulling her mike away from her mouth on loud notes to avoid overload, and holding it closer—but not unreasonably so—on soft notes. Too many singers use their mikes as a tonsil massage, regardless of what and how they're singing.—I.B.

I too attended a concert by the First Lady of High-End Hi-Fi at New York City's Ballroom, and I was fortunate enough to have slightly better seating than Mr. Berger. My impressions, from first row, center, were much the same, however. Miz Amanda's voice was clearer when unamplified (whatta setta pipes!), but the room's long, narrow shape probably dictates that some reinforcement is necessary. I kept being amazed by how well the sound of the percussionist's set of small tubular bells carried. Her pianist/musical director is good, and the happy byplay of all the musicians was quite pleasing to me.

I would have liked to discuss Amanda's feeling about not using the sound system, but I didn't feel quite comfortable in having an extended conversation after the set. I had inferred that Amanda was a bit puzzled by the "No electronics" request from Noel Lee, honcho of Monster Cable. In any case, it worked well.—E.P.

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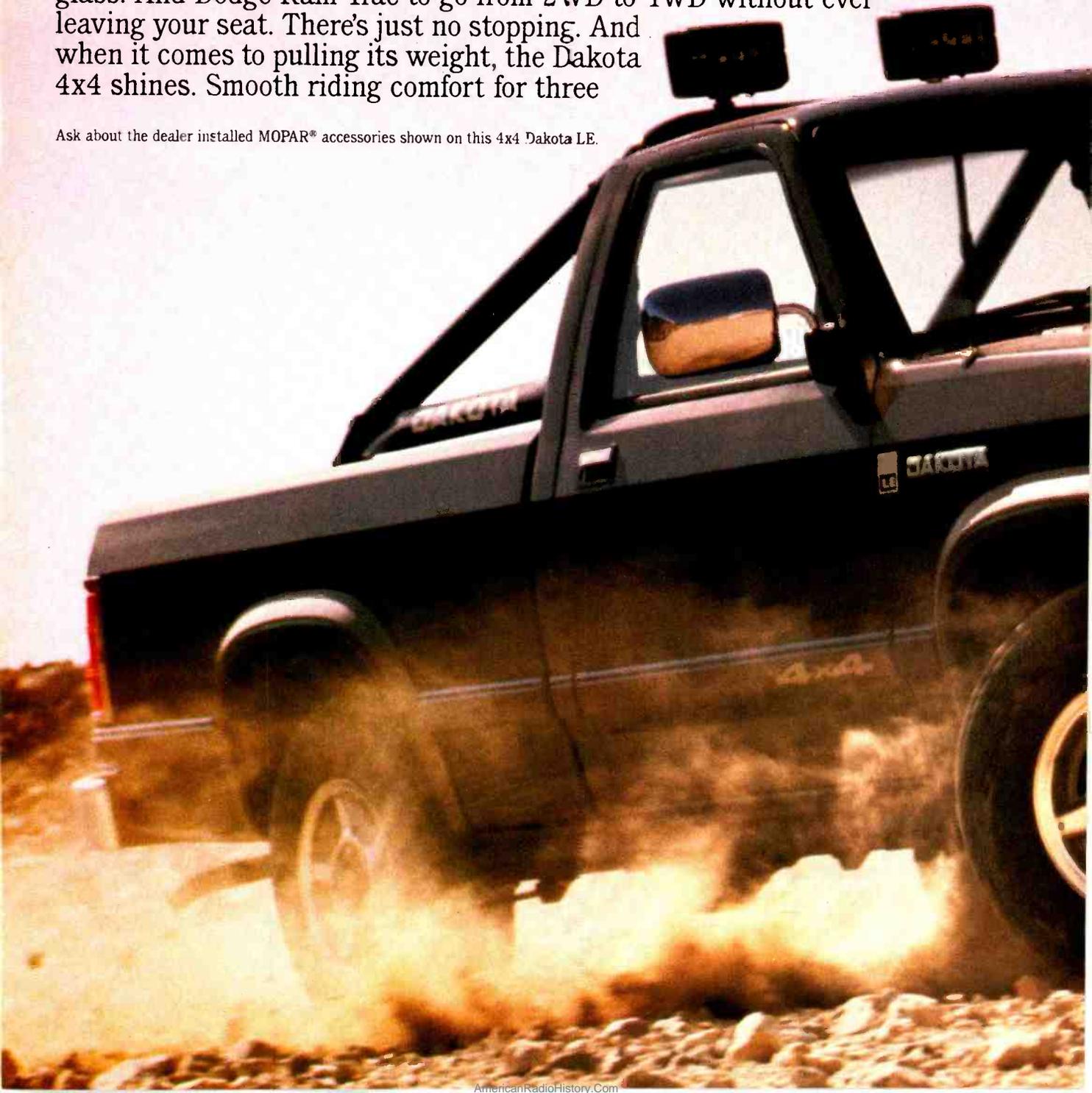
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Exclusive Test Report

FOUR D • A • T RECORDERS

LEONARD FELDMAN

As of this writing, you can't buy a Digital Audio Tape recorder in this country no matter how much you're willing to pay. In Japan, however, DAT recorders have been on sale since the third week of March 1987. It's expected that some DAT machines will be available in the United States before the end of this year. Therefore, the Editor of *Audio* and I thought it would be a good idea to have a look at some of these machines. As a rule, products arriving from Japan for sale here carry different model numbers from their Japanese counterparts. Aside from that,

and their slightly different power line requirements (Japan house voltage is 100 V a.c., 60 Hz, as opposed to our nominal 120 V), features and specifications are normally just about the same.

Audio's representative in Japan was asked to run down to Tokyo's famous Akihabara section—an electronics wonderland where everything from electric fans to the most sophisticated digital equipment can be purchased—and pick up a DAT recorder. He selected a Technics Model SV-D1000 and promptly shipped it by air to us. I borrowed

TECHNICS SV-D1000



**SONY
DTC-1000ES**



**LUXMAN
KD-117**



**MITSUBISHI
CAR PLAYER**



The manufacturers are obviously applying to DAT recorders what they have learned from the CD players they've produced.

another DAT recorder, a Sony DTC-1000ES, from Tom Jung, who'd purchased it for his CD company, DMP (Digital Music Products). The Luxman division of Alpine Electronics offered to supply us with a prototype of the DAT machine they intend to sell, Model KD-117. Finally, Mitsubishi loaned us a hand-made prototype of a car DAT player. Like standard car cassette units, this tiny DIN-sized prototype can only *play* Digital Audio Tapes; it cannot record.

I managed to acquire an English translation of the operating manual for the Sony unit, but I was pretty much on my own when it came to the other three machines. Fortunately, I was able to figure out and use most of their features thanks to the clear and logical English nomenclature on their front and rear panels. With rare exception, Japanese manufacturers label electronic products' controls and switches in English even when they are intended solely for local consumption. (I guess that saves the cost of tooling up for two kinds of panels and having smaller production runs of each.) For bench tests, measurements, and listening tests, I obtained several samples of blank Digital Audio Tape (again, much of it purchased in Japan, the rest provided as prototype samples by TDK) as well as a few prerecorded DAT cassettes

of classical and popular music. DMP also supplied a demo tape for use in this project.

It was obvious from the first that the manufacturers have learned a great deal from the successive generations of CD players they have developed and produced. Each DAT data block has a subcode area that can be used to identify the start of a selection by number. Other control and identification data is also included in each block. (For a detailed view of the standard DAT data block format, see the accompanying sidebar, "The R-DAT Standard.") It appears that all DAT decks will be able to record this identifying mark automatically at each point on the tape where the deck is put into record mode; some, including the Sony, also allow the user to record it manually at any point on the tape. Codes assigning program numbers can also be recorded automatically by any deck, and manually with the Sony and some others. These codes are, of course, completely independent of the audio data and do not in any way interfere with it or degrade audio quality.

Once identification codes have been entered in the special subcode areas, the DAT unit can search at high speed for any desired point that has been so marked. The "start ID" codes can be detected in sequence, for example, or one can search for a

THE R-DAT STANDARD

A conference on digital audio tape recording was organized way back in mid-1983; its objective was to create uniform standards for home digital audio recording. The conference eventually attracted the participation of some 84 companies, whose representatives formed a variety of working groups, study groups, and a steering committee. In June of 1985, tentative specifications for Stationary-head Digital Audio Tape recording (S-DAT) and Rotary-head Digital Audio Tape recording (R-DAT) were compiled. A year later, in June of 1986, the final R-DAT Technical Standard was agreed upon and issued publicly. This Standard is being followed by all of the manufacturers which have begun to produce DAT recorders.

Helical scanning, much like that used in home VCRs, is employed in

all R-DAT machines. Once the cassette is loaded, the tape is drawn out and wrapped around the head drum, which spins at 2,000 rpm and is angled at 6°22'59.5" relative to the tape. Unlike videotape, however, the audio tape is wrapped around only one-quarter of the head drum; this limited wrap angle should help minimize tape wear. The head drum and tape capstan are driven by separate motors. Each of these motors must be precisely controlled for proper tracking of the digital data as it is recorded and played back.

Figure B1 shows the track pattern on a short section of the new digital tape. The drum's two heads are each angled differently with respect to the tape, which is only 3.81 mm wide, so successive tracks will have different azimuth angles. This reduces crosstalk, making it possible to lay the digi-

tal tracks down right beside each other with no guardbands between them. The standard DAT system can completely correct any error caused by mistracking or dropouts over an area up to 2.6 mm in diameter (68% of the tape's width), or a stripe 0.3 mm high. Errors caused by dropouts or mistracked areas up to 8.8 mm long and 1.0 mm high can be concealed by interpolation.

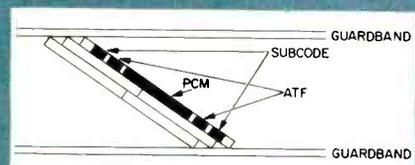


Fig. B1—R-DAT track pattern, showing PCM audio, subcode, and tracking-correction data blocks.

specific program number. The Sony DTC-1000ES also lets you add a "skip ID" signal to any selection on the tape, during either recording or playback. During playback, if you press the "skip" button, the tape will skip over any start-ID signal that is accompanied by a skip-ID signal. The skip-ID signals can also be erased, in which case the start-ID signals will once again become detectable.

real-time tape counter which shows elapsed time of the selection being played, tape running time, or total remaining time, depending upon the setting of a counter mode button. Program-number indicators show the number of the selection being played, providing the tape has been recorded with program-number subcodes. An "AMS" (Automatic Music Search) indicator displays the number of selections to be skipped backwards or forwards when this function is in operation. If a numeric button is pressed (to call up a specific selection by its program number), the display shows the target selection number while the tape transport searches for it.

SONY® DTC-1000ES

The front panels of DAT recorders resemble those of CD players. The Sony's panel starts at the extreme left with a "Power" button, a "Timer" switch (for use with an external clock timer), and a stereo headphone output jack. The cassette compartment, next to the power switch, is similar to a CD drawer except that it is much less wide. The standard DAT cassette measures only 7.3 cm wide by 5.4 cm deep by 1.05 cm thick ($2\frac{7}{8} \times 2\frac{1}{8} \times 1\frac{1}{32}$ in.). An "Open/Close" button operates the cassette drawer, which can also be closed with a light press of its front.

An elaborate display area is to the right of the cassette drawer. The main display is a



The tape drawer of the Sony DTC-1000ES DAT recorder.

The main PCM audio information contained in each angled track occupies just under 60° of the record/play head's rotation. The smaller area in Fig. B1 labelled "ATF" contains digital data used for tracking; the area

marked "Subcode" contains various identification data and other subcodes. The copy-prohibit flag is one of these subcodes. If this flag bit has a value of zero, indicating that the source is copy-protected, digital-to-

digital copying onto another DAT recorder will not be possible; when the second recorder detects this bit, its recording circuitry will shut off. Since this copy-prohibit bit is present in each data block (and is fully independent of the PCM audio data), it would be extremely difficult to defeat or override it.

The Table shown here lists basic parameters of the R-DAT Standard. Note that it includes a wide-track option for prerecorded tape, to make high-speed duplication easier. Since the wider track pitch reduces the recording density, the tape must be speeded up to restore the data-transmission rate to the standard 2.46 megabits/S. This cuts the maximum recording time from 120 to 80 minutes in wide mode.

The Table also includes the additional home-recording options available at a sampling rate of 32 kHz. However, I do not feel most audiophiles will want to use the machines for such limited-fidelity applications.—L.F.

Basic parameters of the R-DAT Standard.

	RECORDING AND PLAYBACK MODES				PLAYBACK MODES	
	Std.	Opt. 1	Opt. 2	Opt. 3	Normal	Wide
Number of Channels	2	2	2	4	2	2
Sampling Frequency (kHz)	48	32	32	32	44.1	44.1
Quantization Bit	16L*	16L*	12NL*	12NL*	16L*	16L*
Redundancy (%)	37.5	58.3	37.5	37.5	42.6	42.6
Rec. Line Density (kB/in.)	61.0	61.0	61.0	61.0	61.0	61.1
Rec. Sq. Density (MB/sq. in.)	114	114	114	114	114	76
Subcode Capacity (kB/S)	273.1	273.1	136.5	273.1	273.1	273.1
Cassette Size	← 73 x 54 x 10.5 mm →					
Rec. Time (minutes)	120	120	240	120	120	80
Tape Width	← 3.81 mm →					
Tape Material	← Metal Particle → Ferric					
Tape Thickness	← 13 microns, ± 1 →					
Tape Speed (mm/S)	8.15	8.15	4.075	8.15	8.15	12.225
Tape Pitch (microns)	13.591	13.591	13.591	13.591	13.591	20.41
Drum Size	← 30 mm, 90° Wrap Angle →					
Drum Rotating Speed (rpm)	2,000	2,000	1,000	2,000	2,000	2,000
Writing Speed (meter/S)	3.133	3.133	1.567	3.133	3.133	3.129
Head Azimuth, Alt. Tracks	← ± 20° →					

*L = Linear; NL = Nonlinear

DAT



Most of the Sony's controls are duplicated on this remote transmitter.

Like the other two DAT decks, the DTC-1000ES combines counter, program, recording-level meter, and many other indicators in one centralized display.

The Sony DTC-1000ES gives the user the options of manually adding or erasing start and skip ID codes. Its recording-level controls resemble those of many analog cassette decks.

The Sony display includes a "Copy Prohibit" light. This illuminates whenever an attempt is made to produce a direct digital-to-digital copy of a CD or digital tape which has been copy-protected by a digital flag code. This digital-to-digital copy-inhibit flag is present on every CD in my collection and, according to the best information I have, is on just about every CD produced to date. It will also be present on prerecorded DATs. For now, to record digitally protected sources onto DAT, you must feed the source player's analog outputs to the DAT recorder's analog inputs.

Sampling-rate indicators on the display show whether the recorder is sampling at 48, 44.1, or 32 kHz, all three of which are covered by the DAT Standard. In playback, DAT machines automatically recognize the sampling rate of the tape and set themselves accordingly. The 48-kHz sampling rate is the only one used for recording on the DTC-1000ES and most home DAT recorders. Pre-recorded DATs are expected to use the 44.1-kHz sampling rate, which will allow record companies to produce them easily from CD master tapes; the inability of DAT home decks to record at this sampling rate is a further inhibition against copying CDs in a digital-to-digital manner. The 32-kHz sampling rate is used in direct-broadcast satellite transmissions of digital audio; most home

DAT decks can play but not record tapes made at this rate.

A "Caution" light illuminates in the display if moisture condensation is present on a tape. A "Search" indicator lights up while tape search is in progress, and various other indicators illuminate when such functions as "Start ID" and "Skip ID" are being entered or deleted.

The lower section of the Sony's display area is dedicated to separate fluorescent record-level meter indications for left and right inputs. Because of DAT's wide dynamic range, this metering system is calibrated from 0 dB (maximum recording level) down to -50 dB, with an infinity symbol still further down the scale. Above zero, instead of the numerical calibrations familiar from analog recorders, there is only a red "Over" warning. As I was soon to learn, the recording level denoted by the "0-dB" mark is truly a maximum. Analog recorders can tolerate some degree of overrecording, but if you go over the 0-dB mark on a DAT recorder, you hit a brick wall of horrendous distortion. I suspect this will take some getting used to on the part of experienced home recordists who are accustomed to pushing past recommended maximum levels in order to get the best dynamic range and signal-to-noise ratios possible.

Major tape-transport operating controls are located beneath the Sony's display area. Included are "Stop," "Play," "Cue" (fast forward), "Review" (rewind), forward and reverse "AMS" buttons, "Rec.," "Pause," and "Rec Mute." Counter "Mode," "Reset," and rewind "Memory" buttons are to the right of the display, as are buttons ("Write" and "Erase") for inserting and deleting the start-ID and skip-ID subcodes described earlier. There's even a button for renumbering your selections in consecutive order on a tape. If, for example, you had only recorded starting IDs for a given tape (but had assigned no program numbers), pressing the "Renumber" button would rewind the tape to the beginning; program numbers would be entered automatically in numerical order for each of the selections you had recorded on the tape.

The number keys, a "Clear" button (for cancelling incorrect entries), and a "Start" button (for initiating play of a randomly selected program) are farther to the right. Concentric rotary record-level controls are at the far right of the panel; below them are a "Phone Level" control, a "Skip" switch, and a two-position switch that selects either the analog (line-level) inputs or the digital input



In DAT recording, "0 dB" is a brick wall, not just a friendly warning. Beyond this level, distortion rockets up horrendously.

The remote control supplied with the DTC-1000ES duplicates virtually all of the control functions of the front panel with the exception of such operations as setting record levels, selecting inputs, and opening and closing the cassette drawer.

The rear panel carries the usual pairs of phono jacks for analog line input and output. It also has separate digital input and output jacks (each digital jack carries both channels). These jacks allow digital-to-digital copying of home recordings, using this deck and a second DAT recorder. Another purpose of the digital output jack is to permit D/A conversion of recorded digital data using a separate D/A converter such as Sony's DAS-703ES. It's worth repeating that the digital input jack *will not allow you to record any digital program source that is protected by a digital flag code, as just about all CDs are and as all future DAT prerecorded cassettes are expected to be.*

Technics

SV-D1000

Technics too seems to have kept the most desirable convenience features of CD players in mind when they designed their first DAT recorder. As with the Sony, program numbers can be assigned to selections as they are recorded on a tape by the user; unlike the Sony, however, start-ID coding is automatic only and cannot be added by the user. Search facilities and tape-counter modes are similar to those on the Sony unit, with the addition of a purely numeric counter mode. The Technics player also offers a few other controls and features not found on the Sony. For example, the A-to-B phrase repeat popularized by CD players is available on the SV-D1000, as is an output level control that affects both the line and phone outputs. Another useful addition is a recording channel-balance control that allows you to adjust for any channel balance disparities present in the program source you are recording. Of course, such adjustments can usually be made at the program source, but it's nice to have this facility on the front panel of the DAT recorder itself.

The Technics' record-level display is far more extensive than the Sony's. Its calibration extends across more than one-third of the front panel and is numbered from 0 dB (maximum record level) all the way down to -60 dB. As with the Sony, there are no calibrations above 0 dB, merely an "Over"



The tape drawer of the Technics tilts the cassette up towards the user.



The yellow and red segments on the Technics SV-D1000's recording meter help warn the user when levels approach the point of overload distortion.



Only the Technics has a recording balance control, and it proved useful.



Rear-panel jacks of the SV-D1000 include both coaxial-cable and fiber-optic digital connections, as well as the analog input and output jacks.



DAT

The tape drawer of the Luxman.

Indicators for the three standard sampling rates are on the front of the Luxman's tape drawer.

The Luxman KD-117's comprehensive display includes a recording-level meter calibrated from 0 down to -80 dB.

The Luxman has two sets of analog inputs, one intended specifically for recording from CD players.

indicator which lights when low-distortion levels are exceeded. The meter also has peak hold, a feature found on better analog cassette recorders, which shows record-level peaks for several seconds after they have occurred.

The Technics unit, in addition to its other programming options, has a "Recall" button which lets you review your programming to make sure you haven't entered an incorrect number. Just about all the remaining controls on the Technics perform the same functions as those on the Sony, with most of those functions, again, available on a supplied remote control.

In addition to its analog inputs and out-

S/N was about equal to that of early CD players, better than analog tape but not as good as today's best Compact Disc machines.

puts, the Technics has digital input and output jacks. There are two sets of them, in fact, one for coaxial cable and the other for fiber optics. Its circuitry also senses when an attempt is made to duplicate a copy-protected digital recording. If you attempt to copy such program material by direct digital-to-digital data transfer, a light associated with the digital input's selector button flashes on and off (instead of lighting continuously) and you cannot get into record mode.

LUXMAN

KD-117 Prototype

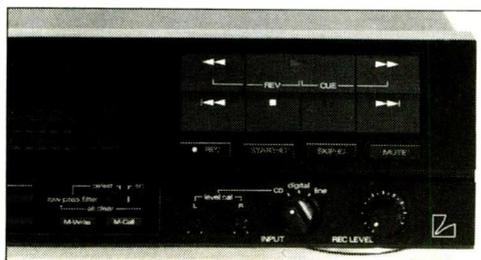
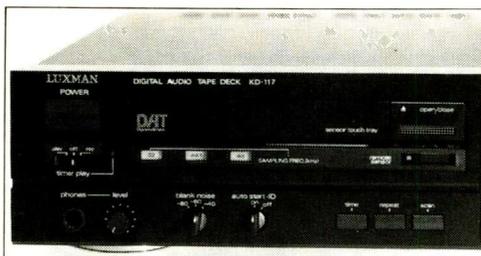
The Luxman KD-117 sample was supplied with neither an English nor a Japanese owner's manual, so it was a bit trickier to figure out and use than the other machines. Nevertheless, I found that most of its features lined up pretty well with those of the other home DAT recorders.

Again, the level-meter scales are integrated within the main display area. These meters, like those on the Technics unit, are linearly calibrated but go down to -80 dB. Like the Sony unit, the Luxman lets the user add start-ID signals manually as well as automatically.

The Luxman has two sets of line inputs (the first labelled for CD use, the second for other line-level program sources) as well as a digital input. Next to the input selector switch on the front panel are left and right level-calibration controls which can be used when recording sources with right/left level imbalances. Though the front-panel markings make these controls look as if they apply only to the CD input, they also work with the other line-level analog inputs.

Since the Luxman does have separate inputs for a CD player, I presume the "Low Pass Filter" switch on the front panel is to remove any ultrasonic products from the input signal's path when transcribing a CD via the digital-to-analog-to-digital route.

The remaining controls are substantially similar to those on the first two machines I evaluated and analyzed. The designers of these machines all favor putting the cassette drawer at the left, the main display area near the center, and operating controls to the right of the display and/or beneath it. The designers of the Luxman unit chose to place the main tape-transport and record buttons at the extreme right of the panel and the number keys (for programming and direct ac-





A prerecorded DAT sample from a trial run by GRP.

cessing of selections on a tape) below the display. Sony and Technics designers chose the reverse, placing the number buttons at the extreme right and the main controls beneath the central display. Either arrangement is perfectly fine with me.

Preliminary Measurements

I'm calling the lab tests I performed on these three recorders "preliminary" because I did not measure them as comprehensively as I would if they were currently available for purchase. (The same holds true for my measurements of the Mitsubishi DAT player for the car, discussed at the end of this article.) The object of these tests (during which I fed generator-produced test signals into the machines' analog line inputs) was to get a good first-hand look at how well these models record and play digital tapes.

Frequency response curves for the three DAT recorders were all pretty similar, so I am showing only the Luxman's (Fig. 1). Note that overall record/play response extended to 22 kHz, thanks to the 48-kHz sampling rate I used in recording. With this sampling rate, output filters, whether analog or digital, need be concerned only with cutting frequencies above 24 kHz (half of 48 kHz), rather than with everything above 22.05 kHz, as would be needed with CD's 44.1-kHz sampling frequency. At 22 kHz, response was down only 0.1 dB for the Sony and Luxman units; the Technics was just about as flat, down only 0.2 dB. Both the Technics and Sony deviated less than 0.1 dB from perfect uniformity at any frequency within the audio band.

Since THD was too low to measure with my Sound Technology test instrumentation, I used a conventional, manually operated dis-

tortion analyzer. At 0-dB recording level, THD was approximately 0.005% for all three recorders. As is usual with any digital audio medium, lower recording levels yielded linearly higher levels of harmonic distortion, as the system had fewer and fewer digital "bits" with which to describe sampled amplitudes.

Figure 2 shows what happened when I tried to push recording levels above the 0-dB mark on the Sony unit; I got virtually the same results on the Technics and the Luxman. At +3 dB recording level on the Sony machine, third-order distortion reached 3.9%; had I pushed harder, to +4 dB above nominal maximum recording level, it would have approached 10%. Backing off to +2 dB dropped the distortion level down to little more than 0.1%, and at +1 dB it fell off the bottom of the graph (my Sound Technology tape tester can only read distortion levels down to around 0.01%). When measured by other means, the residual THD of these machines at 0-dB record level proved to be no more than around 0.005%.

Similarly, the Technics sample offered vanishingly low distortion at or around 0-dB recording level, but when pushed to +2 dB, its third-order distortion zoomed up to 4.9%. Like the Sony unit, its distortion would also have climbed to around 10% had I raised the

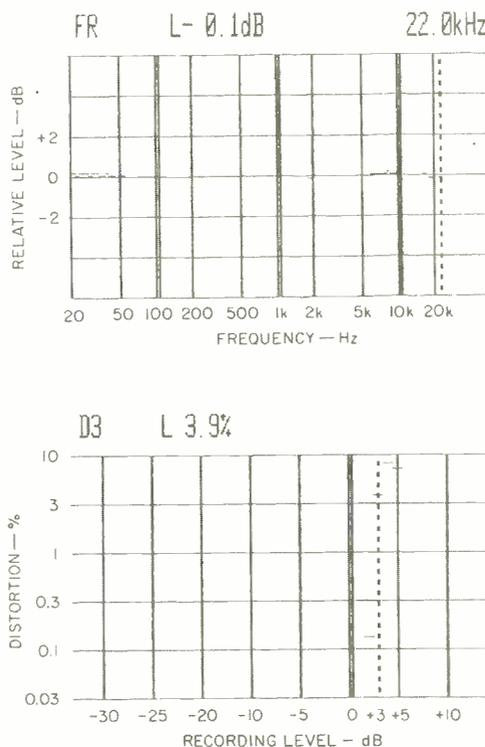


Fig. 1—Record play frequency response of the Luxman prototype. Like the response of the other decks, it was extremely flat from 20 Hz to 22 kHz.

Fig. 2—Overload distortion on the Sony DAT recorder. Below 0-dB recording level, distortion on all three decks was less than 0.01% but rose rapidly, as shown, when level was raised beyond 0 dB.

Fig. 3A—A-weighted S/N analysis, DTC-1000ES.

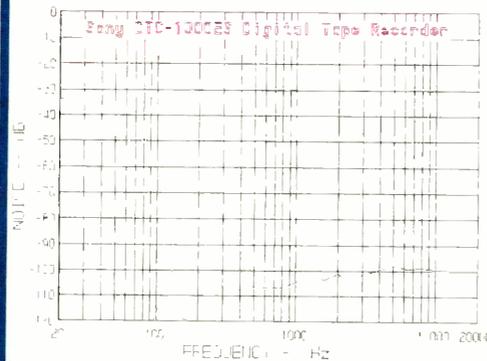


Fig. 3B—A-weighted S/N analysis, SV-D1000.

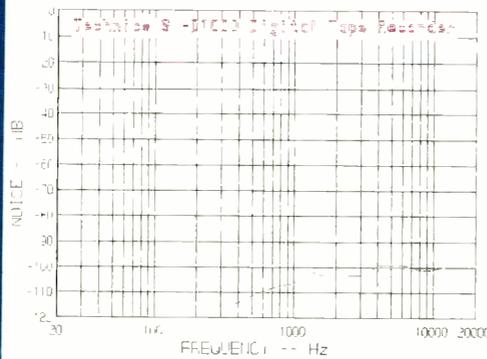
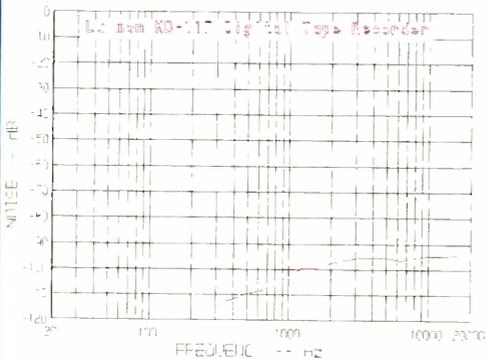


Fig. 3C—A-weighted S/N analysis, KD-117 prototype.



recording level another dB or so. The Luxman delivered very similar results, with distortion around 0.005% at 0-dB record level, rising to around 4.0% at the +3 dB record level shown on its metering system.

Figures 3A, 3B, and 3C show the results of A-weighted signal-to-noise analyses done for the three recorders. The Technics and Sony units registered readings (on a one-third-octave by one-third-octave basis) of over 100 dB for most of the audio spectrum and overall composite S/N readings in excess of 90 dB. The Luxman unit registered an overall composite S/N reading of 87.5 dB. These figures are more comparable to those I obtained from first-generation CD players, nearly four years ago, than to those I get from CD players today. Perhaps this is because

these DAT recorders are first-generation machines, too; also, I was forced to use analog test signals, for reasons I'll get to shortly.

If these three units had any wow and flutter, it was well below the level detectable by my test system. In other words, any wow and flutter produced in recording and playback together was below about 0.002%!

Channel separation was of the same order as that measured for most CD players I have tested recently, as illustrated in Figs. 4A, 4B, and 4C. I attribute the slight decrease in separation shown for the Luxman and Technics units to some minimal amount of capacitive crosstalk present in their analog output stages rather than to any part of the digital circuitry. In any case, I think it's safe to say that -70 dB of crosstalk at 10 kHz is hardly going to affect stereo imaging!

Use and Listening Tests

One of the things that particularly impressed me about all three machines was their speed of access. Most of us have gotten used to the rather slow fast-forward and rewind speeds of analog cassette decks. Such decks must run even slower in their "fast" music-search modes so they can detect the pause between selections. In contrast, the DAT machines were able to find any desired selection on a two-hour tape in times that ranged from a few seconds to slightly more than 30 S, depending on how far away the desired selection was from the tape's current position.

This rapid access is possible for two reasons. First, longitudinal tape travel in the play and record modes is just a bit less than one-third inch per second (8.15 mm/S), so it takes less than 100 feet of tape to record a two-hour program. In contrast, a standard C-90 analog cassette contains about 420 feet of tape for 45 minutes of recording in each direction.

The second reason for R-DAT's quick access has to do with the way its high recording density is achieved. The system uses an angled, spinning head assembly (like that on a VCR) which lays very narrow tracks diagonally across the tape. This raises the writing (head-to-track) speed to 3.13 meters/S, or 10.3 feet/S. In fast-search modes, the tape remains in its normal 90° wrap around the head drum, which continues spinning at the same 2,000 rpm as in playback or recording. Those spinning heads can therefore detect start IDs and other subcode information even during fast-wind modes, which shortens access times.

When you call for a given selection on a

The total absence of audible background noise and the wide dynamic range were unmistakably digital in character.

DAT recording, the transport goes into the fast-wind or fast-rewind mode. The deck reads the program-number codes as they pass; as the desired selection approaches, the tape slows down. The process is interesting to follow on the tape counter. It's as if some unseen hand were guiding the fast-wind process, controlling the tape's speed to find the precise start of a selection quickly and accurately.

I made several recordings on each of the three machines. For test purposes, I had hoped to be able to copy my latest test CD onto DAT, using digital-to-digital connections. As you might have guessed, the copy-inhibit system foiled this attempt, and I had to settle for a digital-analog-digital transcription. Interestingly, one of the prerecorded tapes given to me did not have the copy-prohibit flag encoded in its subcode control block, so I was able to make digital-to-digital copies of it. (It was also recorded at the 48-kHz sampling rate, of course.) The other two music tapes, and all the CDs I tried to transcribe, did have the copy-inhibit flag. As a result, when I tried to record them by feeding my CD player's digital output to the recorders' digital inputs, the Sony's "Copy Prohibit" light and the LED on the Technics' "Digital" input-selector button began to flash within seconds. I had to settle for recording via my CD player's analog output and the recorders' analog inputs, adding extra D/A and A/D stages and analog circuitry to the chain.

I mentioned earlier that maximum recording levels are extremely critical when using DAT machines. As careful as I tried to be, I invariably pushed the meters above the 0-dB mark whenever I attempted to obtain maximum dynamic range. I soon decided that it's better to stay well below 0 dB to ensure that peaks never exceed that mark. I learned, too, that manufacturers are going to have to be extremely careful in calibrating the recording-level indicators. An error of 1 or 2 dB can make a big difference if the 0-dB reading actually corresponds to +1 or +2 dB above true maximum recording level (the level at which 16-bit samples consist of 16 ones and no zeros). In fact, I discovered that the calibration of the Sony unit made setting levels a bit more critical than with the Technics or Luxman. At 0-dB record level (as indicated on the Sony's meters), THD for the record/play cycle was already beginning to creep up just a bit, though it was still below 0.01%. Backing off by as little as 0.5 dB brought THD down to the 0.005% level exhibited by the other two units when they were set for their "0" record-level indications. It's possi-

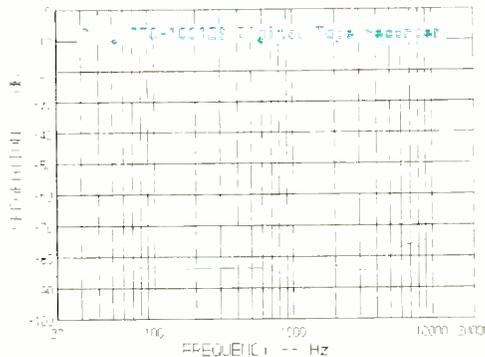


Fig. 4A—Channel separation vs. frequency, DTC-1000ES.

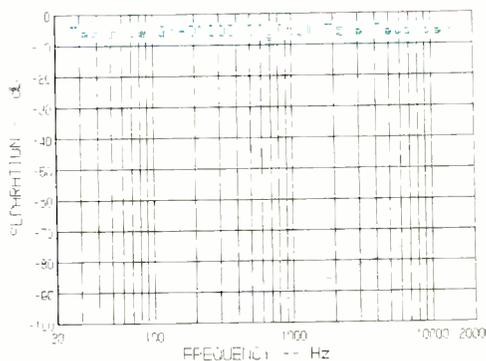


Fig. 4B—Channel separation vs. frequency, SV-D1000.

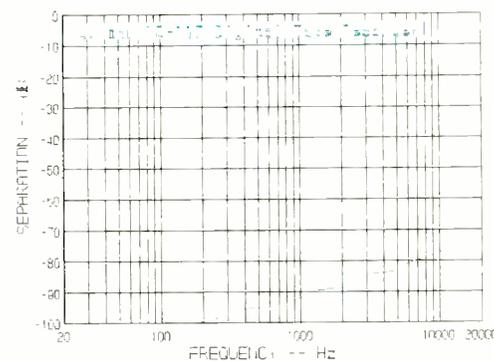


Fig. 4C—Channel separation vs. frequency, KD-117 prototype.

ble, of course, that the slight rise in distortion may have been caused by overload limitations of the record amplifier's analog stage or even by slight overload of the playback amp's analog stage, but my guess is that I was coming up against the limitations of the 16-bit sampling system.

Making a DAT recording turns out to be as simple as operating the most basic of cassette decks. You don't have to add starting IDs to your individual selections if you don't want to, but I found this feature to be very desirable, especially when recording a series of signals from my test CD onto a tape. As each new test began, I simply pressed the "ID" button. Then, when I needed a tape with which to test the play-only Mitsubishi prototype car unit, I was able to skip easily



Using these four machines showed me that DAT is the next step in the quest for a true high-fidelity home recording system.

back and forth to the test signal I required instead of having to hunt for it with fast forward and rewind. On all three decks, counter readings change so quickly during fast winds that even if you know the tape count (or real-time indication) where a given selection starts, you will have a hard time stopping precisely at that spot. Much better, I soon discovered, to let the "smart" microprocessor read subcode data and do the cueing job for you.

There was no mistaking the sound quality of these units during playback. The prerecorded material had that familiar "CD sheen" about it, with a total absence of any audible background noise and with a dynamic range that was unmistakably "digital" in character and intensity.

I hope to be in a much better position to evaluate sound quality a few months from now, if and when a greater variety of prerecorded DAT software becomes available. I well remember when my CD collection consisted of five CDs, none of which contained particularly outstanding examples of the recording or performing arts. Testing these DAT recorders with the even more limited selection of software available to me recalled those early days of CD excitement. Of course, there is one important difference. I was able to record good-quality CD material onto DATs, albeit by going from digital to analog and back to digital. Even those recordings sounded very clean and offered wide dynamic range as well as low noise levels (once I learned how to adjust recording-level controls properly).

I am not about to rank these three DAT recorders in any order of quality or preference; it's much too early to do so. Suffice it to say that all three units attest to the great engineering skills of their designers. Eighty-plus companies labored diligently for more than three years to establish a workable R-DAT standard. (The "R" stands for rotary head, as distinct from S-DAT, a format that employs stationary heads and may someday be employed for professional DAT gear.) They have obviously done their job well.

Whatever the future holds for DAT recorders, the technology and ingenuity, as well as

the many features of this new recording format, must be admired and respected. As I understand it, these first units are selling in Japan for the equivalent of \$1,200 to \$1,500. If and when they show up on these shores, their price will probably be considerably higher. Still, if the audio enthusiasts in this country want DAT recorders badly enough, you can bet that they'll buy them and, in so doing, will establish a demand for them. Once the market broadens, it'll just be a matter of time before DAT recorders will become affordable for the less affluent members of the audio fraternity.

MITSUBISHI

Car Player Prototype

When you consider the amount of digital electronics involved in a DAT recorder, it is nothing short of amazing that Mitsubishi (and no doubt others in the near future) will be producing a car DAT player that fits a standard DIN or ISO dashboard cutout. The unit supplied by Mitsubishi was clearly a hand-built sample. I was warned not to treat its mechanism too harshly, but in my lab it worked beautifully. It was powered up via a DIN cable connected to a Mitsubishi car power amp (Model CVX-5, rated at 70 watts per channel in stereo mode); in effect, I had on my lab bench a complete car sound system driving a pair of monitor speakers.

When the Mitsubishi is first powered up, a display area at the right of the tiny front panel illuminates but remains blank. As soon as a tape is inserted, the time display appears, showing minutes and seconds. The initial reading is 00:00, but seconds and minutes begin to register as soon as play starts. Also displayed is the program or selection number and a long arrow symbol containing the word "Play." If the repeat-play functions are called up, the display also shows either the word "All" (for repeat of the entire tape) or "1" (for repeat of the current selection).

Controls are similar to those on the home DAT recorders except, of course, that there is no "Record" button. "Bass," "Treble," front-rear "Fade," and concentrically mounted volume and balance controls supplement the tape-motion controls. A repeat button, when pressed, sequences through single, full, or no-repeat commands. Taking a cue from some car radios and even a few car cassette players, Mitsubishi has included a "Scan" button. Press it, and the tape ad-

A play-only unit, Mitsubishi's DAT machine will be for car use.



vances from one recorded selection to another, stopping and playing the first 10 S of each before advancing to the next. Pressing the "Play" button at any time disengages "Scan" and allows you to listen uninterrupted to the selection of your choice. Considering that a DAT cassette may contain as much as two hours of recorded material, this is a very useful feature, allowing a driver to audition many selections without having to repeatedly take his hands off the wheel.

When the "Stop/Eject" button is pressed, the tape is first released from its wrap around the spinning head drum and fully retracted into the cassette shell while the head drum ceases its rotation. The cassette is then ejected partway from the cassette slot—just enough for you to see its rear edge in the slot. A second push on the same button releases the tape cassette still more, allowing you to retrieve it from the slot. At least on this prototype, I was told to push tapes only partway in for loading and then to press the "Play" button. When I did so, the loading mechanism took over, gently positioning the cassette further inside the player and "threading" the tape for its 90° wrap around the spinning head drum. This unit may be a prototype, and a hand-made one at that, but its mechanical action was smooth and reliable and the sound quality reproduced via the accompanying amplifier was excellent. If production units are as good, this product should enjoy an excellent reception when it becomes available.

Mitsubishi was kind enough to supply a wired DIN adaptor. Its use allowed me to measure the DAT player directly without having to go through the accompanying car amplifier, though I did use that amp for my listening tests.

I had recorded a frequency response sweep from my EIA test CD to a DAT cassette using the digital-to-analog-to-digital approach on one of the home DAT recorders. I felt that this type of test tape would be adequate for checking the playback response of the Mitsubishi; as you can see from Fig. 5, it was. Response varied by no more than ± 0.25 dB from 20 Hz to 20 kHz. For signal-to-noise tests, I had to use a tape that I had made (with no signal applied) on one of the home recorders; therefore, the plot of Fig. 6 may well show that deck's noise in recording as well as the residual playback noise of the Mitsubishi. In any event, this car player measured over 100 dB for most of the $\frac{1}{3}$ -octave points analyzed; overall composite noise, A-weighted, was 86 dB. That's not at all bad for a "prototype."

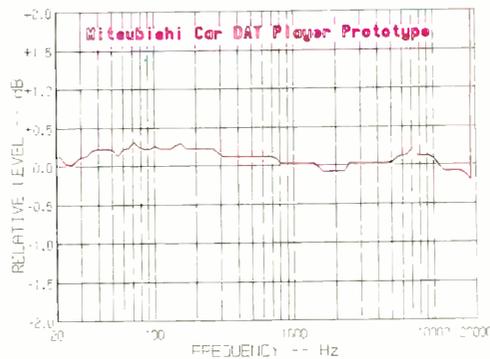


Fig. 5—Playback frequency response, Mitsubishi car stereo prototype.

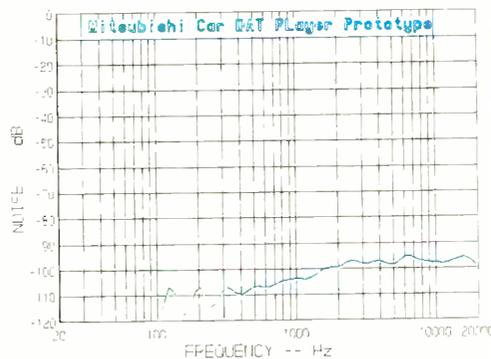


Fig. 6—A-weighted S/N analysis, Mitsubishi car stereo prototype.

Summary

After spending just over a week with these four units, I have concluded that DAT represents the next step in the quest for a true high-fidelity home recording system. Of course, those of us who have wanted to record audio digitally, at home, have been able to do so for some time by linking a VCR to a PCM processor. Somehow, though, doing so has always seemed to me to be a sort of "add on" to what is basically a video-oriented technology. After all, when you record digital audio onto videotape, you're still wasting some of the tape's capacity by recording horizontal and vertical synchronizing video pulses and merely substituting PCM code for picture signals. In DAT we have a system that is designed expressly for recording and playing high-quality audio—a system that takes into consideration the special needs of audio, including the right levels of error correction and detection. Being dedicated to audio, the system also provides for all of the convenience features that digital data can utilize, such as various programming, searching, and scanning modes. Personally, I can't wait to measure DAT units built for U.S. distribution and sale. I'm eager to do so for two reasons: First, so I can report my findings to you, and second, so I can pick the right model to purchase for myself. 

1

SONY CDP-705ESD COMPACT DISC PLAYER

Manufacturer's Specifications

Frequency Response: 2 Hz to 20 kHz, ± 0.3 dB.

S/N: 106 dB (EIAJ).

Dynamic Range: 97 dB (EIAJ).

THD: 0.0025% at 1 kHz (EIAJ).

Separation: 100 dB at 1 kHz (EIAJ).

Wow and Flutter: Less than 0.001% (EIAJ).

Number of Programmable Selections: 20.

Output Level: Fixed, 2.0 V; variable, 0 to 2.0 V; headphone, 28 mW into 32 ohms; digital output, 0.5 V peak to peak.

Power Requirements: 120 V a.c., 60 Hz, 16 watts.

Dimensions: 16¹⁵/₁₆ in. W \times 4⁷/₈ in. H \times 15⁹/₁₆ in. D (43 cm \times 12.3 cm \times 39.5 cm).

Weight: 29.7 lbs. (13.5 kg).

Price: \$1,500.

Company Address: Sony Dr., Park Ridge, N.J. 07656.

For literature, circle No. 90

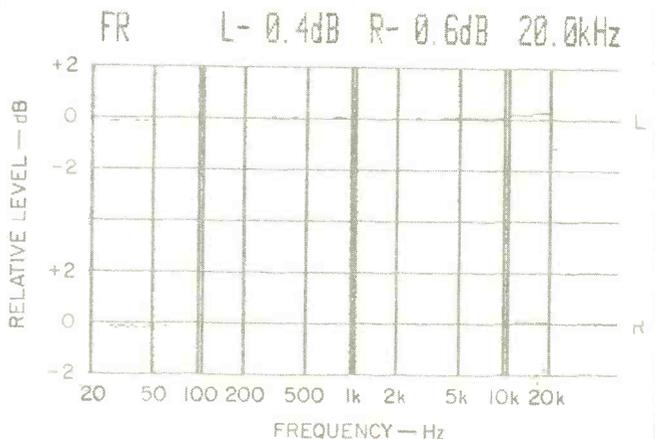
When I measured and listened to Sony's CDP-650ESD two years ago, I thought that the science of digital audio disc reproduction had reached its ultimate level. I should have known that when the subject is sound reproduction, there's always room for improvement—however small in audible terms. The company's latest effort in its ongoing crusade to deliver the best digital sound possible is the not-inexpensive CDP-705ESD Compact Disc player.

I suspected that this unit was something out of the ordinary when I lifted it onto the test bench: It is probably the heaviest CD player I've tested. While weight is certainly no measure of how an audio component performs, some of the CDP-705ESD's heftiness does, indeed, impact on performance. The weight is largely due to a new chassis material, a specially developed calcium carbonate substance reinforced with glass fibers to make it more rigid, according to Sony, than conventional metal frames. Sony also states that this chassis has been acoustically tuned to a low system resonance so that external or internal vibration transfer is reduced. Additionally, the chassis is nonmagnetic. The player's entire bottom panel, back panel, and center partition are copper plated, then finished in black for cosmetic symmetry. Mechanical vibration is limited by separating the main chassis from the base with rubber bushings. The internal resonance of the base is suppressed by vibration-absorbing material that has been applied at key structural locations. This player also has large insulator feet to help keep mechanical and airborne vibration from affecting performance. All this is done to reduce vibration which, if excessive, might induce laser reading errors or loss of data. Excessive vibration also forces the system to interpolate sample readings, and excessive interpolation results in distortion. Thus, anything that can be done to reduce the need for such interpolation will likewise reduce distortion.

Sony's compact Linear Motor laser-transport mechanism, with its combination of fast access speed and precise cueing, has been carried over into this design. So have such earlier refinements as the polyresin ceramic material used to damp any vibrations that might otherwise occur as the laser-optical assembly moves rapidly from one point to another.

Electrical interference is reduced through the use of highly stabilized power supplies and the inclusion of copper bus bars in various circuits to avoid current loops. High-speed

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





switching diodes are used as supply rectifiers, and RC filters are inserted in the secondary side of the power transformer to resist external noise and to suppress hum that might be transmitted to other audio components. Separate digital and analog power supplies and subregulators are also used to help minimize electrical interference between the two sections.

In terms of electronic circuitry, several refinements are incorporated in the CDP-705ESD. Instead of two-times oversampling, Sony has elected to use four-times oversampling along with true 16-bit, dual-D/A conversion. While providing no additional music information, this technique has the advantage of decoding at a frequency four times higher than the standard 44.1-kHz sampling rate. The result is that unwanted noise sidebands are shifted to a higher frequency range (centered about 176.4 kHz). This allows a gentler filter to be used in the final analog stage to eliminate the sampling frequency. The result is phase accuracy throughout the audible spectrum as well as more uniform frequency response near the treble cutoff point. The digital filter circuits in one of the new LSI chips which Sony has used in the CDP-705ESD, in tandem with new high-speed D/A converters, hold band-pass ripple to less than 0.001 dB while providing more than 80 dB of stop-band rejection at any frequency above 25.7 kHz.

Sony has also developed what they call an advanced Error Prediction Logic tracking servo circuit to control the position of the laser pickup. This circuit monitors the pickup's position 8,000 times per second. When an error is first detected, the circuit memorizes its parameters. On the next pass or revolution of the disc, the same signal parameters are compared by a microprocessor to the information memorized on the first pass and then noted. The circuit next determines the probable location and duration of the error

before the third disc rotation, after which it directs the servo circuit to respond with the exact amount of current necessary to maintain proper tracking. This circuit divides each disc rotation into more than 1,065 discrete intervals, monitoring about once every 0.34°.

Circuit features carried over from earlier models in Sony's ES series include the Envelope Differential Servo Detection system, which detects any dropouts of digital data as soon as they occur, allowing for error correction before tracking error results. The same circuit "freezes" the laser pickup in position when no digital data is present, providing faster recovery from gross disc defects and more uniform tracking. Sony's Unilinear Converter is also present in this model, serving to reduce spurious, out-of-band "beats" caused by the interaction of multiple clock rates such as those found in other oversampling filter designs. Optical coupling has again been used between the digital filter stage and the demultiplexer and delay stages to isolate the audio stages from the digital circuits that precede them.

For all its internal refinements, the CDP-705ESD offers about the same operating and convenience features that have been available on the company's previous ES-series players and even on their lower-cost models. Direct track access (using the numbered keys on the front panel or on the supplied remote control) is available, as is direct index access. Up to 20 selections can be programmed for play in any order. The various modes of repeat play (including repeat of a defined musical section) are all here, as is the popular "shuffle play" Sony introduced some time ago. This mode randomizes the order in which the tracks on any CD will be played. Fixed and variable outputs as well as a headphone output are provided, and the variable output level can be controlled using the remote.

A digital output jack is also included. This is nothing new,

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(808) 533-4122
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(808) 935-7146

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(312) 980-4946
Columbia Audio-Video
(312) 354-4770
Columbia Audio-Video
(312) 433-3010
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(312) 966-5590
Mills Recording
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(312) 893-6464
Stereo Studio
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(618) 741-1350
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(617) 235-5100
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First Tech
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Wright's Sight & Sound
(816) 665-7208

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Sound Pro
(406) 453-4364

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Import Audio
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J S Audio
(201) 292-2799
Landes Audio
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Leonard Radio
(201) 261-5525
Monmouth Stereo
(201) 842-6565
Samm Sound
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Stereo City
(201) 561-5577
The Sounding Board
(201) 445-5006
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Sound Waves
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The Sound Room
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Audio Exchange
(212) 982-7191
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(212) 249-4104
Continental Sound
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Custom Media Design
(212) 689-5916
Leonard Radio
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Leonard Radio
(212) 840-1958
Music Masters
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Stereo Shop
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(919) 942-8546
Stereo Sound
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Sight & Sound
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Sight & Sound
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Sight & Sound
(513) 471-5602
Sight & Sound
(513) 248-1110
Stereo On Wheels
(513) 898-4590
Stereo On Wheels
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Stereo On Wheels
(513) 253-3113
Hammond Electronics
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Hammond Electronics
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Hammond Electronics
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Hawthorne Stereo
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Fraxley Electronics
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(615) 327-4312
The Sound Room
(615) 928-9233
New Wave Car Stereo
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New Wave Car Stereo
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Hilcrest High Fidelity
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Hilcrest High Fidelity
(214) 934-8585
Hilcrest High Fidelity
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Stereo & Record Ctr.
(214) 757-3500
Stereo & Record Ctr.
(214) 297-1933
Stereo & Record Ctr.
(214) 933-9401
Stereo & Record Ctr.
(214) 561-7455
Texasiana Audio Ctr.
(214) 793-2866
Brook Audio
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Bjorn's Stereo Design
(512) 646-6991
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(713) 696-5719
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Sheffield Audio
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Hi Fidelity of Lubbock
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Soundroom
(806) 353-9171
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(817) 277-1924
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(817) 346-4500
Sound Idea
(817) 284-4503
The Sound Room
(915) 594-8201

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Broadway Music
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Hi Fi Shop
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Mountain Music
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(703) 665-4477
Excalibur
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Myer-Emco
(703) 536-2900
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Audio Exchange
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Digital Sound
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Sounds Unlimited
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Dasco Electronics
(206) 943-1393
The Sound Authority
(206) 577-0900
Home Entertainment
(206) 881-1265

WASHINGTON D.C.

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(304) 529-3355
Pied Piper
(304) 255-0235
Stereo Video Unlimited
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General Electronics
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The single digital output port can be used both for graphic subcode data and for the direct transfer of digital audio data.

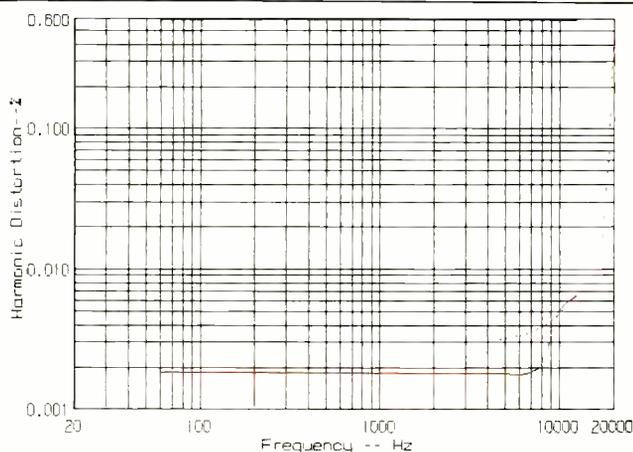
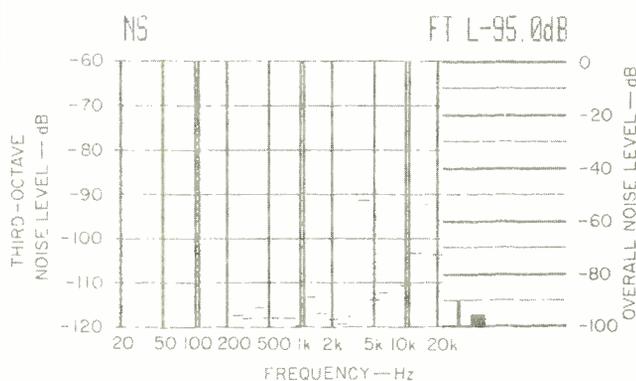


Fig. 2—THD vs. frequency at 0-dB recorded level. Dashed line shows effect of out-of-band "beats" rather than true distortion. (See text.)



A
B

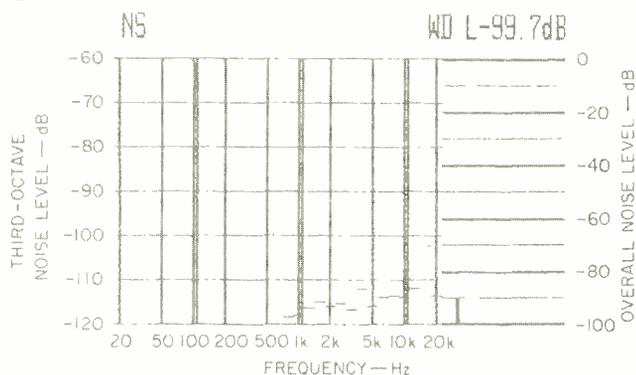


Fig. 3—S/N analysis, both unweighted (A) and A-weighted (B).

several makers have offered subcode and direct digital output terminals on earlier CD players. However, Sony tells me that this redesigned digital output stage fully conforms to industry format standards and also includes a new digital "latch" for correction of any time-base errors caused by jitter. When the digital port is used, the player's analog stage is completely bypassed. Furthermore, one will be able to use the single digital output for graphic subcode data as well as for direct transfer of digital audio data. Previously, separate ports were needed for these two functions.

Control Layout

The front-panel layout of the CDP-705ESD is reminiscent of earlier Sony ES players, though with some rearrangement of buttons and switches. The "Power" pushbutton, a head-phone jack, and a three-position "Timer" switch (for use with an external clock timer) are at the panel's left end. The smooth-acting but ruggedly constructed disc tray is positioned above seven small pushbuttons which handle the various repeat-play modes, time/program display options, the "Shuffle" mode mentioned above, "Auto Pause" (which, after each selection plays, cues up the next track and puts the unit in pause mode), and "Auto Space" (which inserts a pause of approximately 3 S between selections).

A large display area to the right of the disc tray shows track and time information and also incorporates the "track calendar" introduced by Sony a few years ago. This is a grid with 20 numbers for as many tracks; when a disc is inserted in the tray, numerals corresponding to the tracks available on the disc are illuminated. As tracks are played, the track numbers are extinguished. When random-access programming is used, only those numerals included in the program illuminate. Just below the display area are six small, light-touch buttons used for skipping ahead or backwards from track to track, for advancing to the next or previous index points within a track, and for fast forwarding (or reversing) the laser pickup while monitoring the output at reduced volume levels. Below these six keys are four large buttons, controlling eject, play, pause, and stop.

One minor feature of the "Index" buttons eluded me for a while, since it is not mentioned in the owner's manual. When I tried to move backwards from one index point to another, no matter how many times I pushed the reverse index button, the best I could do was to get the laser to return to the start of the current index point. It was only when I inadvertently kept the button depressed for a few seconds, rather than for just a touch, that the laser assembly did, finally, move back from index point 3 to index point 2 of the track I was playing.

At the upper right are the number buttons used for directly accessing tracks and for programming the machine. "Check" and "Clear" buttons, used during programming, are also found here, as is a "+10" button for programming track numbers higher than 20 (if you happen to own a CD with that many selections on it). Three light-colored buttons near the lower right corner of the panel are used to select programmed play, single-track play, or continuous play of an entire disc. A tiny rotary level control in the lower right corner completes the panel layout. When the remote control is used to alter output levels at the variable output jacks, this

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THE PRIDE IS BACK



T70

The CDP-705ESD was the first player I have tested whose de-emphasis was perfect, not deviating by so much as 0.1 dB.

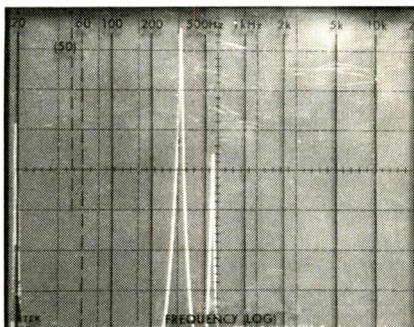


Fig. 4—Spectrum analysis of reproduced 20-kHz test signal from 0 Hz to 50 kHz. (See text.)

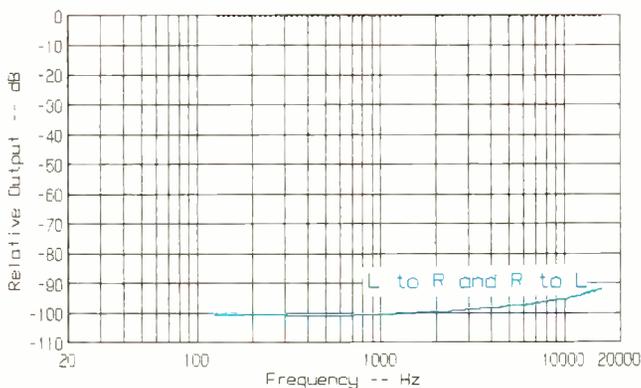


Fig. 5—Separation vs. frequency. Separation was identical from left-to-right and from right-to-left channels.

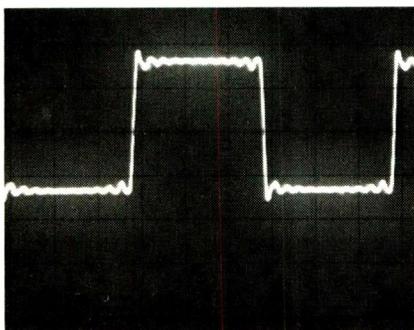


Fig. 6—Reproduction of a 1-kHz square wave. (See text.)

tiny knob actually rotates, since the gain is being altered by a motorized precision potentiometer.

The rear panel is equipped with pairs of fixed and variable analog output jacks as well as with the single digital output jack mentioned earlier. A slide switch above the digital jack must be in the "On" position for the digital code's signal to appear at this jack. With the switch on, regular analog audio output is not available at either set of line output jacks or the headphone jack.

Measurements

Figure 1 shows frequency response of each channel as the response sweep track of my new EIA test disc was played on the CDP-705ESD. Maximum deviation from absolutely flat response within the audio range was no more than +0.2 dB and -0.6 dB, with the maximum negative deviation occurring only at 20 kHz. Harmonic distortion at 0-dB (maximum) recorded level was by far the lowest I have measured for any CD player. At most frequencies, THD was actually less than 0.002%. (For all I know, since the "floor" of my THD measuring equipment is not much lower than 0.002%, it may even have been still less!) A plot of THD versus frequency is shown in Fig. 2. The dotted line corresponds to the readings taken with the 20-kHz low-pass filter removed from the measurement path. It indicates that the higher readings (never higher than 0.5%, in any case) result from out-of-band signals which are not necessarily harmonically related to the test frequency.

Figures 3A and 3B show, respectively, unweighted and A-weighted signal-to-noise ratio. Overall unweighted S/N measured 95.0 dB, and A-weighted S/N was 99.7 dB. The benefit of Sony's Unilinear Converter system and the use of a single master clock to synchronize all digital functions is clearly seen in Fig. 4, in which the 20-kHz output of the test disc was analyzed using a spectrum analyzer sweeping from 0 Hz to 50 kHz. One can see the usual 24.1-kHz out-of-band "beat," caused by the interaction between the 44.1-kHz sampling rate and the 20-kHz test signal. The beat is, in fact, rather high in amplitude because of the gentle analog filtering used in this player. But you will notice that there are absolutely no other spurious outputs visible, either above or below the test frequency (represented by the taller of the two spikes in the scope photo). Most players, even those that use oversampling and digital filtering, exhibit additional spurious products both outside and within the audible frequency range.

Stereo separation was also the highest I have obtained for any CD player. At low and mid-frequencies, separation measured a full 100 dB, decreasing only very slightly to 95 dB at 10 kHz and to 92.0 dB at 16 kHz. Figure 5 shows separation versus frequency from left to right and from right to left; only a single curve can be seen because separation was identical in both directions. Dynamic range, measured in accordance with the prescribed EIAJ and EIA methods, was an impressive 107 dB, and wow and flutter was too low to be measured with my test equipment. In the past, I have always run into trouble when trying to measure output linearity below around -70 or -80 dB. I assumed that this was caused by limitations in my test setup and was surprised to find that this is not the case. The CDP-705ESD exhibited

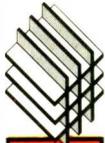
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Even so, something is still standing between all the natural sound they produce and your ears.

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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.

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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.

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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.

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I could cite a lot of CDs that sounded better on this unit than on many others, but your own listening will be more convincing.

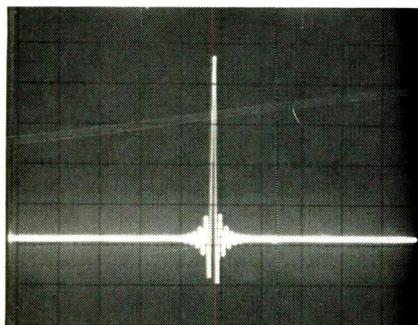


Fig. 7—Single-pulse test.

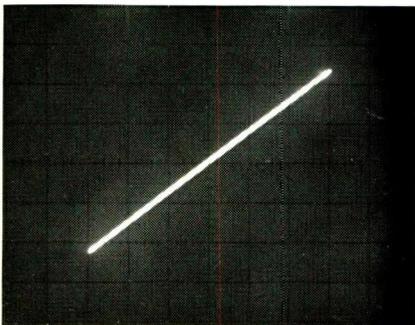


Fig. 8—Interchannel phase comparison at 20 kHz. Absence of interchannel phase error is indicated by 45° angle of Lissajous pattern.

near-perfect linearity (within 0.1 dB) down to 80 dB below maximum recorded level and was off by less than 1.0 dB at -90 dB!

As far as I have been able to determine, very few commercially pressed CDs employ pre-emphasis for additional improvements in S/N and dynamic range, but for those that do, it's important that a player exhibit proper de-emphasis characteristics. This player provided perfect de-emphasis when presented with a pre-emphasized test signal; it was the first player I've tested that didn't deviate by so much as 0.1 dB in this measurement. CCIF (twin-tone) intermodulation distortion was only 0.001% at 0-dB recorded level, increasing very slightly to 0.0015% at -10 dB. Output level for 0 dB, whether measured at the variable output jacks with the gain control set to maximum or at the fixed output jacks, was 2.10 V, with no difference in level between channels.

Figure 6 is a 'scope photo of a 1-kHz square wave as

reproduced by this player. If the ripple along the horizontal portions of the display seems a bit lower to you than it has in previous reports, all I can say is that I got the same impression. It suggests that this unit's phase accuracy is somewhat better than that observed in other players. The reproduced unit pulse shown in Fig. 7, besides confirming that oversampling and digital filtration have been used here, also tells me that the CDP-705ESD does not invert waveform polarity. Finally, Fig. 8 shows that dual D/A converters are being used and that time correction has been applied so that there is no phase shift between the 20-kHz signal reproduced from the left output compared with the same signal reproduced from the right.

As you might expect, the CDP-705ESD tracked my special "defects" disc perfectly. It also did a remarkable job of tracking several discs that I was ready to discard because of scratches and imperfections which led to sustained mistracking and muting on other CD players. I had seen some pretty dramatic demonstrations of the effectiveness of Sony's Envelope Differential Servo Detection system before, but those had been given by people at Sony. It's quite another matter when you experience the incredible tracking ability of this system on your own turf. It is nothing short of remarkable.

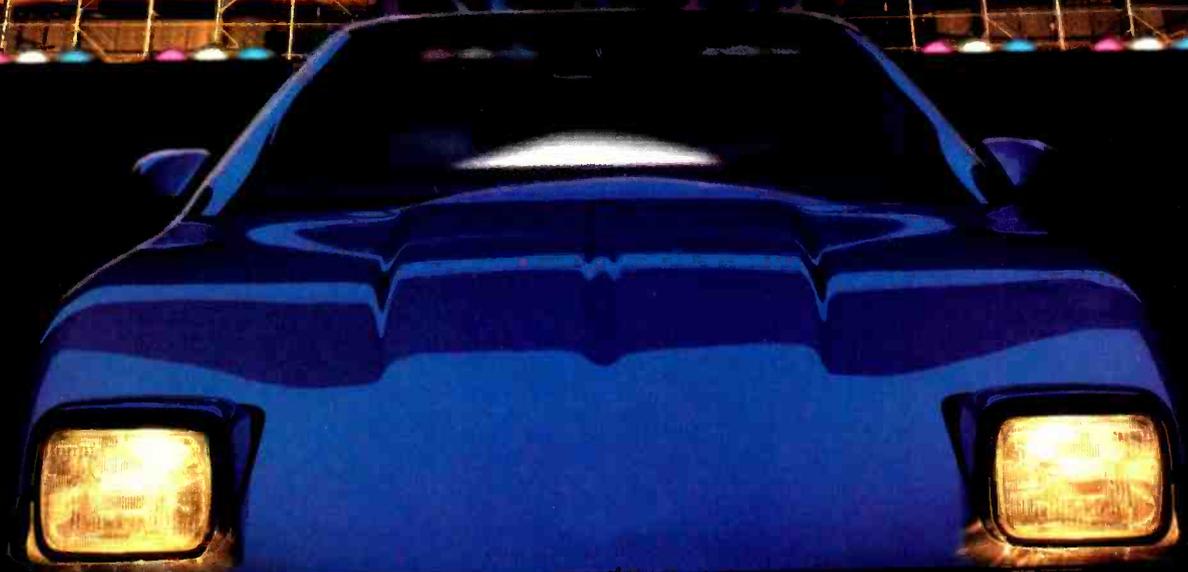
Use and Listening Tests

I can't honestly say that I detected any major audible difference in sound quality between the CDP-705ESD and my reference CD player, the Sony CDP-650ESD, though with certain discs I detected a somewhat more pleasant high end when using the new model. I can attest to the fact that access time has actually been reduced even further, to less than 1 S from tracks near the center of a disc to those near its outer rim. I can also state, with a fair degree of confidence, that tracking ability and stability are better on the CDP-705ESD than on the reference unit. Which of the many mechanical and electronic improvements is responsible for this improved tracking I can't say, but I do know that I was able to tap the top and sides of the CDP-705ESD a lot harder than I can on the CDP-650ESD before there was any evidence of mistracking or momentary muting.

One of the discs I used to audition this player was a Denon recording of a Mozart clarinet quintet that I recently bought in Japan. The sound of a clarinet can be somewhat grating if the delicate relationships of all its overtones are in any way altered or upset. The sound of the clarinet solo on the Denon disc was velvety-smooth and warm. Above all, it was totally devoid of the harshness I had heard when playing this recording on a low-cost player. A second recently acquired disc that sounded particularly fine on this player was an all-digital Philips recording of Elgar's "Cello Concerto in E Minor" (Op. 85) that also contains his well-known "Enigma Variations." Again, the warmth and richness of the cello, which has been so difficult to reproduce properly, was immediately evident when I played this disc on the CDP-705ESD. I could cite other discs that sounded better on this machine than they had on competing units, but if you can afford this state-of-the-art CD player, you'd probably be more thoroughly convinced by listening for yourself than by taking my word for it.

Leonard Feldman

ANYTHING ELSE IS JUST UN-PROFESSIONAL



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

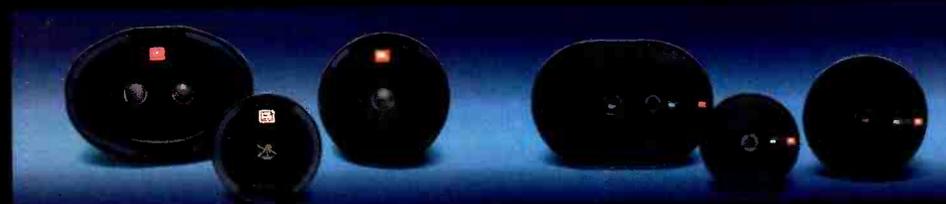
Rugged, reliable, automotive versions of JBL's professional equipment, the "T" and "TL" series are designed by the same acoustical engineers with the same attention to quality and performance.

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

High polymer laminated and mineral filled polypropylene low frequency transducers, in the "T" and "TL" respectively, deliver smooth, uncolored, powerful bass response. They're remarkably resistant to the automobile's acoustically hostile environment.

You'll get that smooth JBL response on the bumpiest roads, too. Cast aluminum mountings and die-cast frames resist twisting and buckling, even when mounted on uneven surfaces. Cones and voice coils are tightly aligned for consistently accurate musical reproduction and high power handling. The JBL "T" and "TL" series automotive loudspeakers. Once you've heard the professionals, you won't want anything else.

For more information and your nearest dealer call toll free 1-800-525-7000, Ext. 515 or write JBL, 240 Crossways Park West, Box 9515, Woodbury, New York 11797



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

JBL

A Harman International Company

2

SAE A202
AMPLIFIER**Manufacturer's Specifications**

Power Output: 100 watts per channel, 20 Hz to 20 kHz, both channels driven into 8-ohm loads; 105 watts at 1 kHz into 8-ohm loads; 150 watts at 1 kHz into 4-ohm loads.

THD: 0.025%.

SMPTE IM: 0.025%.

Frequency Response: 20 Hz to 20 kHz, +0, -0.3 dB at 100 watts; 10 Hz to 100 kHz, +0, -3.0 dB at 1 watt.

Dynamic Headroom: 1.2 dB.

Damping Factor: 70.

S/N: 110 dB, unweighted, re: rated output; 125 dB, A-weighted, re: rated output; 100 dB, A-weighted, re: 1 watt output.

Input Sensitivity: 1.0 V re: rated output.

Separation: 75 dB at 100 Hz; 53 dB at 20 kHz.

Dimensions: 19 in. W x 3½ in. H x 14 in. D (48.3 cm x 8.9 cm x 35.6 cm).

Weight: 31 lbs. (14.1 kg).

Price: \$449.

Company Address: P.O. Box 60271, Terminal Annex, Los Angeles, Cal. 90060.

For literature, circle No. 91



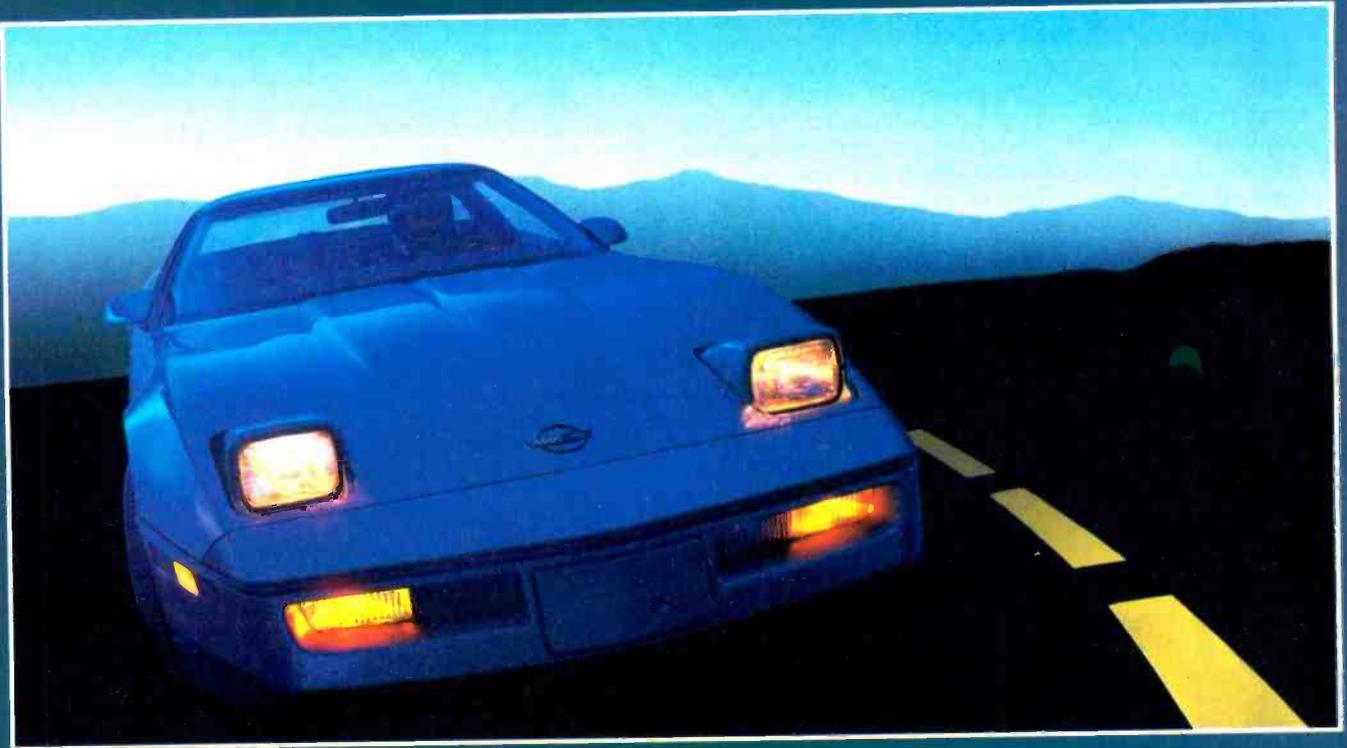
From all outward and inside appearances, the A202 seems to be a rather conventionally designed Class-AB power amp. It is built using an adequately large power transformer and filter capacitors, with good heat-sink structures properly positioned to dissipate the heat generated by the output devices. The A202 uses a complementary design, with mirror-imaged circuits to individually process the positive and negative halves of a musical waveform. A ring-core power transformer is used for improved headroom and low-impedance performance stability.

One of the things that differentiate this amplifier from others in its power class is its unique speaker-protection circuitry. The A202 is equipped with a fail-safe relay protection circuit. If, under any circumstances, d.c. or subsonic

frequencies appear at the amplifier's output terminals, the A202 will disconnect itself from the speaker loads and will remain disconnected until the problem has been corrected. The sensitivity of this protection circuit has been adjusted so that thumps caused by a tuner's muting, or by a user dropping a stylus on a record or flicking it to remove dirt or dust, will momentarily disconnect the speakers to prevent damage. However, some faint crosstalk across the relay can still be heard when the relay is open. The relay system includes a contact diode prevention circuit. This overcomes a problem often encountered with other relay protection circuits—a slight diode effect at high frequencies caused by oxidation forming on the relay leads.

The A202 also has an automatic thermal shut-off that will

BECAUSE TOO MUCH PERFORMANCE IS NEVER ENOUGH

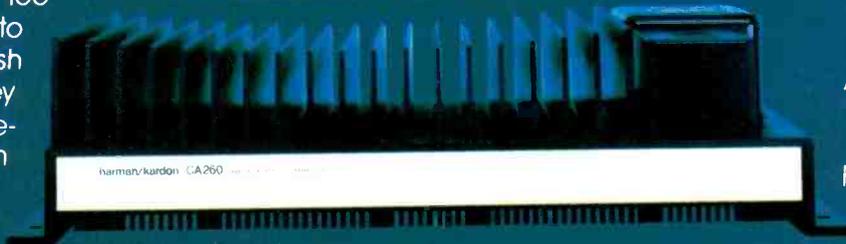


Harman Kardon's drive for sonic excellence has elevated the standards of high fidelity for over 30 years. Our striving for the ideal is often considered "too much" by our competitors. Now the pleasure of "too much performance" is brought to the automotive environment.

Our competitors must feel that 20-20,000Hz ± 3 dB is "too much performance" to expect from an in-dash cassette/tuner, or they would offer it. We believe it the minimum necessary for true high fidelity reproduction. Even our least expensive model offers this and other "over design" distinctions: Dolby[®]; dual gate MOSFET front ends, superior tuning sections, hand selected tape heads and heavy duty transports.



Shown: The new CH161 DIM[®]-mount in-dash cassette/tuner, and CA260 automotive amplifier.



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

Automotive high fidelity performance from Harman Kardon. It's too much.

For more information and your nearest dealer call toll free 1-800-525-7000, Ext. 201 or write 240 Crossways Park West, Box 9201, Woodbury, New York 11797.

harman/kardon

A Harman International Company

High Performance Necessities for the Mobile Audiophile.

[®]Dolby is the registered trademark of Dolby Laboratories, Inc.

The A202 protects speakers against d.c., subsonics and transient thumps, and protects itself against overheating.

power down the amplifier and let it cool if it has been overheated and poorly ventilated. If this occurs, the A202 will act as if it had been unplugged from the power line. After cooling, it will power itself up again automatically.

After the usual instructions about unpacking and installing this amplifier, the SAE owner's manual supplied for the A202 (as well as for the more powerful A502) offers a section entitled "A Short Story About Amplifiers." Essentially, this "story" spells out SAE's design philosophy when it comes to basic power amplifiers. I would call it a mildly conservative approach that emphasizes the need to accommodate a variety of unusual loudspeaker loads. Decrying designs which roll off bass response as a cost-saving measure, SAE is equally against those that offer d.c. coupling from input to output. As evidence that response down to d.c. is not required and is, in fact, poor design practice, they cite the fact that the RIAA playback curve for phonograph records calls for a 6-dB/octave roll-off below 20 Hz. And, as they rightly point out, should even a small amount of d.c. reach your loudspeaker's voice-coil winding, it will eventually cause the drivers to heat up, possibly melting the adhesive used to hold the voice-coil to the cone. It will also demagnetize the speaker's permanent magnet. They conclude by saying that d.c. on a loudspeaker can do absolutely no good (there's no audio information at "0 Hz") and will usually cause the loudspeaker system to deteriorate in quality, often to the point of failure. All this is by way of justifying the fact that the A202 and the A502 are a.c.-coupled power amplifiers. Both employ 4.7- μ F input capacitors ahead of the FET differential input amplifiers.

Control Layout

Considering the fact that the A202 is a basic power amplifier, it has one of the most strikingly attractive front panels I have come across in a long while. Perhaps SAE's motive in making it as good looking as it is was to discourage users from hiding the component away in poorly ventilated locations. In any case, the focal point of the front panel is a display that incorporates, for each channel, a 10-segment LED power/dB level indicator and a peak-indicating LED. The 10-segment indicators show relative power in either average-response or fast-response modes. The peak indicator shows instantaneous peak excursions in the program material. The displays for each channel fan out in opposite directions along the panel's width; when no signal is applied, a single LED at the center of the display, labelled "Idle," remains illuminated. LEDs to either side of this central one are calibrated in 3-dB increments from -24 dB (corresponding to 0.37 watt into 8 ohms) to +3 dB, where 0 dB is the nominal rated power level (100 watts).

To the left of the display is a rocker that actually controls two separate push-on/push-off switches behind it. Each switch turns a set of speakers on and off, so two pairs of speakers can be used singly or together. A similar-looking rocker arrangement is found to the right of the display. Again, the rocker really controls two separate push-on/push-off switches. The first of these is the main power on/off switch. Labelled "Standby," it activates the a.c. power relay that completes the circuit to the power transformer. (The relay is logic-controlled and powered from a separate

standby transformer that's always "on" so long as the power cord is plugged into a 120-V source.) The other end of this rocker, labelled "Fast Response," increases the LED power/dB level display's sensitivity so that the display more nearly shows peaks rather than average power levels.

All connections to the amplifier are made via a pair of phono-tip input jacks and two color-coded sets of quarter-turn quick-connect speaker terminals on the rear panel. The terminals will handle wire gauges from #16 to #12—and special speaker cables of heavier gauge if they have metal pin tips. SAE recommends that for runs longer than 25 feet, at least #14 gauge be used for 8-ohm speakers and #12 gauge be used for speakers having lower impedances.

Measurements

Driving fixed 8-ohm loads, the A202 delivered 112.5 watts of power at 1 kHz before reaching its rated THD level of 0.025%. SAE's broad-band rating of 100 watts per channel was obviously based upon the amplifier's low-frequency power-output capability, which measured 102 watts per

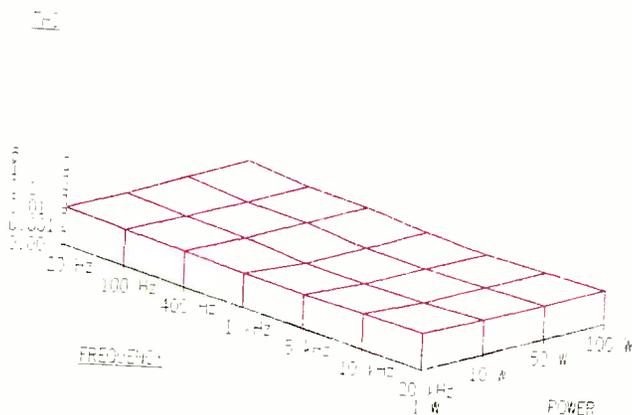


Fig. 1—Power output vs. THD and frequency for 8-ohm load.

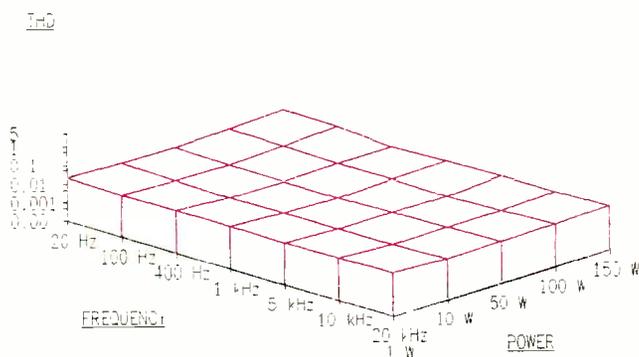


Fig. 2—Same as Fig. 1 but for 4-ohm load.

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, inter-cooled, 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

	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.

with an advanced anti-lock rear brake system.

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.



Division of Chrysler Motors

The very acceptable sound and long-term reliability of the A202 help make it an overall good value.

channel at the same THD level. Up at the 20-kHz end of the spectrum, the amp delivered almost as much power as it did at mid-frequencies: 111.01 watts per channel. The rated SMPTE IM of 0.025% was reached at an equivalent composite signal level corresponding to 116.3 watts per channel. Switching to 4-ohm loads, maximum power output at mid-frequencies was well above the SAE rating of 150 watts; I measured 161.2 watts per channel. This time, however, both low- and high-frequency output was restricted to 150 watts per channel for the rated THD level of 0.025%. Plots of distortion versus power-output levels and frequency are shown in Figs. 1 and 2 for 8 and 4 ohms, respectively.

I was surprised to find that the damping factor of the A202 was much higher than the certainly adequate 70 claimed by SAE. I measured a static damping factor of 330 for 8-ohm loads, using a 50-Hz signal as specified by the EIA Amplifier Measurement Standard.

Though SAE stresses the need for high current capability in modern amplifiers, the power levels achieved using 4-ohm loads suggest that the A202 is current-limited rather than voltage-limited. To produce a steady-state power level of 100 watts per channel into 8-ohm resistive loads requires a voltage of 28.23 V rms to be available at the output terminals, and the amplifier had no difficulty attaining this level. Current required for 100 watts into 8 ohms was just over 3.5 amperes per channel. With 4-ohm loads, however, the output voltage for even the higher 150-watt rating needs to be only 24.5 V rms, a value easily available from the A202's power supply. On the other hand, the current required for this power level is more than 6 amperes per channel (double that with both channels operating), which is about the limit of what the amplifier can supply. Had the A202's limits been based upon voltage, it should have been able to deliver double the 8-ohm power into a resistive 4-ohm load (200 watts per channel, instead of the rated 150 watts). All of this suggests that if this amplifier is to perform at its best, it should be coupled to speakers whose impedance does not dip much below 4 ohms at any frequency within the audible spectrum. If this precaution is not observed, it is likely that at peak loudness levels demanded by digital program sources, current limiting—and related non-linear distortion—might take place from time to time, especially if you tend to listen at relatively loud levels.

CCIF (twin-tone) IM measured a mere 0.003% using 8-ohm loads; it increased very slightly to 0.0035% using 4-ohm loads. Dynamic headroom was a bit short of the claimed 1.2 dB, measuring 1.0 dB for 8-ohm loads and 0.83 dB for 4-ohm loads. Overall frequency response at 1 watt was flat within -1.0 dB from 4 Hz to 220 kHz, and the -3 dB roll-off point occurred at 300 kHz.

Input sensitivity measured 100 mV for 1 watt output. Translating this to rated output (100 watts into 8 ohms) yields 1.0 V, exactly as specified.

There seems to be, however, some discrepancy between the various numbers for A-weighted signal-to-noise ratio published by SAE. The company's spec relative to 1 watt is 100 dB. Taking this figure as our base, then S/N relative to 100 watts (rated output) would be 20 dB greater, or 120 dB. Yet, the published figure of A-weighted S/N relative to rated output is 125 dB. When asked about this difference, SAE

said their original measurements were about 103 and 123 dB but got rounded off in different directions.

Normally, S/N in an amplifier is measured by applying 0.5 V of input and then reducing the output (by means of the amplifier's level control) so that only 1 watt of output is delivered to the load. Then the signal is removed, and the S/N ratio relative to that 1-watt output level is recorded. Because the A202 has no level control, I simply used the control on my test generator. This allowed me to set a signal level that would drive the amp to 1 watt output, which is a legitimate technique, albeit not quite within the terms of the test Standard. My measurement showed 87 dB, A-weighted, referred to 1 watt.

Use and Listening Tests

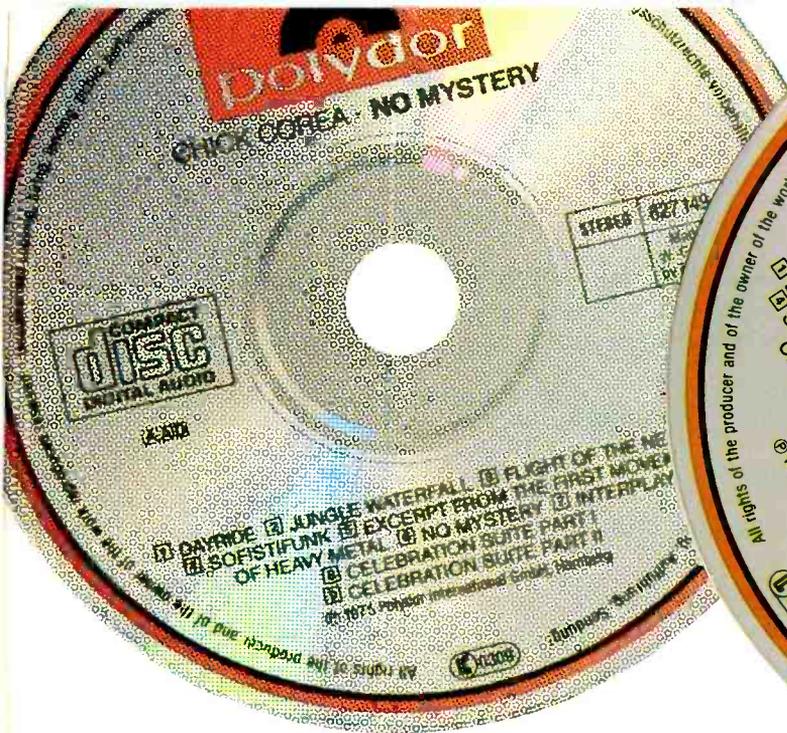
The A202 is in SAE's "high resolution" series of power amplifiers. If by high resolution they mean musical clarity, absence of audible distortion at normal listening levels, and good stereo imaging generated by wide-band response, with little or no phase shift even at the audio frequency extremes, then the A202 certainly qualifies. Incidentally, I noted during my bench tests that the amplifier does not invert input signals, an extra benefit for those listeners who feel that phase inversion of a music signal is a form of distortion or inaccuracy. I have yet to be convinced of this, but certainly agree that maintaining signal polarity from input to output can do no harm.

I would add, however, that listeners who play primarily digital material at rather loud levels through low-efficiency speakers can find, at times, that peaks seem somewhat compressed if not outright distorted. This is the current-limiting I talked about earlier, and it can show up under these particular conditions. Although I have not auditioned the higher powered version of this amplifier (the A502, priced \$200 higher), I have a feeling that its 3 dB of extra power available for the load conditions specified would make an audible improvement during moments of peak power demands. The extra cost of the A502 would then be worthwhile. I should mention, too, that this higher powered model can also be operated in bridged mode, for an output power of 600 watts into 8-ohm loads, should anyone desire that much power in a listening environment. Of course, then you'd need a pair of A502s. The A202, on the other hand, cannot be bridged in this way. In any event, the "dollars-per-watt" ratio of these SAE amps seems to be quite reasonable regardless of which of the two models you choose.

I did compare the sound of the A202 with that of a higher priced, d.c.-coupled unit that happened to be in my lab at the same time. Admittedly, this amplifier had higher power ratings, but as long as peaks (monitored on an oscilloscope) remained below clipping and current-limiting levels, I could detect no difference in sound quality between the two units. I can only conclude from this that SAE is quite right when they contend that the ability to "go down to d.c." contributes nothing to overall sound quality.

Overall, the SAE A202 offers good value for its price, very acceptable sound quality, and a measure of long-term reliability that should appeal to listeners who don't want to worry constantly about amplifiers harming their speakers or self-destructing.

Leonard Feldman



A visual representation of 16-bit/88.2 kHz oversampling, the current industry standard.



Yamaha's redefined HI-BIT standard 18-bit/176.4 kHz oversampling.

Yamaha has just redefined the compact disc.

The new Yamaha CDX-1100U brings a whole new definition to the term definition.

It does so by simply integrating the most innovative and advanced CD technologies ever. No doubt exactly what you expect from the leader in digital audio sound reproduction.

But if you think that's all we did to improve our new CD player, listen carefully. Because the CDX-1100U also employs HI-BIT technology no other manufacturer has even thought of.

Like quadrupling the sampling rate to 176.4 kHz, then combining it with our exclusive 18-bit



digital filter and 18-bit dual digital-to-analog converters. This unique combination produces waveform resolution accuracy four times greater than any other CD player on the market today.

What does all this accuracy mean? For starters, a more precise interpretation of the music that was always on your discs to begin with. A truer, more realistic soundstage, articulated without sacrificing musical warmth or smoothness.

Of course, there are other design features that put the CDX-1100U at the forefront of CD performance. Including a floating suspension system that eliminates vibration-induced signal modulation, and photo-optical couplings for a noise-free digital signal transmission.

And there's more than leading-edge technology to the CDX-1100U. There's also leading-edge convenience. By way of our 44-key wireless remote that has interactive control compatibilities, our 4-way repeat play, and our 24-track random programming that lets you play the music in the order you want it played.

If you'd like more details on Yamaha's latest advances in digital technology, write for a free technical white paper. But for the simplest and best explanation of our technological superiority, slip one of your compact discs into a CDX-1100U and push "Play."

Then you'll know you've finally heard it all.



YAMAHA 1887-1987

Yamaha Electronics Corporation, USA, P.O. Box 6660, Buena Park, CA 90622

3

TECHNICS CQ-H7500 CAR STEREO

Manufacturer's Specifications

Tuner Section

FM Usable Sensitivity: Mono, 13.2 dBf.

50-dB Quieting: Mono, 15.2 dBf.

S/N: Mono, 70 dB.

Frequency Response: 20 Hz to 20 kHz, ± 3 dB.

Capture Ratio: 1.5 dB.

Alternate-Channel Selectivity: 75 dB.

Image Rejection: 45 dB.

I.f. Rejection: 100 dB.

AM Usable Sensitivity: 32 μ V.

Cassette Section

Frequency Response: Type I tape, 30 Hz to 15 kHz, ± 3.0 dB; Type IV tape, 30 Hz to 18 kHz, ± 3.0 dB.

S/N: 56 dB; 66 dB with Dolby B NR; 74 dB with Dolby C NR.

Wow and Flutter: 0.09% wtd. rms.

Separation: 48 dB.

Fast-Forward and Rewind Time: Less than 90 S for C-60 cassette.

Preamp and Graphic Equalizer

Equalizer Control Range: ± 12 dB at 65 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz, and 10 kHz.

Frequency Response: 10 Hz to 40 kHz, $+0$, -3.0 dB.

THD: 0.01%.

Loudness Contour: +10 dB at 100 Hz.

Output Voltage Level: 0.6 V at 1 kHz for 75-kHz FM deviation.

General Specifications

Current Consumption: 0.7 amperes.

Dimensions: 7 in. W \times 5 $\frac{7}{8}$ in. D \times 1 $\frac{15}{16}$ in. H (17.8 cm \times 15 cm \times 5 cm).

Weight: 3 lbs., 15 oz. (1.8 kg).

Price: \$700.

Company Address: One Panasonic Way, Secaucus, N.J. 07094.

For literature, circle No. 92



The standard DIN dashboard cutout (7⁵/₃₂ by 2³/₃₂ inches) seems to have posed something of a challenge to innovative car audio equipment designers. These relatively small dimensions have induced manufacturers to see just how many useful operating features they can cram into a product. If the Technics CQ-H7500 is not a clear winner of this contest, it certainly comes close. I found it hard to believe just how versatile this little system is. The tuner section has six AM and six FM presets and scanning capability (with 5-S pauses at each received station). An effective FM optimization circuit not only provides stereo FM blending when weak signals are encountered but also switches from stereo to mono when necessary, mutes treble if noise is excessive, and even reduces output when FM reception becomes intolerably noisy. Tuning is by means of quartz-referenced phase-locked-loop frequency synthesis. The display shows either station frequency or clock time, switchable at the push of a button.

In addition to its tuner section, the CQ-H7500 includes a cassette player, of course, with auto-reverse transport, Dolby B and C noise reduction, and programmable tape search, among other features. The unit also includes a seven-band graphic equalizer with six preset equalization curves (three set at the factory, three set by the user) and a real-time spectrum analyzer. To make room for all these controls, the designers had to make most of the buttons on the front panel perform at least two functions, and sometimes three.

Control Layout

A rotary volume-control knob at the left of the CQ-H7500 doubles as a channel-balance control when it is pulled forward. Concentrically mounted behind this knob is a ring which acts as a front-rear fader control if you have separate amplifiers for the front and rear speakers. Above the rotary knobs are four tiny pushbuttons. The lower pair is used for turning on the "FM Optimizer" circuit and the loudness compensation circuit. The upper two buttons are used to individually defeat the equalizer settings for front and/or rear speakers. The buttons for front and rear equalizer defeat and for the FM Optimizer have tiny LED indicators which show when these functions are in use.

Just to the left of the panel's center are two display areas. The main display not only shows station frequency and clock time, but also tells you which tuner preset you have selected and whether an FM signal is being received in stereo. During tape operation, the display tells you the direction of tape travel and whether the transport is in play, fast-forward, or rewind mode. It also has indicators showing selection of metal-tape (70- μ S) equalization, repeat play, blank skip, and the music-sensor feature (including the selection it has been programmed to find), and shows which noise-reduction system is in use. In either tuner or tape mode, the display also shows if loudness compensation is in use and indicates which preset equalizer curve, if any, has been selected. All this information is displayed in an area just over 1.3 inches wide, yet all of it is legible and easily interpreted once you learn how to operate the unit.

The second display, just below the main one, shows either the real-time spectral content of the music or the

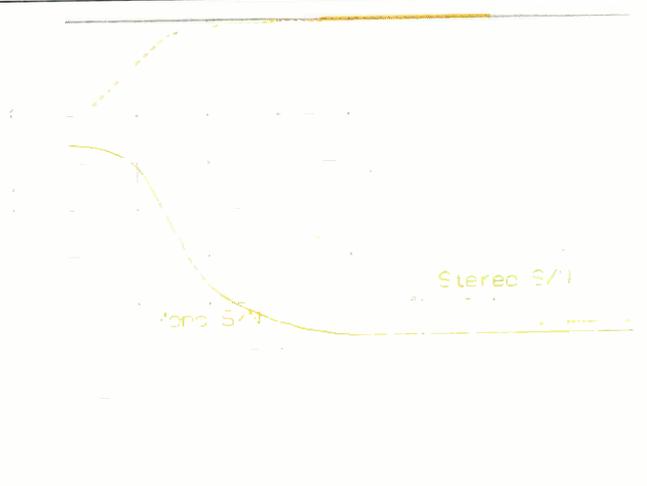


Fig. 1—Mono and stereo quieting characteristics, FM section.

equalizer curve in use. This display is the same width as the one above but slightly taller.

The cassette slot is to the right of the main display; to conserve space, cassettes must be inserted sideways. Tape play starts immediately after the cassette is inserted, and the only way to stop it is to eject the tape or to switch to tuner operation (by pushing the "Tuner" button at the right of the cassette slot). If the tuner is selected while listening to a tape, the tape will be ejected automatically, but if power is switched off before a tape is ejected, the tape will not eject automatically, though the pinch roller will release. This is the only thing that bothered me just a bit about the tape player's ergonomics. In addition to the pushbuttons for stop/eject, fast forward, and rewind located beneath the cassette slot, there's a button labelled "TPS" (tape program search) and one labelled "PRG," used for reversing the direction of tape travel. Of course, if a tape comes to an end, tape reversal takes place automatically.

The buttons which operate the tape transport double as the scan, seek, and up/down manual tuning keys in radio mode. When setting equalization curves, two of these buttons also serve to boost or cut response in any of the seven graphic-equalizer frequency bands and to shift the adjustment function from band to band. The legends which indicate tape functions for these buttons illuminate only when a tape is playing, but the legends for tuner and equalizer functions are lit at all times.

Along the bottom edge of the panel are seven smaller buttons. The first is used to initiate equalizer adjustment or selection of memorized curves. The other six are multi-functional: When a tape is playing, they select playback equalization, Dolby B or C NR, repeat play, and blank skip

Technics has included just about everything, even a few features that most users wouldn't have thought of but will enjoy.

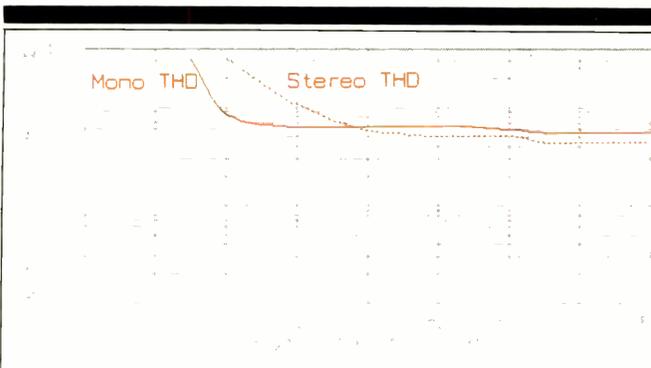


Fig. 2—Mono and stereo distortion characteristics at 1 kHz, FM section. Minimum distortion values are 0.5% in mono, 0.4% in stereo.

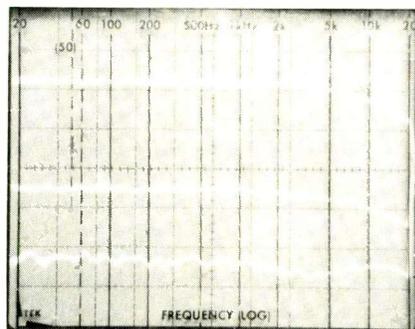


Fig. 3—FM frequency response (top trace), separation for strong signals (bottom), and separation for weak signals with FM Optimizer activated (middle).

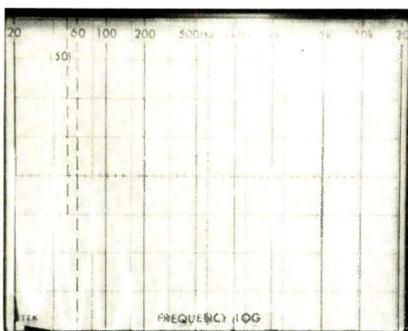


Fig. 4—FM stereo crosstalk and distortion for a 5-kHz modulating signal.

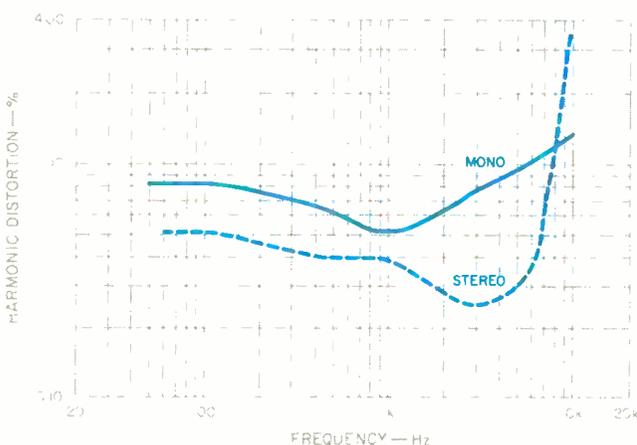


Fig. 5—Harmonic distortion vs. modulating frequency, FM section.

(which puts the transport in fast forward when spaces of more than 15 S are encountered between selections). When the radio is playing, these buttons are used to store or select the station presets. And when the equalizer button has been pushed, they control preset-curve memories.

At the extreme right of the panel, just below the "Tuner" button, are three more buttons arranged in a vertical row. The uppermost switches the lower display between the EQ-curve and real-time analyzer modes. The middle button toggles between AM and FM, and the bottom button toggles between clock and frequency displays.

As you can see, Technics has thought of just about everything—and included a few things most users would never have thought about but will be glad to have.

All connections to the CQ-H7500 are via DIN plugs designed to match those on Technics car amplifiers, CD players, and other components. For use with other manufacturers' equipment, Technics makes DIN-to-RCA adaptors for \$23 each. The amplifier adaptor (Part No. CA-DR11EU) also includes power and ground connections. If you are as frustrated with the car stereo industry's nonstandardized DIN plugs as I often am, you'll want to purchase this accessory if you will be using the CQ-H7500 with power amplifiers not made by Technics. Note that if you plan to use only one amplifier with the CQ-H7500, the DIN socket from the amplifier or the adaptor *must* be connected to the rear-amplifier DIN plug on this tuner/player or you won't get power to the unit. Two such adaptor kits are needed if you plan to use separate stereo amplifiers for front and rear speakers. The CQ-H7500 also has a DIN connection for a CD player or other auxiliary source. If your CD player is not a Technics model, it will also need an adaptor, but since the amplifier outputs have male DIN plugs and the CD input has a female jack, a different adaptor will be needed (Part No. CA-DR12).

Tuner Measurements

Mono usable sensitivity measured 13.5 dBf, close enough to the 13.2 dBf claimed by Technics. In stereo, 20 dBf of

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

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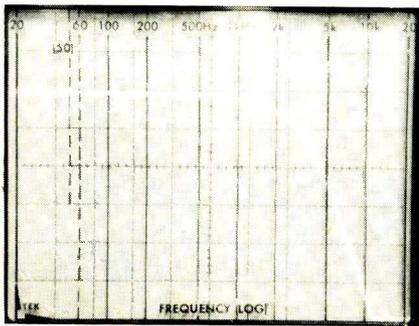


Fig. 6—AM frequency response.

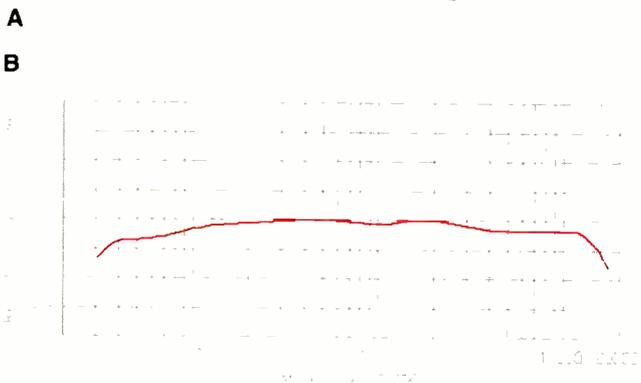
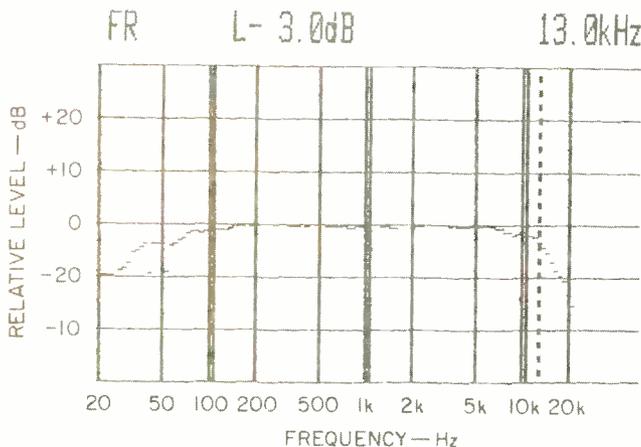


Fig. 7—Frequency response, tape section, for Type I (A) and Type II (B) tapes.

input signal was needed to reach the 3% (-30 dB) noise-plus-THD level which constitutes usable sensitivity. Figure 1 shows how residual noise varies as a function of input signal level, and Fig. 2 shows how THD at 1 kHz varies with input level. At signal levels of 40 dBf or higher, THD in stereo was actually lower than it was in mono: I measured 0.4% for stereo as against 0.5% for mono. FM frequency response and separation are shown in the spectrum analyzer 'scope photo of Fig. 3. I suspect that response was deliberately rolled off at the high end, even for strong signals. You can see the roll-off in the top trace of Fig. 3; it amounted to -5.0 dB at 10 kHz and -7.0 dB at 15 kHz. Figure 3 also illustrates one of the actions of the FM Optimizer circuit. The bottom trace shows full separation in the presence of a strong signal; it measured in excess of 40 dB at mid-frequencies, 38 dB at 100 Hz, and more than 30 dB at 10 kHz. When a weaker signal was applied to the tuner (around 40 dBf) and the Optimizer button was pressed (middle trace), separation decreased across the entire frequency band owing to some judicious "blending" which, at the same time, reduces background noise.

Figure 4 shows stereo separation (the difference in height between the tall spike at the left and the shorter spike within it) for a 5-kHz modulating signal. It also shows the spurious distortion and crosstalk products that are present at the unmodulated channel's output. These spurious products, including spikes of rather high amplitude at 38 kHz (the subcarrier frequency) and at 5 kHz to either side of that subcarrier product, are considerably higher than they usually are in home FM tuners or receivers. The higher-order harmonics are also considerably greater than what I usually find for home tuners. This is consistent with the overall higher THD readings, even for a 1-kHz signal, shown in Fig. 2. The subcarrier product and its sidebands aren't much of a problem in car audio since those ultrasonic frequencies are inaudible and are only of concern when FM signals are to be recorded on tape—something not likely to be done with a car audio system.

Figure 5 shows how harmonic distortion for the FM tuner section varies with modulating frequency. The high THD figure (approaching 4.0%) for stereo is more the result of "beats" between the 19-kHz pilot carrier and the modulating frequency (in this case, 10 kHz) than it is actual harmonic distortion. Nevertheless, since those beats do fall within the audio band, even the 20-kHz low-pass filter that I used in making these measurements did not lower the percentage substantially.

Capture ratio for the FM tuner section was 1.5 dB, exactly as claimed. Alternate-channel selectivity was actually a bit better than claimed, measuring 77 dB as against Technics' figure of 75 dB. I.f. rejection was better than 100 dB, but image rejection merely reached the unimpressive 45 dB claimed by Technics.

The frequency response of the AM tuner section (Fig. 6) was at least flat down to the lowest bass frequencies, but its treble response was very limited. There's no need to comment yet again about the limited bandwidth of AM tuners, particularly those in car audio systems. If you want long-distance AM reception, especially at night, without whistles, birdies, and adjacent-channel interference, you have to



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Compared to most of the car players I've tested, frequency response with both normal and high-bias tape was above average.

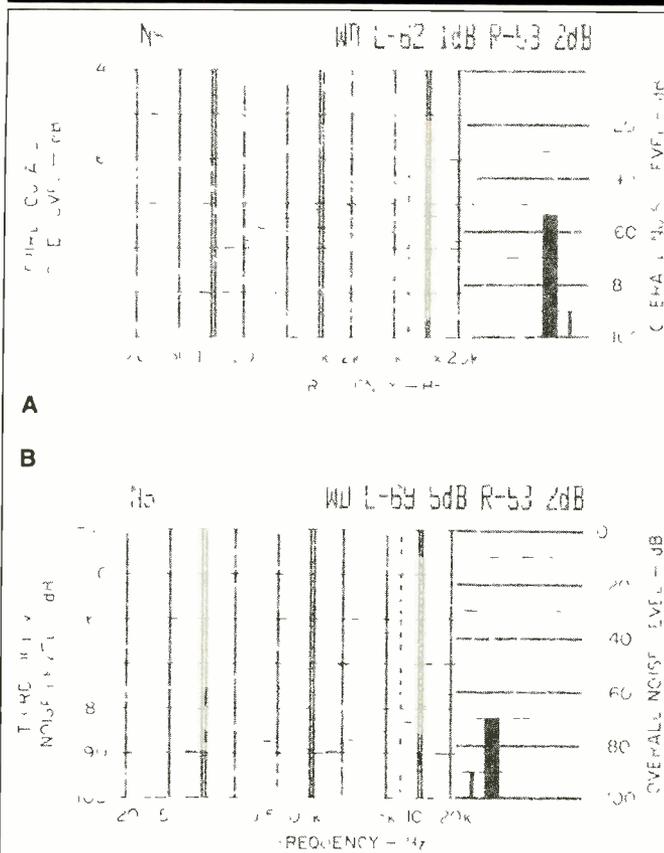


Fig. 8—A-weighted S/N analysis, tape section. In each figure, upper curves show S/N without NR. Lower curve in (A) is S/N with Dolby B NR; lower curve in (B) is with Dolby C NR. (See text.)

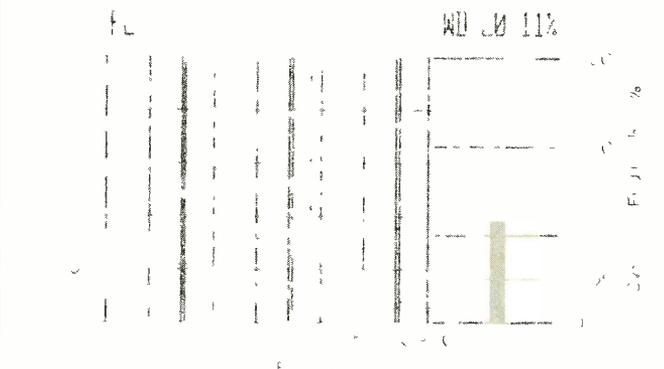


Fig. 9—Wow and flutter, tape section.

either settle for a tuner with limited treble response or get one whose makers went to the expense of adding a whistle filter. Despite its limited frequency response, however, the CQ-H7500 had its share of birdies.

Cassette Player and Equalizer Measurements

Figure 7A shows the frequency response obtained using normal (120- μ S) tape. Response was down 3.0 dB at 13.0 kHz. I also measured response using a high-bias (CrO₂) test tape (Fig. 7B); for this I had to plot response on a point-by-point basis, since the tape has spot frequencies rather than a continuous sweep. In all such response measurements, bear in mind that even a slight azimuth difference between my test tapes and the player's tape playback head could account for the slightly poorer-than-claimed response for this deck. On the whole, I consider the results obtained with both the normal and the high-bias tape to be above average compared to most car cassette players I've tested in the past.

Figures 8A and 8B represent A-weighted signal-to-noise analyses using Type I tape that had been recorded with no signal applied. In both graphs, the upper curve (and the readout for "R" of 53.2 dB) represents the overall S/N measured without Dolby noise reduction. The reference is to Dolby level (200 nWb/m); if it were to the 250-nWb/m level now becoming standard, you could add another 2 dB to each result. In Fig. 8A, the lower curve and the 62.1-dB readout represent results obtained with Dolby B noise reduction. In Fig. 8B, the lower curve and the 69.5-dB readout are for Dolby C noise reduction. At 6.3 kHz, weighted S/N was 63.8 dB without noise reduction, 74.1 dB with Dolby B NR, and 86.4 dB with Dolby C NR.

Wow and flutter measured 0.11% wtd. rms, fractionally higher than claimed by Technics. An analysis of the wow-and-flutter components, shown in Fig. 9, reveals that the chief contributor to this figure is a flutter component at around 16 Hz. My analysis of azimuth error revealed a not-too-unusual result. Overall azimuth error with a tape travelling in the forward direction (plotted in Fig. 10A) was actually quite low and certainly acceptable. When the tape travelled in the reverse direction (Fig. 10B), azimuth was worse, even with Technics' compensating azimuth-correction circuit. This is indicated in Fig. 10B by the phase change of over 180° at the 5.7-kHz signal frequency. Since this particular frequency is not very high, one may conclude that azimuth errors of more than 360° will take place at higher frequencies. The audibility of such deviations from linear phase response is, however, open to discussion.

Use Tests

Every time you touch any button on the control panel of this unit, you get a confirming beep to tell you that you did indeed hit a button and not a blank spot on the panel. This lets you keep your eyes on the road.

The controls did not strike me as tricky, except for setting new EQ curves. The buttons used to perform this allow you only 5 S for each entry of a given band's response. During those 5 S, a light blinks to let you know you can proceed. If you try to change settings after the light stops blinking, the button you push in this attempt will simply change AM or FM

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The displays were crisp and easy to read by day or night, and the real-time analyzer was informative but not distracting.

frequencies. (That's one of the penalties of having multi-function buttons.) In the owner's manual, Technics warns users not to try setting the EQ curves while driving, as the procedure takes great concentration and deft fingers, to which I say a loud amen.

Of course, on the lab bench (or even in a parked car), the job can be accomplished after a few attempts; Figs. 11A and 11B show two arbitrary equalization curves that I programmed into the unit's memory, where they could be recalled safely while driving. However, considering the fact that three nonerasable equalization curves have been programmed in at the factory (intended for classical music, rock music, and instrumental/pops programs), it hardly seems worth the extra effort.

There would be little point in my conducting listening tests of the CQ-H7500 in my lab. It deserves to be auditioned in a moving vehicle, with a good set of amplifiers and speakers, a job I leave to Technical Editor Ivan Berger. I can only repeat my amazement at the ingenuity of Technics' engineers, who managed to incorporate so many features into a head unit as tiny as the CQ-H7500. If nothing else, this incredibly versatile and feature-laden component will certainly be a conversation piece. *Leonard Feldman*

Behind the Wheel

The human-engineering aspects of the CQ-H7500 are rather good, especially when you consider this is part of Technics' first full line of car stereos. The displays are very clear by day or night, and most of the controls are shaped and spaced to be very easily distinguished from each other.

Many car stereos gain panel space by changing various buttons' functions according to the operating mode. Technics did it a bit better than most manufacturers by giving each button, whenever possible, functions which are analogous to one another. Thus, for instance, the same button which tunes down the radio dial rewinds the tape, lowers the level in an equalizer band, and shifts down to the next lower EQ band.

In tuner mode, the major controls (up and down manual tuning plus one-way scan and seek) were fairly easy to find and easy to use, and I liked the variety of tuning systems offered. The preset-station buttons, however, were not as good. A row of seven identical buttons strikes me as too long.

I had difficulty distinguishing by touch between the rounded function-indicator arrows molded into the main control buttons. And, being black on black, they were difficult to see. Since the display of EQ curves is always visible, whether the EQ is switched in or defeated, it's easy to think that the equalizer is in use when it isn't—especially since the LEDs in the defeat switches go on when the equalizer is turned off, are some distance from the EQ display, and are hard to see in direct daylight.

Setting equalizer curves would be easier if you had more than 5 S after switching into equalizer mode to set curves, or if you had to press the equalizer button a second time to end the equalizer-setting mode. Also, the setting method is a bit unusual. The same buttons that raise and lower level in each EQ band also shift between those bands: You press the button twice to change the level, then hold it down to

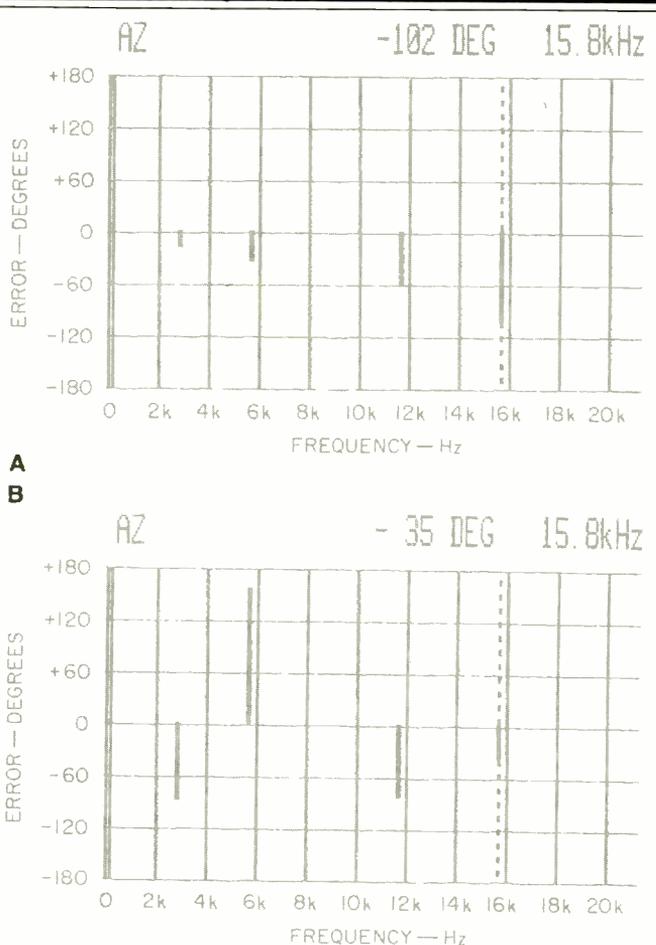


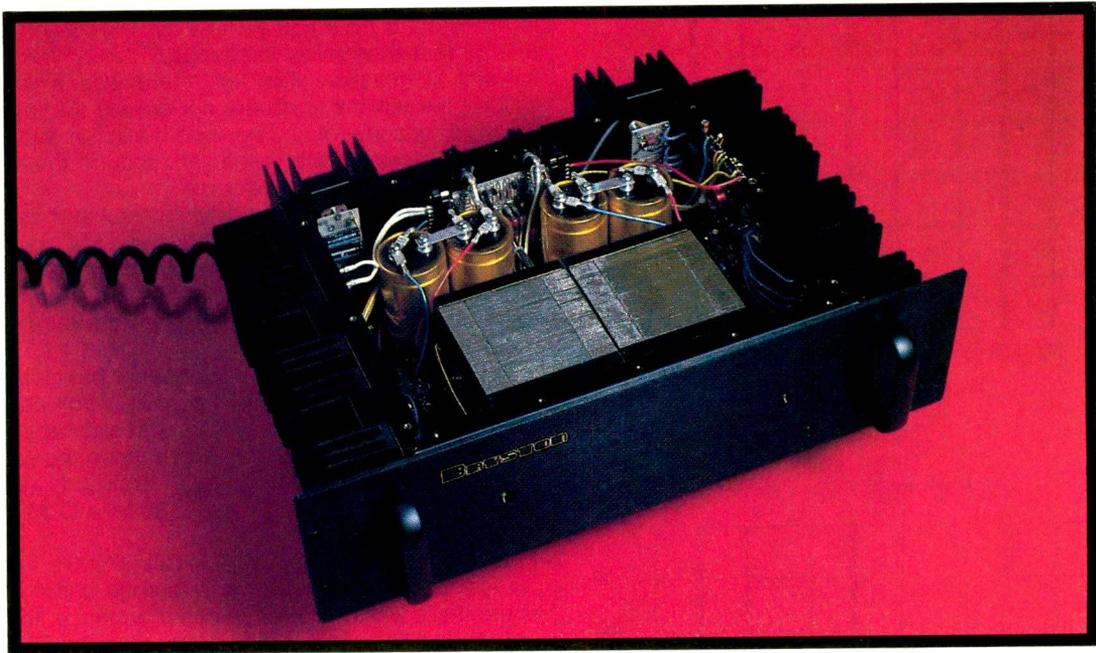
Fig. 10—Azimuth error for forward (A) and reverse (B) directions of tape. (See text.)

move to the next band. Timing is rather critical, and the instructions aren't as clear or emphatic as they could be.

Other than that, the equalizer controls were excellent. When you're driving, having pushbutton selection of preset EQ curves makes a lot more sense than having to adjust all seven bands from scratch, and a scan button lets you automatically run through the six preset curves to hear which sounds best for the current program material. The factory-set "classical" curve looks weird—it has heavy boost at 65 Hz, 500 Hz, 2 kHz and 10 kHz, heavy cut at 250 Hz, mild cut at 1 kHz, and no change at 4 kHz. But it sounds okay—rather like a subtle high-end boost, for some odd reason. The "rock" preset (full boost at 65 Hz, flat from 250

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The general sound seemed musical and clear, and the softness of the treble in tape and FM modes wasn't objectionable on the road.

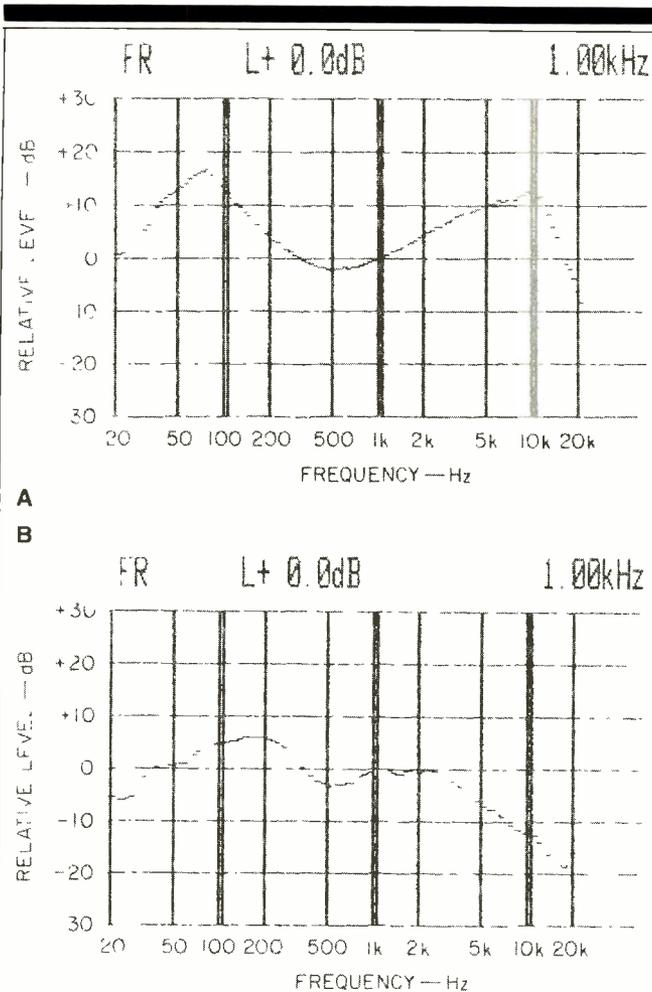


Fig. 11—Two examples of the complex curves that can be produced with the seven-band equalizer section.

Hz to 1 kHz, and progressively increasing boost above that) was very good for that type of music. The "pops" curve (mild boost from 250 Hz to 2 kHz, mild cut at 10 kHz) added a pleasant warmth; surprisingly, I preferred this curve for AM despite the AM tuner's already pronounced treble roll-off. Having independent equalizer-defeat switches (though not independent equalization curves) for front and rear was a good touch, too.

The real-time spectrum analyzer display surprised me. The LCD display, while crisply readable, was far less distracting than dancing-LED displays are; the peak-hold feature also helped. From time to time, the information shown proved useful rather than merely entertaining. For example,

I discovered one reason some of my tapes of old radio programs sound so harsh: They have virtually equal energy in every band from 250 Hz to 2 or 4 kHz, and virtually no energy above or below this range.

Night illumination was fair; there was a glowing halo around the volume knob but not around the tape slot. The black buttons are, of course, invisible in the dark—illuminated halos around them (especially around the seven lower buttons) would be very welcome.

Generally, the sound seemed musical and clear, and the softness of the treble, in both tape and FM, was not objectionable on the road. When switching from tape to tuner, the FM did not boom out louder than the tape, a common problem, but was slightly softer than the tape, which was good.

The tape deck sounded a bit warmer but clearer than my new reference unit (a Soundstream TC-308), and the Technics had more tolerance for tapes with high recorded levels. On my tapes, the sound was pretty much the same in both forward and reverse directions. Dolby C NR tracking seemed good. Rewind time was 2:39 for a C-90 tape, which seems a bit slow.

On most stations, FM or AM, CQ-H7500's tuner section did just about as well as the reference unit's. On stations where there was a difference in performance, the reference unit tended to do just a little better than the Technics. In a static test in the Hartford, Conn. area, the reference unit was better on 16 FM stations (mainly in the lower half of the band) and the Technics was better on eight (mainly in the upper half of the band). In New York City, on a corner chosen for horrific multipath, the reference unit did slightly better on 16 stations, the Technics on four. On AM, in Hartford, the reference unit got 14 stations better while the CQ-H7500 did better on only eight; this difference was largely due to the Technics' pronounced whistle on weak signals. In New York, where the signals were stronger, the two AM sections performed identically. On the road, however, the reference unit seemed to pick up noticeably more good signals and was definitely able to keep receding stations listenable for a few more miles than the Technics. Incidentally, with strong AM signals on the Technics, there was enough high-frequency content to register (though just barely) on the RTA's 10-kHz band.

The FM Optimizer had no effect on stations that already came in well, and no useful effect on those that came in only poorly, but it was very useful on stations whose quality was fair to pretty good. On "multipath corner" in New York, the Optimizer gave an audible improvement to 13 of 49 FM stations. (In my Hartford test, it temporarily refused to turn off—the only problem I encountered in my tests—so I could not make comparisons.) As signals grew weaker, the loss of separation caused by the Optimizer circuit grew more obvious, but the accompanying reduction in noise was well worth it.

Overall, I feel warm but not wild about the CQ-H7500. Its features are very well thought out, and its performance and ergonomics are much better than average. That's good going for a first car stereo product, but I bet Technics will do even better by the time its second or third car stereo generation rolls around.

Ivan Berger

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Sound: B- Performance: A-

The The is 25-year-old guitarist/key-boardist/singer-songwriter Matt Johnson, who would probably bristle at the term "one-man band" since he used about two dozen talented sidemen and three coproducers on *Infected*. He's also an egalitarian kind of guy, and that fact throbs through every groove of this savage indictment of Western values.

Infected is jangly and raw and can get on your nerves, but it also knows when to let up. In "Infected," an angst-ridden push-pull between survival and despair, the lyrics are dire and Johnson's singing is street-tough, but he offers a sweet female chorus and Spanish horns as counterpoints. He contrasts the anger of "Heartland" with a jaunty jazz piano that expertly makes his dark message bearable without defusing it. In "Angels of Deception," the tempo shifts and the arrangement changes from rock to almost gospel to punctuate Johnson's point about the divine hell we've made for ourselves.

Musically, *Infected* dares you to be bored. Go ahead—try to pick a description off the rack and make it fit this album. *Infected* cross-pollinates so

The Joshua Tree: U2
Island 90581.

Sound: C+ Performance: A-

U2 has always submerged its sweet, corny messages within fancy stuff. You know—love lost, love regained, love imagined. If the Irish-Christian quartet weren't as forceful and melodious as they are here, vocalist/lyricist Bono (Paul Hewson) might have found himself up to his knees in the stuff that makes corn grow.

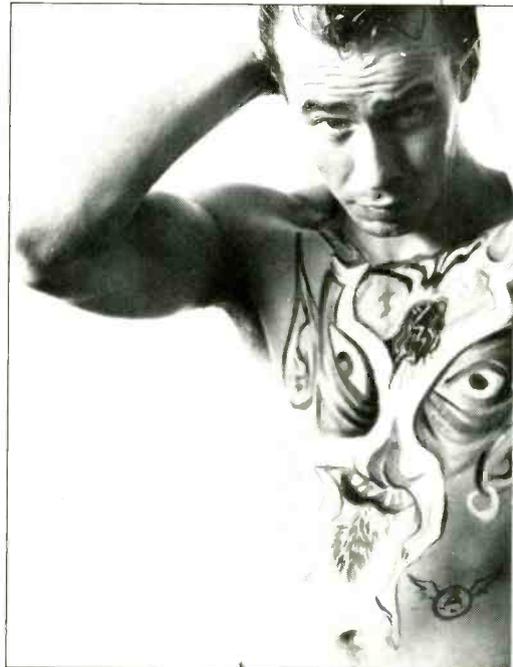
In the tense opening thrum of *The Joshua Tree*, dawn breaks over the desert like an eerie portent of things about to happen. Which they do—quickly. Somewhere early in this dense assemblage of sound evoking religion, humanity, and nature comes a feeling of apocalypse without apocalyptic crescendos. The world ends neither with a bang nor with a whimper; in fact, it doesn't end at all. It just winds up looking bleak and hopeful at the same time.

In spare, dark melodies and uniformly mid-tempo rhythms, *The Joshua Tree* assumes a mantric feel, its compositions punctuated by quick bubbles of guitar and cymbal rings which strike like inspiration. There are no soaring highs, no "Pride (In the Name of Love)." Likewise, except for the lilting but too-predictable "With or Without You," there are no hook-laden ditties.

Face it—U2 doesn't ditty well. What it does do well (with the distinctive guidance of coproducers Daniel Lanois and Brian Eno) is encircle you with a just-off-beat sound that swirls closer and closer. In "I Still Haven't Found What I'm Looking For," it's a chugging, twangless country-gospel swirl; in "Mothers of the Disappeared," it's like a marble running round a circular metal track.

Plunk in the middle of those tight musical twisters are images of harsh, bitter landscapes racked by elements older than human existence. Bono's characters burn and scorch and run in circles; religious iconography crops up as Jacob wrestles an angel. By the final songs, nature—the repository of a knowledge that technological humankind doesn't grasp—merges with us in tragedy.

The Joshua Tree doesn't convince completely; in "Bullet the Blue Sky," for instance, U2 tries to be tough and lyrical at the same time. As a result, they overkill the point, and the song comes off like reheated Doors. Such inevitable lapses aside, however, *The Joshua Tree* is an almost unbroken string of exquisite small moments. It deserves a pressing better than what this copy received; the ticks and pops in the silent passages sometimes made the music sound like milk poured on dry breakfast cereal. *Frank Lovece*



Photograph: ©1987, Ebet Roberts

many forms that the closest you can get to neat categorization is to call it Jaggeresque/Tom Waits-ish folk/punk/jazz/cabaret—a circus of slashes that surrounds the target without hitting it. But at least it conjures the record's multi-faceted aura.

Johnson's tunefulness could have undermined his serious intent; instead, it keeps his theme of existential ennui from becoming overbearing: "I don't want to be with any people I know, but God knows, I don't wanna be alone," he sings at one point. *Infected* may not be "The Wasteland," but, on the other hand, you can dance to it.

Frank Lovece

Never Let Me Down: David Bowie
EMI America PJ-17267.

Sound: B- Performance: B-

David Bowie has made some very good records and a lot of bad ones. Considering that *Never Let Me Down* is getting plenty of push, it would be nice to say that it belongs in the former group. Unfortunately, the album is a hollow pile of twaddle.

Peter Frampton plays some nice, bluesy guitar here but sounds like he's been over-influenced by Stevie Ray Vaughan's bits on Bowie's *Let's Dance*. Standby Carlos Alomar plays guitar and guitar-synth but remains very much in the background. Producer David Richards did a far better job on Iggy Pop's last record, which was nice and spare, compared to this congested thing.

And the songs! There are exactly two passable—not even brilliant—songs here, and each appears on the close of a side. The rest of the songs—and we use the term "song" loosely—are collages of chord progressions and half-melodies which don't seem to go anywhere except where the lyrics demand. Whereas on *Ziggy Stardust* Bowie had a seemingly natural melodic writing style, and on *Let's Dance* he was able to phrase well to Nile Rodgers' progressive funk grooves, here Bowie delivers neither a melody nor a happening beat. He has made a soulless drum-machine record that has him crooning over mush.

Sonically, this album resembles the worst of Bowie's *Diamond Dogs/Aladdin Sane* period, except that what once

was disturbing now just seems cluttered. Any emotional force is diminished by the digitized sounds; what should have been sweetening is now foreground.

So *this* is David Bowie's return to guitar-rock, his comeback, his last great record before retirement? Matey, we've been shown this emperor's new clothes too many times already.

Jon & Sally Tiven

Stand Up: The Del Fuegos
Slash 9 25540-1.

Sound: B+ Performance: B+

Lean and gnarly, The Del Fuegos' *Stand Up* growls out a bluesy, Boston-barroom pop that evokes a streetwise urban landscape full of Springsteen *verité* images and Heartbreaker love songs. (Tom Petty makes a guest appearance.)

Dan Zanes' songwriting has matured considerably since the previous LP, with highlights including the Albert Collins-like R&B of "Wear It Like a Cape," the sleazy down-and-outness of "He Had a Lot to Drink Today," and the decadent irony of "A Town Called Love" (with James Burton on guitar).

Mitchell Froom's noteworthy production has also gotten more sophisticated, with Zanes' quirky vocal gravel



placed in an airy sonic tapestry of sparse arrangements that capture the band's grungy style and enthusiasm. For instance, check out the subtle echo effects and use of space on "Scratching at Your Door."

Stand Up is good, basic rock 'n' roll—not likely to win awards for innovation, but likely to earn repeated spins on your turntable

Michael Wright





The sound of *Never Enough* is mainstream rocking pop, sinewy and hard-edged, with strong yet vulnerable singing by Patty Smyth.

Lauper's debut, *She's So Unusual*, will strike again with Patty Smyth's *Never Enough*. Album producers Rick Cherstoff and William Wittman produced and engineered (respectively) that Lauper album. Head Hooters Rob Hyman and Eric Bazilian play keys and guitar and contribute backing vocals here, much as they did for Cyndi. The Neil Jason/Anton Fig rhythm section is another connection to Lauper.

It should add up to a hit album, too, because *Never Enough* delivers in the one department that matters most: The songs. The choices are very smart and very effective in showcasing Smyth. Some of the best are the title track, which was originally done by Baby Grand (the group Hyman and Bazilian were in before The Hooters); "Give It Time," another Baby Grand song; Tom Waits' "Downtown Train," and the Nick Gilder song "Tough Love."

The sound of the album is mainstream rocking pop—sinewy and strong and a bit harder edged than the

Lauper debut. Added touches include a David Sanborn sax solo in "Downtown Train," Magic Dick's harmonica solo in "Give It Time," and Philadelphia rocker Tommy Conwell's guitar solo in "Isn't It Enough." Rick Di Fonzo, former guitarist of The A's, is another key presence throughout the album. There may not be any trailblazing going on here, but solid and satisfying rock it is.

As it should be, the glue of the album is Patty Smyth's singing. Strong yet vulnerable, Patty develops a real musical personality through the course of *Never Enough*. She has more dimension here than in her previous work with Scandal. Where her singing on the last Scandal album was strong, it was somewhat strident too, and Smyth avoids that trap nicely this time. She also shows real femininity, which one might contrast to the stance and style of Chrissie Hynde or Ann Wilson.

It looks very much like Patty Smyth has arrived with *Never Enough*.

Michael Tearson

Never Enough: Patty Smyth
Columbia FC 40182.

Sound: B Performance: B+

No doubt about it. Columbia must definitely hope the same platinum lightning that struck with Cyndi



Prince's latest sampler of funk, rock, dirty talk, clever pop, and slow blues has some of his best guitar work to date.



Inside Story: Grace Jones
Manhattan ST 17242.

Sound: B Performance: B

Question: How does someone who is primarily not a musician or singer go about making a record? Answer: She gets a lot of help.

Grace Jones' collaborators on this recording excursion are composer Bruce Wooley ("Video Killed the Radio Stars") and producer Nile Rodgers (Chic, Duran Duran, Bowie), both of whom are extremely creative and artists in their own right. So what basically happens is that the two of them come up with a musical track, and Grace writes some lyrics and a melody to go on top of it—fair enough.

The musical style that Grace grafts her lyrics onto is the prototypical Rodgers modern pop, with all those danceable synth-drum beats. It's not so much a style of its own as a conglomeration of the same musical stylings you've heard on previous Rodgers

projects. Like Billy Idol, Grace is more of a cartoon character than a flesh-and-blood singer. She sings on key and with character, but her voice isn't exactly loaded with emotion or interesting inflections.

"I'm Not Perfect" is a pretty good song; it also epitomizes the spirit of the album—not *the* ultimate record, but maybe *Grace's* ultimate record.

Jon & Sally Tiven

Sign 'O' the Times: Prince
Paisley Park 9 25577-1, two-record set.

Sound: B+ Performance: B

Part of Prince's popularity has always come from his willingness to exhibit the deeper levels of his desirous nature through one of the widest picture windows in the pop hotel. Having seen Prince display a whole circus of sensual extremes over the years, we've come to expect more of the same, with few sensibilities left to

shock. What's surprising about *Sign 'O' the Times*, a two-record set, is that Prince's obsession with sex is expressed alongside what seems to be an equally passionate religious conviction. "The Cross" is about as straightforward a religious admonition as you

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It seems as if the energy of The Psychedelic Furs has been drained; languid songs drone on like an old Maytag washer.

will find this side of a hymnal. One of the two inner sleeves features Prince swathed in saffron with a crucifix gleaming on his breast; the other pictures a scantily clad figure, still in saffron, covering his face with a huge black heart. I don't really think Prince has got an angel and a devil perched on either shoulder tugging him in two directions. Rather, it seems that he's found a spectrum of devotion wherein spiritual and sensual passion coexist.

Musically, this is the usual sampler of jamming funk, hard rock, dirty talk, clever pop, and slow, majestic blues ballads. Releasing his backup band, The Revolution, Prince has returned to a high level of self-sufficiency. Although there are guest appearances by members of The Revolution, horn players, percussionist Sheila E., and vocalist Sheena Easton, Prince plays most instruments and produced all tracks.

The real gems are the title cut, a compelling apocalyptic rap/chant; "It's Gonna Be a Beautiful Night," recorded live before an enthusiastic Parisian audience, and "I Could Never Replace Your Man," which features some of Prince's best guitar work to date.

Susan Borey

Midnight to Midnight: The Psychedelic Furs

Columbia FC 40466.

Sound: B- Performance: C+

If "post-punk" is supposed to be more musical and less self-consciously anarchic than punk rock itself, then The Psychedelic Furs' latest album succeeds on a theoretical level. But that's all.

The problem here is that The Furs have traded raw meat for rabbit food—the songs on *Midnight to Midnight* could fit any old-time crooner's repertoire with just a slowing of the tempo. As Richard Butler's expressive, homely voice runs atop languid rhythms that change only slightly from song to song, it feels as if the band's energy has been drained, as if its creative motors have sat unused in the garage for too long. In nearly every song, you can feel that promising "whirr-rr" as the engine is *just about* to make it . . . and then doesn't.

Butler, whose vocals have always been a knife-slash reply to prettified sing-songers, doesn't come to grips with the material—that's curious, since he wrote all the lyrics and collaborated with bandmates John Ashton and Tim

Butler on the music. The thematically linked lyrics are ambitious, tracing the growing cynicism and disillusionment of a romantic innocence that gets lost by the third song on side one. Unfortunately, they're set against uninspired music that, while occasionally textured with snaky, mocking background horns, mostly drones like an old Maytag washer.

The Furs have talent, and *Midnight to Midnight* does have its moments, such as the deft horns and tag-along guitar of "Shadow in My Heart." On the whole, though, the group's mellifluous sonic wall and mesmerizing semi-nonsense have become, at least on this album, semi-mesmerizing nonsense. I hope it's just a one-off aberration and not a sign of things to come.

Frank Lovece

Tango in the Night: Fleetwood Mac
Warner Bros. 9 25471-1.

Sound: B Performance: B

Although there have been a few great leaps in technology in the five years since Fleetwood Mac's last studio recording, pop music itself hasn't changed all that much. The Mac has thus been able to burst upon the scene again without having to completely update their sound, and it looks like they're on their way to another payoff.

With three distinctive songwriters, the challenge for this group has always been to quilt their styles together into a whole blanket of sound rather than to gather together a pile of pieces. They've come up with a well-planned pattern on *Tango in the Night*, thanks to the album's sensitive yet creative production. The smooth-edged, sentimental crooning of Christine McVie (which reminds me of the foggy sweetness of her *Bare Trees* days) dovetails with the harder edged, staccato delivery of Lindsey Buckingham, and they both complement the spacey soulfulness of Stevie Nicks.

The strongest songwriting on the album belongs to Buckingham, who arranged all the music and shares coproduction credits with Richard Dashut. Lindsey's "Caroline" and "Family Man" come closest to breaking away from the formulas which the band has made the best of for the past 12 years.

Susan Borey





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AUDIO SYSTEMS

CLASS OF '68



Photograph: Peter Tracy

Live at Winterland: The Jimi Hendrix Experience
Rykodisc RCD 20039.

Can this really be? A CD-only release of The Jimi Hendrix Experience, caught live at the peak of their form?

Believe it. Not only is it real, it is a mind-boggler.

None of this material, recorded at San Francisco's Winterland in October 1968, has been available before in an authorized release, and Rykodisc has reproduced it on CD gorgeously. Producer Alan Douglas has taken the 8-track master tape—state-of-the-art in '68—and bounced it up to 24-track digital for mixing and subsequent digi-

tal mastering. Thus, the sound is full-bodied and faithful, an absolute joy to hear.

Faithful is an excellent word with which to describe the presentation as well. There is more than 64 minutes of music on the CD, but adding Bill Graham's intro and Jimi's inimitable stage patter, the real total is a truly generous 71 minutes—near the CD's capacity.

What a show this is! By October 1968, The Hendrix Experience had taken off and become a sensation. The band's confidence, which was shaky on the *Jimi Plays Monterey* album from 16 months earlier, is rock solid here. They know by this time how good they really are.

Some of the selections are Hendrix staples, such as "Fire," "Manic Depression," "Red House," "Foxy Lady," "Hey Joe," and "Purple Haze." There's a hot version of "Killing Floor," with Jefferson Airplane bassist Jack Casady sitting in, a blazing jam on Cream's "Sunshine of Your Love," and more. It is a brilliant show, and on CD it plays through without interruption like a real concert.

For a really super final touch, the enclosed booklet, which contains notes by both Bill Graham and Mark Linett, unfolds into a copy of the original poster created to publicize the show.

You know something? This release is exactly the sort of thing we were told the Compact Disc would make possible: A generous serving of music fabulously reproduced. That it is previously unreleased material makes it so much the better. And (oh boy!) I understand that there is a promise of more to come.
Michael Tearson

Stravinsky: Pulcinella, Le Chant du Rossignol. Ensemble InterContemporain and Orchestre National de France, Pierre Boulez.
Erato ECD 88107.

Stravinsky: Le Baiser de la Fée (Divertimento), Suites Nos. 1 and 2, Octet. The London Sinfonietta, Riccardo Chailly.
London 417 114-2.

Here on two quite different CDs is a fine collection of middle-period Stravinsky—the kind you tap your foot to, the Stravinsky that once was ignored in favor of the big, more "Romantic" early pieces like "Petrouchka" and "The Firebird." Almost all of this music has a fascinating jazz-like, pop-like beat, which is exactly what shocked classical listeners from the 1920s to the '40s. You weren't *supposed* to tap your foot to classical music. Now, it's another story. And the music is of the utmost elegance too, with those brassy bits of tune and the wonderfully strong sonic colors.

The fancier of these discs is from the inimitable Pierre Boulez, once the conductor of the N.Y. Philharmonic, a brilliant leader and great innovator who practically browbeat the Philharmonic

audience with his relentless contemporary programs—and on the side managed to wipe out such stodgy standards as Brahms with his outrageous performances. So *some* people thought, anyhow. Boulez remains a prime leader and as controversial as ever, so be prepared for a few jolts on the Erato disc, as well as some lovely and informed playing.

The main jolt can be found in "Pulcinella," done here in its original ballet form, with voices. I had never heard it before, though the music, nicely derived from Pergolesi of the early 18th century, is well known in various formats including works for solo violin. The jolt comes from the group of loud-mouthed singers—I can use no better term—of the kind who sing their solos in super-opera style: when they get together for a few measures, they combine like jet blasts at a busy airport. A perfectly awful sound, and not even Boulez can sell it to *me!* The rest is just fine, being voiceless. "Le Chant du Rossignol" is a tone poem derived from Stravinsky's curious early opera, one act written before the big early ballets, the other two afterwards and in a wholly changed manner. The tone poem wisely uses only the later music. I recognize the lovely tunes from the opera itself and think that Boulez does them no justice at all, though the total sound is colorful enough.

The second CD is far less jolting and contains plenty of careful British-style playing, beautifully recorded. The major item is the divertimento based on another ballet, "Baiser de la Fée," which was built on Tchaikovsky, of all composers—rather obscure music, to be sure. It is the most ingratiating of all the middle-period works, and I have loved it from the start. The rest of the CD explores a number of short pieces Stravinsky wrote along the way, the two little suites, the "Octet" (based on a dream, the composer said), a late and dissonant brass fanfare, and three solo pieces for clarinet alone. That should keep you interested.

Curiously, the "celebrity" CD, with Boulez, is marked AAD, meaning that there were two stages of analog recording en route to the disc, whereas the milder, lesser (and more pleasant) London CD is all digital. Can you hear the difference? *Edward Tatnall Canby*

The Way It Is: Bruce Hornsby & The Range
RCA PCD 1-8058.

Here's another Bruce to reckon with. This one, Bruce Hornsby, is a throwback to the rock troubadours who filled the airwaves for a time in the late '60s and early '70s. These men and women wrote and performed their own moving, intelligent songs, filled with vivid imagery and sharp observations. Their tunes were folk-tinged and their tone often melancholy or angry.

Hornsby and his band, The Range, bear this legacy into the '80s. Their debut album, *The Way It Is*, has made it onto Compact Disc, and it is a beauty. (In fact, it helped Hornsby and his band cop the Best New Artist Grammy for 1986.) Hornsby does nothing startlingly innovative here, but his great tunes, filled with blue-collar yearning and soft-palette imagery, make the album stand out from the current pop field.

Hornsby's arrangements are superb, in the main straightforward yet with delicate touches of subtle, imaginative instrumentation. They are spare yet tell-

ing, with emphasis on keyboards and strings. No pop performer has used an acoustic piano to better effect, as evidenced by two of the hits from this album, "Mandolin Rain" and the title track.

Like the rock troubadours of a decade or two ago, Hornsby is a multifaceted instrumentalist, playing piano, accordion, synthesizer, and hammered dulcimer as well as handling all lead vocals. He wrote seven of the nine songs on the album with his brother John and penned the remaining two himself. And what songs they are, filled with passionate intensity, sorrow, and regret, speaking of crushed dreams that litter the heart's horizon like crumpled paper.

The production by Hornsby and Elliot Scheiner, plus that by the redoubtable Huey Lewis on three tracks, is excellent. Although there are subtle textures and some wonderful variations on melodic and rhythmic themes, in general these are simple arrangements, and the straightforward production applied to them is sheer perfection. Instruments are fixed firmly in space and remain clear and audible

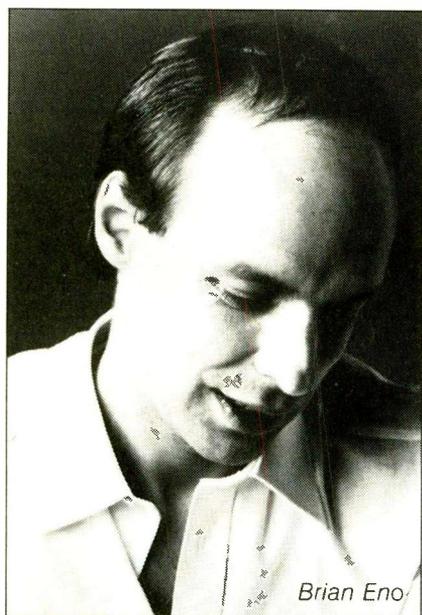


There are some imaginative effects and careful timbres on the Budd/Eno CDs, but tape hiss and equipment noise crop up too often.

even at their faintest. Separation is excellent, and depth of field is masterfully established. Best of all, Hornsby's mellow, slightly nasal mid-ground vocals are cleanly presented, so that his extraordinary lyrics are cushioned on the instruments like jewels in a sleek velvet case.

The digital medium is perfect for this material, but don't get the mistaken impression that *The Way It Is* should be listened to with reverence or awe. You should be tapping your feet to this stuff even as your heart feels the first twinge.

Paulette Weiss



Brian Eno

The Pearl: Harold Budd and Brian Eno Editions EG EEGCD 37.

Ambient 2/The Plateaux of Mirrors: Harold Budd and Brian Eno Editions EG EEGCD 18.

A good way of approaching these discs is to think of them as soundtracks for imaginary movies. Since they are not from any particular film, you can invent your own images and scenarios, and change them every time you listen. However, Harold Budd and Brian Eno have carefully limited and defined the range of emotions in these sonic images. Gently and unobtrusively, they shape your responses.

The Pearl and *Plateaux of Mirrors* present worlds without the expected conflict between good and evil, happy

and sad, and so on. That concept of conflict and resolution is the engine that drives most music (and most other arts) in Western cultures. By deliberately avoiding it, Budd and Eno have developed a style more allied with the New Age genre than with most jazz, rock, or pop styles. This is not the intense, high-energy music of spiritual ecstasy that you'd expect from John McLaughlin's Mahavishnu Orchestra, but the quiet, contemplative music of souls at peace.

Budd and Eno take things at a very slow pace—a maddeningly slow pace for those in a hurry to resolve their conflicts. On *The Pearl*, "Against the Sky" evokes the slowly evolving shapes of clouds drifting across the sky. By comparison, the clouds of Debussy's first "Nocturne" churn frantically. Budd and Eno use only three sounds in their cloud piece, but they draw many fascinating variations from them. The sounds are like the components of a vibraphone (the high-pitched strike tone, the low resonance of the tubes, and the pulsations caused by the rotating discs). Here, they are disassembled, magnified, and idealized. The vibrato component sounds like a Hammond organ at times but often seems like a distant chorus. The harmonies, melodies, and rhythms result from the interplay, overlapping, and timing of these elements.

Those three sounds become thematic elements throughout *The Pearl*. For example, "Their Memories" is based on transformations of the distant-chorus idea. In "The Pearl," Eno and Budd use a tremolo device on each channel, but at slightly different speeds to create a pulsating effect. Through loudspeakers it's beautiful, but on my headphones the hiss from noisy recording equipment is much too obvious.

In fact, the technical quality throughout both discs is not good, even for analog recording. Because the copyright date, both for the music and the recordings, is 1984, we have a right to expect far better engineering than this. It sounds more like 1964. Alongside the highly imaginative production effects and the carefully controlled timbres, you'll hear the bad engineering used to create them. Tape hiss and equipment noise rear their ugly heads

far too often. Overload distortion is so frequent it becomes a part of the style—even when the music would sound better without it. In *Plateaux*, Budd and Eno send the piano through a reverb plate (a rather old-fashioned reverb quality anyway) but overdrive the plate to emphasize the reflections. Tape or digital delay would have made a better effect, and without the overload distortion.

If you listen to these discs on speakers at background music levels, they are pleasant listening—just the thing for a lazy Saturday afternoon. Put one into your CD player with the repeat button on, and curl up with a glass of iced tea and a good book.

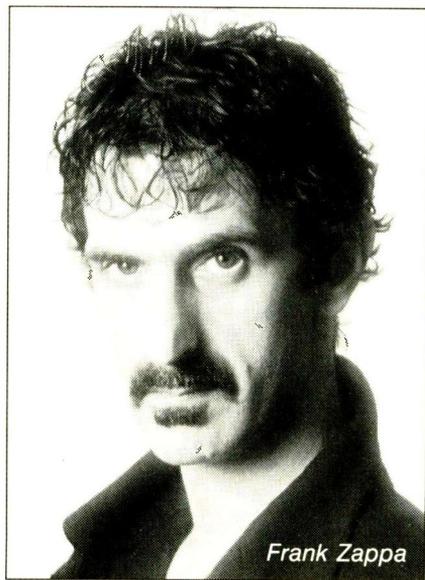
Steve Birchall

Jazz from Hell: Frank Zappa Rykodisc RCD 10030.

Shut Up'n Play Yer Guitar: Frank Zappa

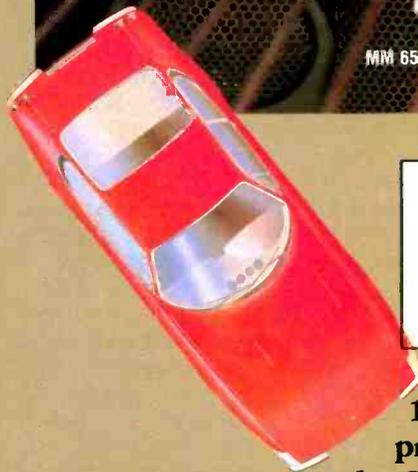
Rykodisc RCD 10028/29, two-disc set.

Attention-grabbing, disquieting, sometimes beautiful—Frank Zappa's *Jazz from Hell* is an utterly intriguing offering. All of the eight instrumental cuts plunge forward from their opening notes in a nonstop sprint for the finish line, ignoring the conventional break/bridge/chorus format. Each cut (with one exception) is a complex interweaving of Zappa's constantly jabbing, flowing, leaping work on the Synclavier



Frank Zappa

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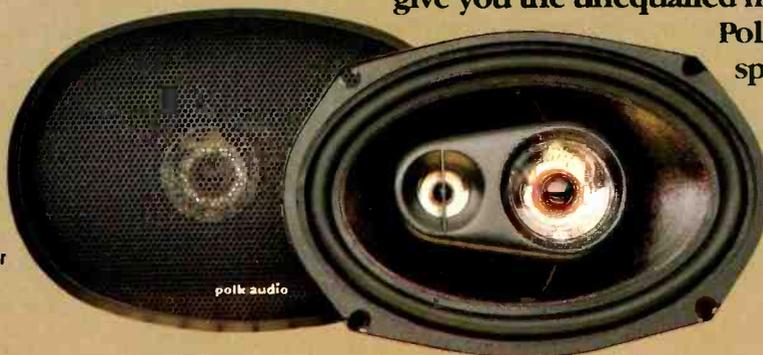
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Rudolf Serkin's playing is faintly old-fashioned, but by no means is it "cute." How lucky we are to get him on digital CD!

DMS with bits and pieces of guitar, other keyboards, bass, and drums, to form restless patterns that vary from the almost-melodic to the frenzied and discordant.

Some of this stuff is difficult to listen to. The title cut, for instance, although intellectually intriguing, is cast in a minor key that grates on the ear. On "Massagio Galore," the human snorts, grunts, shouts, and eerie moans running over a jangling, roiling synthesizer-and-percussion combination might make you ask, "What the hell is *that*?" on first hearing. On the other hand, the more accessible cuts are quite beautiful, with constantly shifting, gliding, bobbing instrumentation that draws the mind into a wonderful dance. (One of these, "St. Etienne," is the only cut to be based on electric guitar rather than the Synclavier.)

Jazz from Hell is one of the rare original digital recordings in the pop sector, and the sound is superb. Every distant squawk, every finger snap, every subtle bass rumble is caught with perfect fidelity. In the arranged maelstroms that often strike on this disc, every instrument maintains its integrity, and every note, no matter the volume, is captured undistorted.

From his Mothers of Invention days to his more recent misanthropic period, Zappa has striven to both outrage and enlighten, often sacrificing the latter for the former. It sounds as if he's hit just about the perfect balance on *Jazz from Hell*. *Paulette Weiss*

It feels like a long step back from *Jazz from Hell* to *Shut Up'n Play Yer Guitar*, a set of live-concert guitar solos dating from 1977-1980 but exhibiting a San Francisco psychedelic sensibility straight out of the 1960s. In fact, Zappa acknowledges this with suitably ironic self-commentary in the tune "Variations on the Carlos Santana Secret Chord Progression."

As with everything Zappa does, this music is both satirical and serious. By extracting solos out of context, Zappa pimps guitar freaks yet demonstrates very respectable technique. And a great deal of care was put into assembling this collage; constructed of various moments from around the world, it almost succeeds as one large work.

You won't find nice, neat "songs" on *Shut Up'n Play Yer Guitar*, but you will

find a nonstop guitar assault which yields an effect not unlike serial classical music. And beware: It could cause flashbacks. *Michael Wright*



Reger: Variations & Fugue on a Theme of Bach for Piano, Op. 81; Haydn: Sonata for Piano, H. XVI: 50. Rudolf Serkin, piano. **CBS MK 39562.**

Rudolf Serkin is one of the last of the grand European masters of the piano who inaugurated the age of piano recording far back in the beginnings of the electrical era. Max Reger, somewhat similarly, was one of the last of the heavyweight late German Romantics before Schoenberg. At a series of musical performances featuring Reger, the 15-year-old Serkin was the sensational pianistic star—that being directly after World War I. So here we have some concentrated musical history—and more, too.

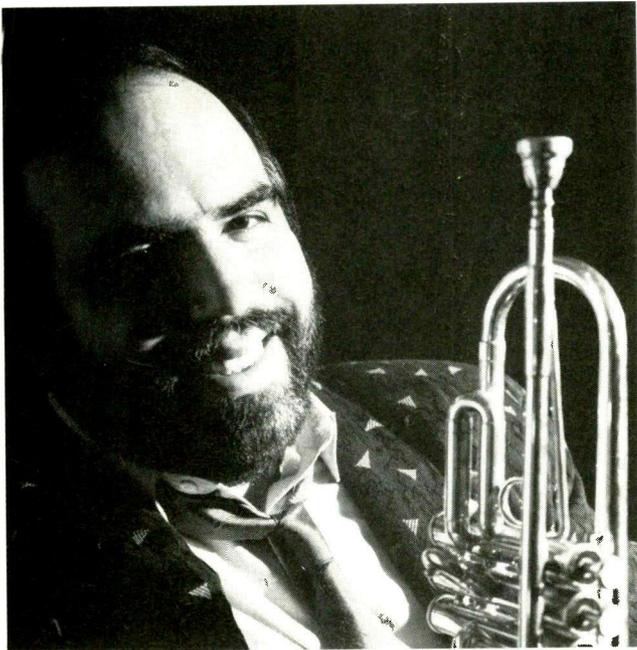
How lucky we are to get Serkin père (there is also his piano-playing son Peter) onto digital CD! Too many of our century's big pianists left their music

on wax masters, or lacquer, and many more on pre-digital tape. For the fact is that digital recording combined with the CD (and appropriate playback equipment) has done more for piano sound than for any other form of music. The combination of background silence and rock-steady pitch is simply unbeatable by any earlier recording medium, if by those almost unmeasurable increments towards perfection that are nevertheless enormously important.

Reger died young and was, in his day (the turn of the century and on), considered a harmonic radical. But you will find him very much a successor to such conservatives as Brahms, who also made Bach one of his models for heavyweight contrapuntal art on piano and organ. The "radical" harmonies of Reger no longer sound radical; their surprising jumps are easy to hear but will not bother you at all. What strikes us, now, is the typical 19th-century approach to the variations and the inevitable and enormous fugue at the end, more complicated than anything old Bach had to say and very much louder. In a word or two, this is great pianism of the big old sort, both in the writing and in the playing *and* in the recording! I'm no Reger fan, but in this transparently clear and persuasive rendition it is hard not to be impressed, whatever your special tastes may be.

The Haydn "Sonata in C," one of his very last, composed in England in the 1790s, is a startling contrast and best played at a slightly lower level than the Reger, even though the two may have been effectively taken down at a fixed dynamic mean. (They were made in different places.) As an older pianist, Serkin plays his Haydn in a faintly old-fashioned manner but by no means with that "cute" sort of miniaturism that was standard for so many years. Serkin has kept up with the times—or perhaps he was always ahead of us. After a few moments of adjustment following the Reger thunder, you will find Papa Haydn full of well-being, good humor, and his typical sly understatement. Indeed, why play these two consecutively at all? Separate them, with that superb new ease of access that the CD has brought to us. That's one of the major advantages of music in the CD format. *Edward Tatnall Canby*

BRECKER ON DENON:



RANDY BRECKER. HIS NEW DENON CD BRINGS NEW LIFE TO STRAIGHT-AHEAD BE-BOP JAZZ.

Brecker chose his sidemen specifically for their acoustic work: Ron Carter on bass, saxophonist Joe Henderson, pianist David Kikowski and Al Foster, all of whom Brecker calls "consummate musicians for this kind of music."

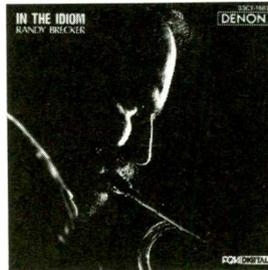
When we commented on the disc's live-on-the-bandstand tone, Randy Brecker points out that all the cuts were "live" direct-to-2-track takes. Then he launches into the quality of Denon's digital recording: "I love the sound. Digital is so much better to work with — even more so for acoustic music." Always welcome, praise for Denon digital recordings is nothing new. After all, the world's first commercial digital recording was by Denon.

In big band, fusion, classic jazz and classical symphonies, the important new music is on Denon. As it should be.

Trumpeter/composer Randy Brecker has just completed his first Compact Disc. And it's on the Denon label. We asked him to describe Denon's approach to jazz.

"Complete artistic freedom," is his immediate response. "Their catalog has a lot of different styles. All very high quality music and all amazingly different."

The title of Brecker's new disc, "In the Idiom," refers to the idiom of late 50s/early 60s be-bop. We thought it quite a departure from the 70s electrified funk of the Brecker Brothers. "I always wanted to do a record in this style," Brecker says. "I really wanted to do a totally acoustic album."



Randy Brecker

CY-1483, "In the Idiom,"
Over 57 minutes, DDD.

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Mozart: Piano Music. Richard Shirk, piano.

Classic Masters CMS 1005. (Available from Classic Masters, 426 Henry St., Brooklyn, N.Y. 11231.)

This is a splendid piano LP, one of the quietest I have heard, without even a trace of the old, familiar 33 $\frac{1}{3}$ -rpm turning sound. The direct-metal cut—which really does seem to produce an outstanding LP product—and the pressing are both by Europadisk, which isn't in Europa but in New York City. (I must mention, however, that as always the CD pitch on piano is almost imperceptibly but importantly steadier, and that the CD version includes an extra piece.) So much for the basic audio.

Richard Shirk, it happens, is the son of my neighbor right across the way—papa was going to give me the record. But fortunately it came direct through professional channels, so this is not neighborhood nepotism! Just as well: I'm set to praise it highly.

Shirk is an impeccable Mozart pianist, to an extent a "classic" Mozart player, as contrasted to many young pianists who play Mozart in the best 19th-century manner, all thunder, sen-

timent and schmaltz. The Shirk phrasing and shaping is beautifully controlled and subtly rhythmic. He is chaste when Mozart is, but there is power when power is called for on the modern grand piano—also a *pianissimo* so faint and delicate as to be just, precisely, exactly audible. So much the better on a good LP or CD. This is *not* the too-too delicate and pure Mozart of a half-century and more back! A good and very musical compromise, if such positive assets can be called a compromise.

The Shirk piano is interesting, a German (Hamburg) Steinway and quite audibly unlike the American brand. There is the modern deep bass, but the middle ranges have a distinct color reminiscent of the increasingly familiar sound of the fortepiano, the piano of Mozart's day. Possibly this accounts for Shirk's choice of this instrument for a recording made in New York. In terms of tonal hue, it has perhaps a pale gold sound, where the U.S. Steinway is all stainless steel, i.e., no color, just a good edge when needed. If you are not inclined towards the fortepiano for your Mozart, this instrument would be an excellent alternative choice—not only for Mozart, but for earlier music in

general, through Beethoven and perhaps on into the 1830s.

There are two of the longer, more profound sonatas here, the C minor with that dark, stern "C minor" sound that Beethoven also exploited, and the B flat, a sunnier work but rich as well. As a counterpoise on side 2, we hear Mozart's variations on one of the sappiest, most vacuous little melodies yet, composed by a Mozart contemporary, Jean Pierre Duport. No wonder these variations, brilliant finger-wise, are not too often heard! Good for a laugh, at least, which might be what Mozart had in mind for his original audience.

Schumann: Fantasia, Op. 17; Berg: Piano Sonata, Op. 1. Louis-Philippe Pelletier, piano.

McGill 86023. (Available from McGill University Records, 555 Sherbrooke St. West., Montreal, Que., Canada.)

McGill University in Montreal was one of the first colleges to set up its own public record label (though Harvard had its 78-rpm Vocarium spoken-word shellacs many years earlier). Every so often McGill sends a few samples of their current product, which is entirely professional (even down to the U.S. Library of Congress number). Good idea—this sort of label caters primarily to its own students and faculty and nearby "civilians," but there is plenty of interest to the outsider.

This one is a rather ambitious piano recording by a member of the McGill music faculty. Despite his decidedly French name, his training seems to have been indirectly German, in the tradition of Franz Liszt and on up through such as Karlheinz Stockhausen of present-day Germany. Nevertheless (and not too surprisingly), what I hear is more of a French way of playing Schumann. It is definitely not in the grand Liszt tradition.

Schumann, to my mystification, has always been immensely popular in France. There is no more thoroughly German a composer, unless it is Brahms! But the French, characteristically, have their own way of doing Schumann to their own satisfaction, so who can complain?

Thus we have a bit of a quandary. Pelletier seems, to me, to miss the towering strength, the ultimate sweetness,

Illustration: Rick Tulka

that carries Schumann through dense jungles of Romantic complexity to the triumphant end. Instead, we have a kind of fussy passionateness. Pelletier uses too much rubato—slowing down, speeding up; he seems to miss the big emotional shape and the poignant moments in this long, four-movement "Fantasia." He sometimes blurs the harmonies, and he misjudges the inner balance—there is too much churning accompaniment, not enough glorious melody. Thus, often, he seems to be wandering in a maze of notes. A common problem in Schumann.

It is Schumann, of course, who actually does the wandering, but only when the big story line is missing! Nothing but a heroic performance will do, and this one does not really make it.

The early Alban Berg sonata, his first published work, ultra-late-Romantic with strange dissonances (cf. early Schoenberg), is played in exactly the same way. It too seems a bit too passionate, yet less than convincing. The French do things so much more smoothly—I'd enjoy hearing Pelletier performing Ravel or Debussy.

Pelletier is, by the way, not confined to McGill; he broadcasts frequently on

Canadian air and has done his share of concert touring, as well as much playing in Montreal itself. He is a specialist in the music of Schoenberg.

Stratas Sings Weill: Teresa Stratas, soprano; The Y Chamber Symphony, Gerard Schwarz
Nonesuch 79131.

Almost as much as the late Lotte Lenya, Teresa Stratas has become a brilliant exponent of the music of Kurt Weill. From her opening-night performance as Jenny in the Metropolitan Opera's revival of *The Rise and Fall of the City of Mahagonny* (1979) to the release several years ago of *The Unknown Kurt Weill*, Stratas has studied, sung, spoken about, and altogether made her own the nuances of Weill's genius.

Here is, for example, the heartbreaking "Lonely House" from *Street Scene*, with its plangent sense of solitude and its free-floating anxiety perfectly captured in the singer's fluid, unbroken operatic line. In "Le Roi d'Aquitaine" (*Marie Galante*), on the other hand, there's a sassy, effortless casualness that is never lax.

The three selections from *Mahagonny* and *Three Penny Opera*, with their unmelodic lines and Stratas' breathy harshness alternating with sudden, unexpected sweetness, reveal that Weill's real spirit—his fundamental humanity—was not, in fact, in the better known Brecht works but in the American theater pieces. "Foolish Heart" (from *One Touch of Venus*) and "One Life to Live" (from *Lady in the Dark*) demonstrate how engaging a waltz or a tango-ballad can be. Stratas seems to smile right off the disc at us in these wonderful, hummable melodies.

This is a splendidly produced album. Only one disappointment: The album cover boasts that "texts and translations and additional liner notes" are enclosed. Well, the only thing in the album I received was one of those new slippery sleeves that do no good to anybody.

Donald Spoto

Hummel: Piano Sonatas Nos. 1 and 6, Nos. 2 and 5, Nos. 3 and 4. Ian Hobson, piano.

Arabesque ABQ 6564, ABQ 6565, ABQ 6566 (three records, sold separately).

Johann Nepomuk Hummel, it's worth saying again, was considered one of the great musical geniuses of his time (the early 19th century), though until very recently his music was unknown to record collectors in the large. He was a fantastic pianist and, in the manner of his day, also a prolific composer. As a child he studied with Mozart; he succeeded Haydn at the famed Esterhazy establishment, was Beethoven's friend, and along with Schubert helped take the Beethoven corpse to its grave.

They are lovely, if somewhat gentle, these Hummel piano sonatas. Not deep, not revolutionary, but in their quiet way they must have influenced such as Chopin, Schumann, even Beethoven himself. It is a smooth, suave, ordered, very melodious sound, very easy to listen to and full of memorable things for the casual ear. Not much thunder but plenty of grace.

Perhaps Hummel would be less interesting if we did not have the astonishing Ian Hobson here to play him with such casual mastery, such marvelously deft shaping, such lightness



A very slight edginess may betray the modest age of this recording by oboist John Mack, but the edge isn't bothersome at all.

and humor, and such brilliance of technique that Hummel positively glows. Here is a pianist who is just plain *too* young, yet somehow knows it all, who sounds like a top-rank veteran of 60 or 70. (He looks 18 in his photograph, but it might be a few years out of date.) The wise, mellow, mature rightness of

his playing is so obvious that just about anybody will enjoy—not so much Hobson as Hummel!

Arabesque's excellent offerings, beautifully recorded and superbly packaged, are distributed by Caedmon in New York. By the time this gets to print, they may be available on CD.



John Mack, Oboe. With Eunice Podis, piano.
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When Telarc, some years ago, made its momentous pre-CD decision to go all-digital, it killed off its entire analog catalog, which was that of a typical small-company classical label. A clever and canny move, as we all now know. Later, that analog catalog was opened up for reissue on other labels, and Crystal Records responded. This oboe/piano recording was thus produced and recorded by those familiar figures, Robert Woods and Jack Renner. The original tapes no doubt have been reprocessed by Crystal for the newer LP.

The record fits nicely into Crystal's repertory of solo-instrument specials done with a wide audience in mind, with additional instrumentation and an interesting variety of music—a good "program" for listening by anyone. The soulfully tuneful Schumann Romances, favorites of mine since a very early 78-rpm recording, lead to six little Britten pieces for oboe alone, based on Greek myths. Then on side 2 we have a piece by the prolific Saint-Saëns. (Was it he who said he produced music the way "a pear tree produces pears"?) This is followed, appropriately, by another French bit, one of those innumerable "conservatoire" contest pieces for competitions. A few, like this one written by Paladilhe, show more than just oboe finger expertise. Paladilhe was at least musically all-French. His busy professional life must have been persistent: He won the *Prix de Rome* in 1860 at 16 and lived on until 1926!

A very slight edginess (on edgy speakers) may betray this recording's modest age, and I find the piano sound somewhat distant and hollow. But it is not at all bothersome, and both the oboist and the pianist are first-rate.

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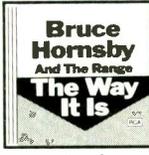
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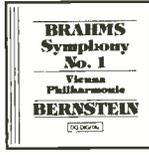
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Michael Riesman's music has clarity and depth but is more like sound design than composition.

Formal Abandon: Michael Riesman
Rizzoli Records 2004.

Sound: B Performance: C+

His name may not be familiar, but those who have followed the music of minimalist composer Philip Glass for the last decade or so have heard Michael Riesman. This musician and composer has been Glass' music director for most of that time, conducting and rehearsing the ensemble on stage and in the studio. In concert, he's the one handling all the complex, interlocked keyboard parts like a whirlwind inside a player piano, while Glass sits at his keyboard handling a few single-note lines.

Formal Abandon is Riesman's first solo recording. Although comparisons to Glass are inevitable, they don't hold up. Composed for the Lucinda Childs Dance Company, *Formal Abandon* is more of a set piece, compared with Glass' juggernaut momentum. It is sound design more than composition; as a recording of music in its own right, it has trouble standing apart from the visual component.

The two side-long compositions, "Formal Abandon-Octet" and "Formal Abandon-Quartet," are like static stage sets. The first establishes a languid rhythm of cycling synthesizer sequences with breathy, staccato punctuation. Moving within this stationary scenery is Riesman, soloing in an improvisatory fashion on acoustic piano (he also handles all the background instrumentation). His romantic melodies recall Debussy in their quiet repose and jazz pianist Chick Corea with their flowing cadences and arpeggios.

"Formal Abandon-Quartet" ups the tempo considerably with a drum-machine rhythm and nattering electronic percussion. But it goes in circles, with little melodic interest.

Released on the newly formed Rizzoli Records label, *Formal Abandon* has a clarity of sound and a depth of field that makes it almost work as sonic architecture. Perhaps if Riesman dumps the computer programs and relies more on his own formidable keyboard skills, his next recording will actually create movement within the sound stage. *John Diliberto*

Khachaturian: Piano Concerto; Prokofiev: Piano Concerto No. 3. Boston Symphony Orchestra, Serge Koussevitsky; Dallas Symphony Orchestra, Antal Dorati; William Kapell, piano.
RCA Gold Seal AGM1 5266.

Remember "Khachaturian Kapell"? The man who was given that nickname was said to be one of the greatest 20th-century pianists though he died in a plane crash in 1953 at an early age. Here is his recording of the piece he played everywhere. Kapell did play other music, as one might guess, including the Prokofiev concerto included here, even more adapted to his special temperament at the piano.

This was the age, we have to recall, of hard, glittering piano technique, full of the mechanical power that is one aspect of the instrument's sound. Everybody played that way—some with ugly results, some with more artful shaping underneath the powerhouse of notes. Kapell was the latter kind, as his contemporaries acknowledged. But at this late date, a lot of the hard, mechanistic, teeth-grating technique, which was then popular, comes through all too clearly. Do not blame the hard, if brilliant, sound of these performances *entirely* on the recording! I can assure you, it was the way to play at the time.

That aspect being mentioned, there remains the recording. No amount of reclamation, not even digital, can undo all of the audio distortion present in the original. It will always sound deadish and non-ambient to my ears, no matter how artfully retouched by the audio people of the present. (We are spoiled today; distortion and plenty of extraneous noise were so familiar to us back then that they paradoxically did not bother our appreciation very much—though listening was indeed tiring for the ear.)

I've already gotten myself into some pickles by praising restorations of "legendary" older recordings. Some think they are *worse* than the original pressings. I suspect that this is a matter of taste as much as of technique. Indeed, I would rather hear a loud hiss and a semblance of highs to color the sound than an over-filtered restoration, quiet but dismally muffled. However, the most persistent distortion in these and



Michael Riesman

Ives' tough music has been competently mastered by Tom Plaunt. But it is dangerous to analyze, and best just to experience.

many other similar recordings is the hard, metallic buzz of the loud passages, as compared with the much smoother soft parts. This is likely to be a problem not only with restored recordings but with the original masters as well.

So give the engineers, RCA and otherwise, a thoughtful chance. Assume, please, that their aim is not unlike your own—to hear the original music optimally, if not in total perfection, even if that means allowing it to sound in major ways *just as it did*, faults and all. I didn't like the buzzy loud parts in either of these pieces but I respect them, if you see what I mean. That is important.

Charles Ives: The Concord Sonata.
Tom Plaunt, piano.

McGill University Records 83018.
(Available from McGill University Records, 555 Sherbrooke St. West, Montreal, Que., Canada.)

When Charles Ives' now-famous "Concord Sonata" first began to get around, only one person was performing it, a pianist by the name of John Kirkpatrick. He was tall, gangling, and a bit apologetic when I went to a concert—decades ago—to hear him tackle the "Concord Sonata." After an eternity of pell-mell playing (the work occupies the whole of an LP, both sides), it became apparent that *something* was wrong—one of the big movements simply would not *end*, like a freight train with an infinite number of cars. Finally, Mr. Kirkpatrick stopped. He was lost, he said. He had been going in circles and probably never would reach the end of that segment. He was sorry, but the music was not easy. The audience clapped, and Mr. K. proceeded to the next huge movement.

For those who revel in symbolism and musical storytelling of a Romantic sort, Charles Ives offers no problem; you just listen and use your inner imagination—in this case to concentrate on such Concord, Mass. personalities as Emerson and Thoreau—while the music rolls on in great waves of intricate expression. Would you ever know if you were accidentally going around in Emersonian circles? It would make precious little difference.

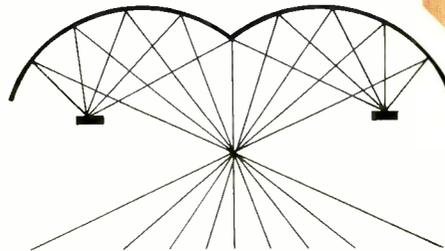
But for those who want to follow musical substance, Ives is tough. We all

know the sound, here so competently mastered (without circles) by Tom Plaunt. Vast, complex waves of highly Romantic dissonance; great, loud climaxes; vast, subsiding sonic hollows, and—against the dissonance—such incredibilities as bits of Beethoven's Fifth or a good old gospel hymn out of

Ives' childhood. Or two of them simultaneously in different keys.

Beyond this, it is dangerous to get into an analysis of structure or of themes. It doesn't really prove much, nor make the music any easier to follow. It is best just to *experience* Ives and let it go at that.

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BLUE NOTABLES



Edmond Hall

The Complete Edmond Hall/James P. Johnson/Sidney DeParis/Vic Dickenson Blue Note Sessions

Mosaic MR6-109, six-record set. (Available from Mosaic Records, 197 Strawberry Hill Ave., Stamford, Conn. 06902.)

Sound: B+ Performance: A to B

Mosaic Records continues to produce essential and superbly annotated and packaged sets of long-unavailable, classic jazz from the vaults of both small, independent record companies and major labels.

Vic Dickenson



The recordings on these dozen sides range from the stunning 1941 Edmond Hall dates with Meade Lux Lewis on celeste and Charlie Christian playing unamplified guitar, to a lone and extremely rare date done in 1952 by trombonist Vic Dickenson.

Of the four artists featured here, only pianist James P. Johnson had achieved any degree of public recognition by the time these recordings were made, and that had nothing to do with his pianistic ability. He had composed some major songs like "Charleston," "If I Could Be with You," and "Porter's Love Song to a Chambermaid" years before, and was living in modest comfort in semi-retirement for most of the 1930s, writing concert and semiclassical music.

Hugues Panassie and John Hammond brought Johnson back before the public in the '40s. Born in 1894, Johnson had suffered one or more strokes prior to making these 1943 solo sides and 1944 band dates, but this and his heavy drinking did not affect his pianistic skills one iota. Tireless and endlessly inventive at any tempo, Johnson shows us how rich the stride heritage is in "Carolina Balmoral," "Mule Walk," "Gut Stomp" and his other solos. The only lapses are his forays into boogie-woogie. "Gut Stomp" is an expanded version of "Havin' a Ball," which Johnson had written and had published in 1937 and then recorded with a small band in 1939.

Clarinetist Edmond Hall retained his New Orleans heritage while adhering to the principles of jazz, which meant swinging hard all the time. Until the late '30s, most of his work had been with big bands, including Claude Hopkins; later he began appearing more often on records and working with combos led by "Zutty" Singleton, Joe Sullivan, Red Allen, and Teddy Wilson. In 1944 he began leading his own swing unit.

Tart, acidic and driving, Hall made nothing but good records no matter who else was playing. He really preferred small-group swing even over traditional New Orleans jazz, and I can think of no better example of the former than his treatment of "High Society," recorded with DeParis, Dickenson, Johnson, and a nonpareil rhythm section of Israel Crosby on bass and Big Sid Catlett on drums. They play it

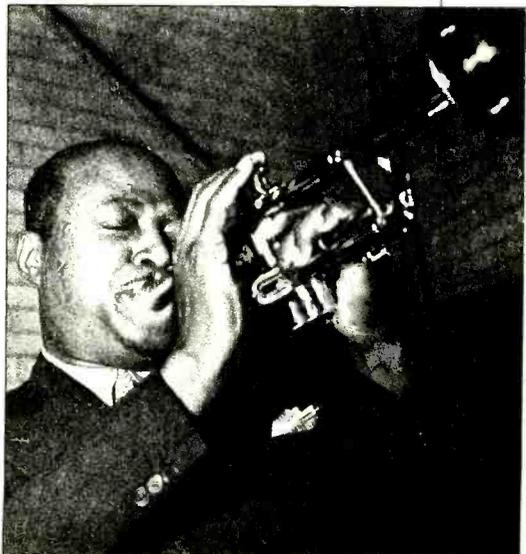


James P. Johnson

straight at the start and then drive the old warhorse in what has to be the most swinging version ever recorded.

Shy, retiring Sidney DeParis may well have been one of the most flexible of the brassmen who came out of the country's best big bands. As Dan Morgenstern's excellent liner notes point out, DeParis had a light, skipping style, full of humor and surprise. He easily fit into the demands of the traditional New Orleans and Dixieland repertoire—perhaps better than any of his compatriots. He is sure-footed throughout. I particularly like his passionate yet con-

Sidney DeParis



Photographs: Frank Driggs Collection

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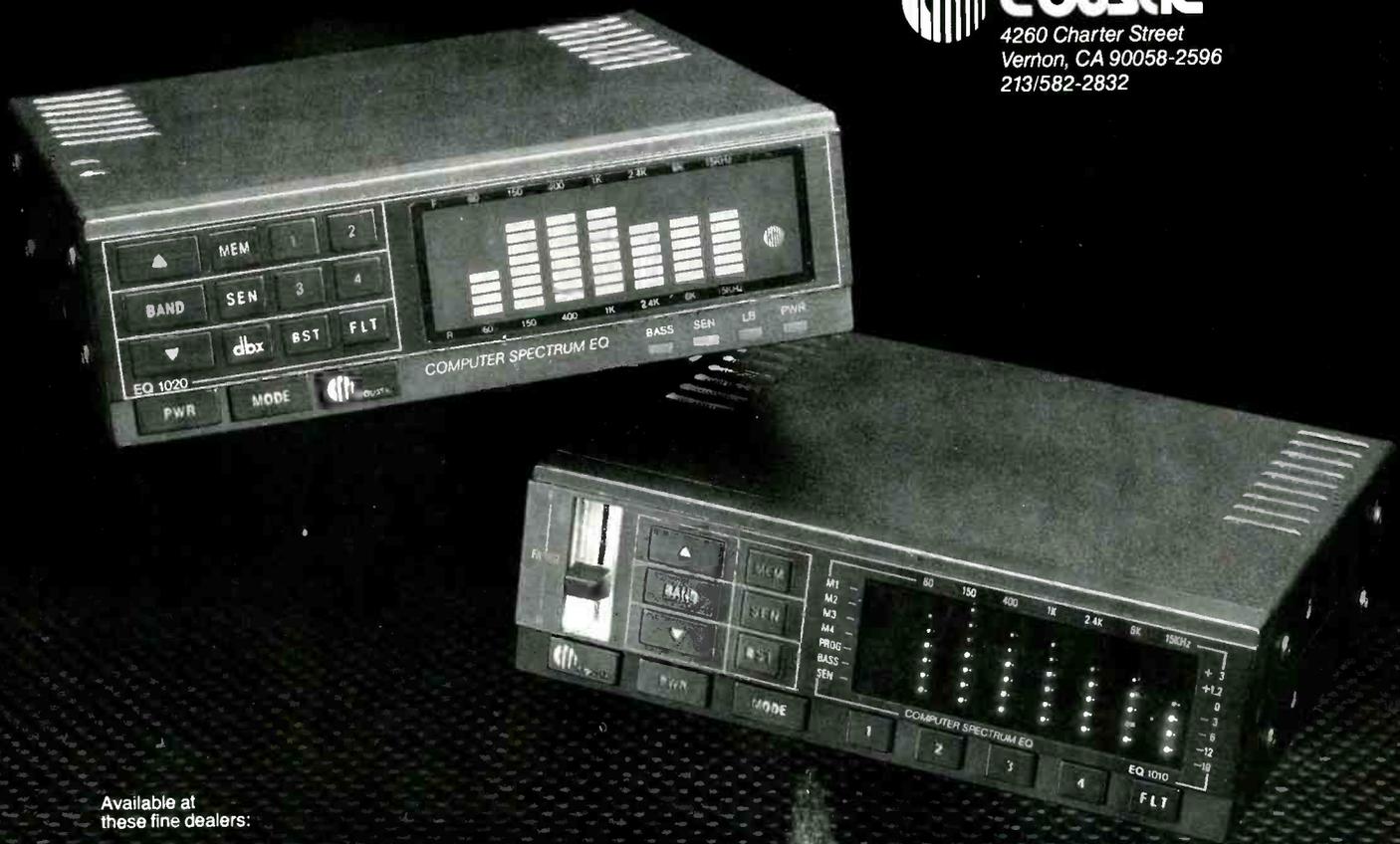
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The Latin Connection has a lot going for it, but Terry Gibbs never catches on to the solid groove of the rhythm section.

trolled and original plunger-mute work on "Blues at Blue Note."

Vic Dickenson was also somewhat shy and retiring, often overshadowed—though not in talent—by the better known and more often recorded J. C. Higginbotham, Dicky Wells, and Benny Morton (heard in this set to advantage with Ed Hall's Swingtet). This was due to his being on the road much of the time and playing in a band like Count Basie's, where Dicky Wells was the most often featured trombonist. Vic took his sly, burry tone and unorthodox pushing style into Eddie Heywood's sextet, and he survived after the '40s by moving into Dixieland.

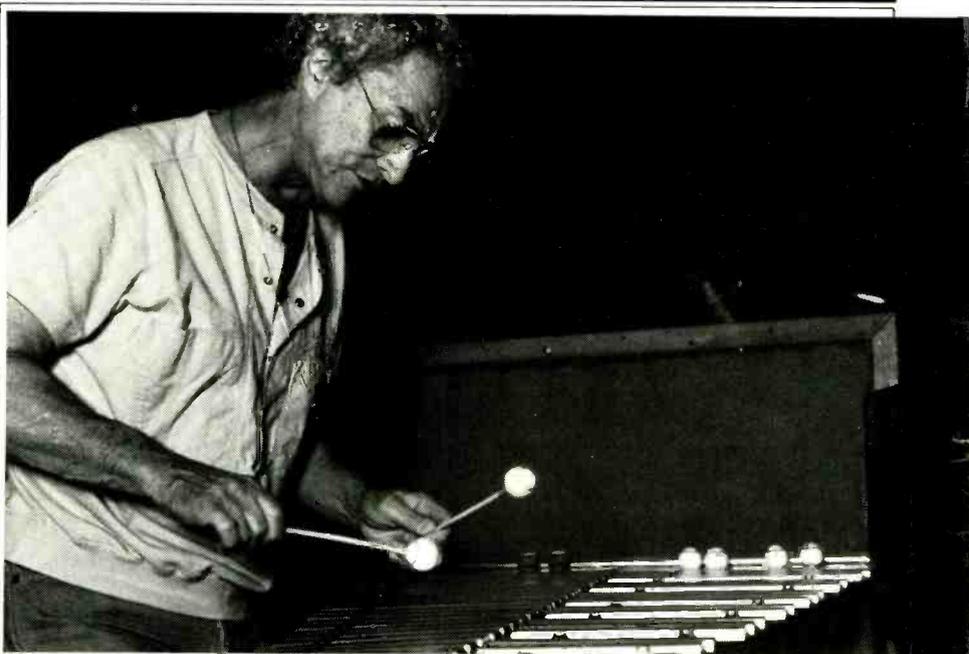
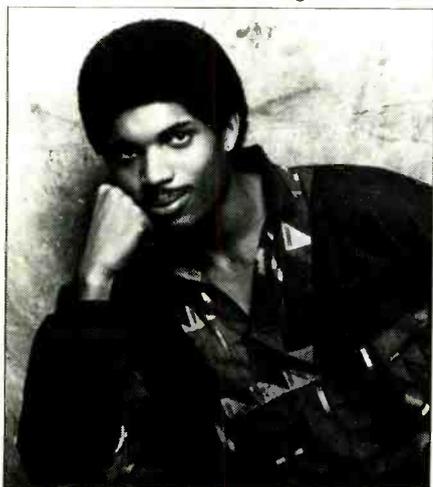
Dickenson plays superbly throughout, but pay particular attention to the final date on this set, done in 1952 with Bill Doggett on organ, John Collins on guitar and the inimitable Jo Jones on drums. The four cuts, including one rare alternate take, had a very small sale as 78s only, and have never been available on LP anywhere. It is a shame it's taken so long for a wide audience to have access to Dickenson's mastery on the ballad "Tenderly," which he himself felt was his own best performance. We are lucky to be able to hear what has to be one of the great trombone solos in music.

This Mosaic set is recommended without reservation. *Frank Driggs*

Standards Volume 1: Stanley Jordan
Blue Note BT 85130.

Sound: C Performance: B-

It's risky business, playing a guitar like a piano and recording "live" with



no overdubs, as Stanley Jordan does on *Standards Volume 1*. While it features distinctive arrangements of pop favorites—notably "The Sounds of Silence," "Moon River," "My Favorite Things" and "Silent Night"—this is not your typical jazz guitar record.

Playing with a clean but very unadorned guitar sound, Jordan's "touch" or tapping technique inevitably becomes the focus. On the one hand (literally), scintillating scales and eccentric phrasing yield some classy jazz moments. These are, however, often marred by awkward ornamentation and missed notes, which are disappointing on a studio record. On the other hand (literally), simultaneous bass lines create some interesting rhythmic figures, but also frequently buzz out of control or sound like the work of an amateur second guitarist.

Although not a repeat of *Magic Touch*, Jordan's quite successful debut, *Standards Volume 1* does provide a good close-up of the guitarist's tapping technique in a revealing solo context, illustrating both its beauty and its limitations. *Michael Wright*

The Latin Connection: Terry Gibbs
Contemporary C-14022.

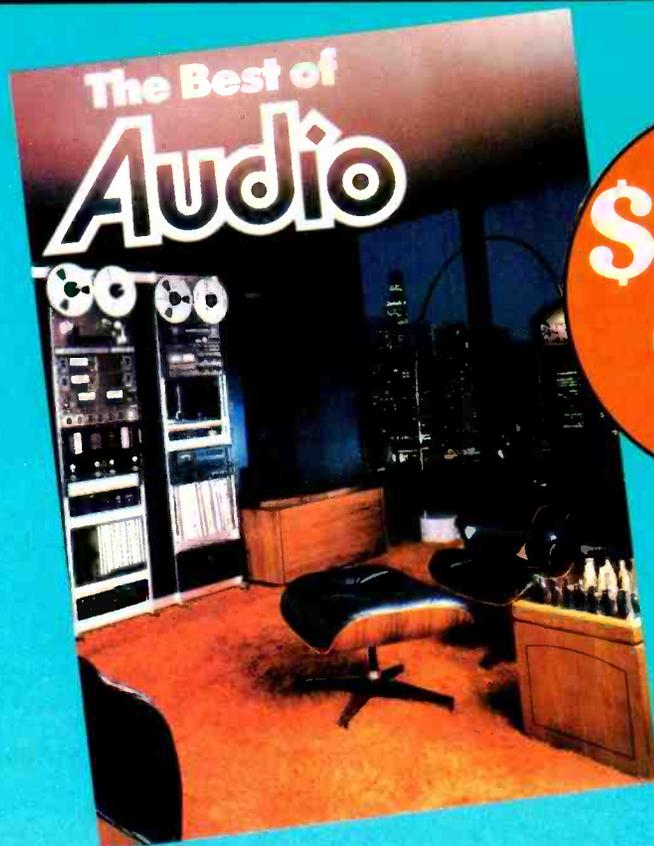
Sound: B Performance: B-

The Latin Connection has a lot going for it. First, it has excellent musicians,

most from the Latin music recording scene: Pianist Sonny Bravo; bassist Bobby Rodriguez; percussionists Orestes Vilato, Johnny Rodriguez and Jose Madera, and a three-song appearance by master percussionist Tito Puente. Also here are alto saxophonist Frank Morgan and the leader of this session, vibraphonist Terry Gibbs. Second, there is good material, including "Scrapple from the Apple" (Charlie Parker), "Chelsea Bridge" (Billy Strayhorn), "Groovin' High" (Dizzy Gillespie), "Sing, Sing, Sing" (Louis Prima), plus Gibbs' original material. Third, the LP is very quiet and dynamic. It was recorded at Fantasy Studios in Berkeley, Cal. and mixed to digital tape using a Mitsubishi X-80 two-track recorder. (The liner notes indicate that this album was recorded on an analog multi-track; mastering was done using the two-track digital tape.)

The Latin Connection indeed has a lot going for it. Nonetheless, it doesn't live up to its apparent advantages. Much of the time the music simply doesn't catch fire. The lead soloists, Gibbs and Morgan, never produce any inspired or inspiring solos, except for a brief few measures by Gibbs on "Flamingo." In fact, they never seem to catch on to the solid Latin groove that the rhythm section creates. The only time the record really takes off is when pianist Bravo is given the opportunity

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to solo, as on "Kick Those Feet" and "Sing, Sing, Sing." Bravo manages to accomplish more in 16 measures than Gibbs and Morgan do in 32. Part of the reason is that Bravo plays percussively, within the groove, while Morgan and Gibbs play more melodically, with less regard (or respect) for the rhythm. With few exceptions, they don't ever truly react to their surroundings.

Next time around, Mr. Gibbs should take a hint from Grace Jones and become a slave to the rhythm. It's the only way to make the Latin connection.

Hector G. La Torre

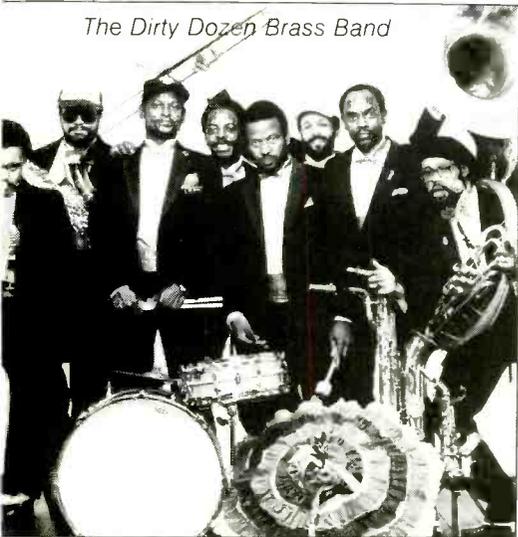
Live: Mardi Gras in Montreux: The Dirty Dozen Brass Band
Rounder 2052.

Sound: B Performance: B to C

This recent Rounder release is one of a series of "Modern New Orleans Masters" recorded by the enterprising independent label. The Dozen are actually eight musicians, mostly 30 or under, who use the traditional instrumentation of the New Orleans brass band as a vehicle to play extended ensemble jazz and typical modern-jazz solos, many on two-note motifs which never go anywhere.

There are two trumpets; a trombone; tenor, baritone, and soprano saxes; a sousaphone, and snare and bass drums. The group has a great deal of energy, and I find Kirk Joseph's flexibility and style with the sousaphone rewarding.

The Dirty Dozen Brass Band



Pullen and George Adams

Kalamu ya Salaam's liner notes—he is executive director of the New Orleans Jazz and Heritage Foundation—claims that this group is the first since the '20s to have a national and international impact playing a style of jazz based on traditional New Orleans forms and instrumentation. I wonder if Mr. Salaam has heard the Olympia or Preservation Hall units, both of whom have national and international standing, difficult though these things are to measure.

The music on this recording could be played by musicians from Indianapolis, Seattle, Oakland, or anywhere else; there is nothing that says New Orleans. It seems to me that if The Dirty Dozen Brass Band is going to sustain interest, they'll have to make use of the rich and vital music of the spiritual and the march, not to mention the dirges that are the foundation of New Orleans brass-band tradition.

With their colorful costumes and the abundant energy of youth, this band has made an impact on the public. But based on the music heard here, they have a long way to go if they want to be taken for anything more than a passing novelty.

Frank Driggs

Breakthrough: The Don Pullen/George Adams Quartet
Blue Note BT-85122.

Sound: B Performance: B+

The Don Pullen/George Adams Quartet has for several years been the most exciting jazz unit going. In concert, they are untouchable, creating a volcanic rush of virtuosity coupled with gutbucket intensity. Adams is a veteran saxophonist whose solos are studies in reckless abandon. Don Pullen is

one of the few pianists to merge the lightning intensity and fractured kinetics of Cecil Taylor with a pure blues feeling. Drummer Dannie Richmond is a master of time. All three musicians formed the nucleus of the last great band led by Charles Mingus. Round them out with bassist Cameron Brown, who's apprenticed with most of the greats (including Archie Shepp), and you have a monster band, a supergroup.

Breakthrough, the quartet's first American release after a string of recordings on the Italian Black Saint label, nearly captures their in-concert intensity. Take "Just Foolin' Around," for instance. Richmond throtties and pushes the drums in circular flurries. Throaty, moaning passion glowers from Adams' saxophone. Pullen swings in and out of time, sometimes playing with the rhythm, sometimes destroying it with clusters of notes and flip-flopping runs that disregard the changes. Cameron Brown darts and weaves in this hurricane of energy.

The liner notes, by the influential poet and critic Amiri Baraka, talk about the group's "accessibility," but for me the attraction is in their pure relentlessness. They never let up, and whether playing ballads like "Song from the Old Country" or putting on the afterburners for "Mr. Smoothie," they convey an emotional passion that sucks you in like a vortex. They're not accessible so much as irresistible.

Breakthrough still doesn't completely capture these players' live intensity, but it does present them in a convincing environment, with each instrument clearly defined, especially Adams' tenor growl and Pullen's sometimes skewed pyrotechnics. *John Diliberto*

Stevie Ray Vaughan's guitar and voice have been captured well, but his band slips in and out of a muddy background.

Roughhousin': Lil' Ed and The Blues Imperials
Alligator 4749.

Sound: B Performance: B

A guitar lays down one of those elemental riffs which garage bands learn in a minute but which haunt you forever. The slide guitarist skids over the rhythm section like an ice skater uncontrollably hurtling towards the edge of a pond. A voice shouts in a declamatory style straight from the Mississippi Delta by way of Chicago. Is it an unknown session from the late J. B. Hutto? Nope. It's "Pride and Joy," the best cut on this debut album from Lil' Ed and The Blues Imperials, a band with a direct line to groove central.

Much of this group's repertoire consists of recycled Elmore James riffs as filtered through J. B. Hutto and Hound Dog Taylor—done nicely, but done before. Yet it would be difficult for any band to revive these familiar bedrock licks without either patronizing the material or burying it under an abundance of technique. *Roughhousin'* suggests that classic slide-guitar blues is truly all Lil' Ed wants to play—there's no other explanation for the boundless enthusiasm he shows us here.

The Blues Imperials come by their passion for slide guitar honestly enough. Hutto was uncle to both Lil' Ed (Williams) and bass player James

Young, and teacher to guitarist Dave Weld. Like Hutto, Lil' Ed uses his slide guitar to augment the rhythm through short, punchy riffs.

This band was originally scheduled to cut two sides for an Alligator anthology but wound up recording 30 songs in just over three hours. Most of the tracks on *Roughhousin'* were cut on the first take, which is the only way to capture music that must be second nature before it can ever hope to sound natural.

Why buy this record instead of those that you'd probably find in Lil' Ed's own collection? Support Lil' Ed and maybe one day he'll bring the glories of heavily amplified slide guitar to your town. If that's not reason enough, the aptly named "Pride and Joy" hints that his band might just yet cut sides to bring it out from under the shadow of Hutto's influence.

Roy Greenberg

Live Alive: Stevie Ray Vaughan and Double Trouble
Epic E2-40511, two-record set.

Sound: C Performance: B

Like a Texas twister, Stevie Ray Vaughan continues to spread mayhem with his virtuoso blues maelstrom on *Live Alive*. Vaughan's playing and singing here are in top form. The textures of his studio recordings are absent on this live set, but they're not



missed when Vaughan's slinky, distorted Strat sound and fretwork finesse take the stage. You can really hear his influences here: John Lee Hooker, T-Bone Walker, Albert Collins, Jimi Hendrix. For creative destruction, check out "Mary Had a Little Lamb," "Look at Little Sister" (with older brother Jimmy Lee of The Fabulous Thunderbirds), and the rousing tribute "Voodoo Chile (Slight Return)."

However, there's double trouble here as well. While Vaughan's voice and guitar have been captured well, his band Double Trouble slips in and out of an inconsistent, muddy background that's certainly not state-of-the-art "live" sound. The second problem is "Life Without You," an extremely embarrassing (or else hysterically satirical) rap which uses some *amazing* twists in logic to connect giving to the poor with putting people down in South Africa.

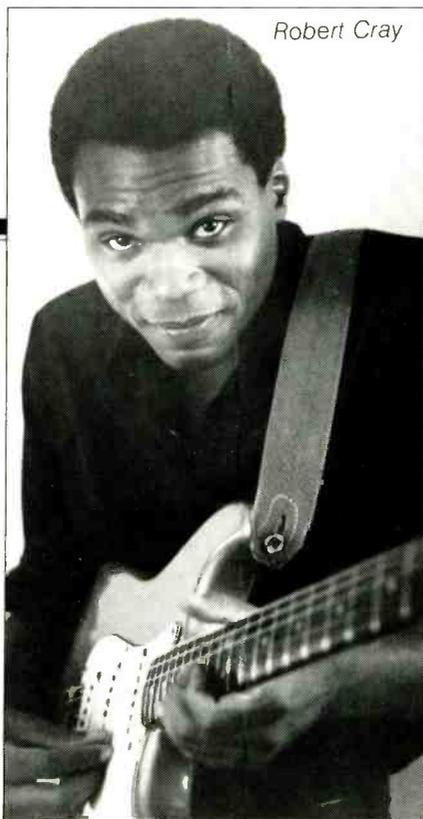
These caveats about *Live Alive* shouldn't deter avid SRV fans, but if you're looking for an introduction to a considerable musical talent, try the studio recordings like *Stevie Ray Vaughan and Double Trouble* or *Texas Flood* instead.

Michael Wright



Lil' Ed and The Blues Imperials

Robert Cray



Strong Persuader: Robert Cray
Polygram 422-830568-1M1.

Sound: B Performance: B+

After several successful outings on small independent labels, blues/R&B guitarist Robert Cray has moved up to the major leagues. Some will be disturbed by the changes that a major label and six-figure production budget can bring to a roots performer, but

almost without exception the Cray sound is changed for the better. Only on one cut, "Smoking Gun," is Cray's intimacy traded in for an album-radio sound—but there is something gained in the exchange, too. The rest of the album is full of the usual stinging guitar and Robert's tales of dalliance.

The only fault on this record is that there could be more variety in the songwriting—a cover or two would have served to flesh out the set better. Whether Robert will now sell a zillion records is an open subject, but he should at least be able to keep his audience with this one.

Jon & Sally Tiven

Some Legendary Art: Art Hodes
Audiophile AP 54.

Sound: B+ Performance: A/B+

In the 1950s, many fine recordings appeared on E. D. Nunn's superbly engineered Audiophile label. The very active and determined George H. Buck, Jr. bought the label and has been using it not only to release some outstanding new recordings, but also to reissue some of the records of the '50s, such as this one.

Art Hodes always made the best out of a basically limited style. No one could ever accuse him of playing too much, and perhaps that is why so much of his music seems to stand up so well over a long period of time.

This date was originally put together by John Steiner, an active jazz historian and recording anthologist of long standing. Besides Hodes' spare but always telling piano, it features for the first time some excellent clarinet playing by Eddie Burelton, a Milwaukee-area native whose playing goes back to the Depression Era.

All the sidemen—guitarist Marty Grosz, who has since expanded his activities in the New York area; bassist Truck Parham, whose career included long stands with Earl Hines and Jimmie Lunceford, and New Orleans drummer Freddie Kohlman—became known around Chicago. Only Eddie Burelton remained unknown, and that is too bad, because his playing seems original to me.

The entire recording is laid-back and easy, and I think you'll find that it wears well on your turntable. *Frank Driggs*

Generation: Kenny Burrell and The Jazz Guitar Band

Blue Note BT-85137.

Sound: B+ Performance: B

Still bopping with that unmistakable soft, fat tone, jazz guitar legend Kenny Burrell appears in a novel context on *Generation*, playing with two young, up-and-coming New Yorkers, Bobby Bloom and Rodney Jones (The Jazz Guitar Band).

Playing straight-ahead, traditional jazz, Burrell commands center stage (and stereo image), takes most of the risks, and shows why he's so respected. Except for some interesting interplay on "Jumpin' the Blues" and the all-acoustic "So Little Time," most numbers feature sequential solos which require careful listening to distinguish. For solo chops, check out Burrell's skittering scalar opening and Kenny Washington's drumming on "Mark I," Bloom's bluesy intro to "High Fly," and Jones' trebly interlude and Dave Jackson's acoustic bass on "Generation."

The live recording of *Generation* is impeccable. It puts you in a great front-row seat for a good, old-fashioned, swinging club jam.

Michael Wright



Kenny Burrell

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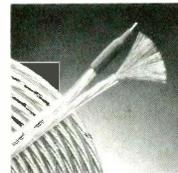
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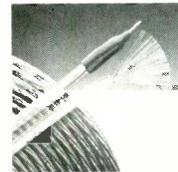


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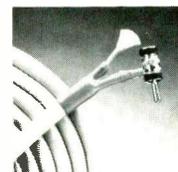


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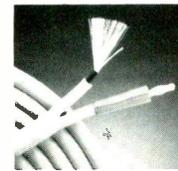


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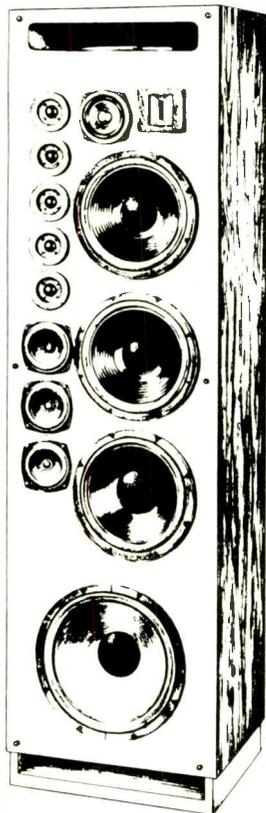


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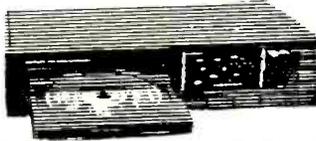
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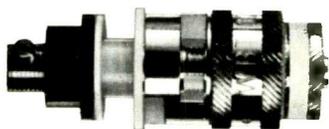
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MAX 90	1.95	SONY UXS-90	50.05
MAX 90	1.95	SONY UXS-90	50.45
MAX 90	1.95	SONY UXS-90	50.85
MAX 90	1.95	SONY UXS-90	51.25
MAX 90	1.95	SONY UXS-90	51.65
MAX 90	1.95	SONY UXS-90	52.05
MAX 90	1.95	SONY UXS-90	52.45
MAX 90	1.95	SONY UXS-90	52.85
MAX 90	1.95	SONY UXS-90	53.25
MAX 90	1.95	SONY UXS-90	53.65
MAX 90	1.95	SONY UXS-90	54.05
MAX 90	1.95	SONY UXS-90	54.45
MAX 90	1.95	SONY UXS-90	54.85
MAX 90	1.95	SONY UXS-90	55.25
MAX 90	1.95	SONY UXS-90	55.65
MAX 90	1.95	SONY UXS-90	56.05
MAX 90	1.95	SONY UXS-90	56.45
MAX 90	1.95	SONY UXS-90	56.85
MAX 90	1.95	SONY UXS-90	57.25
MAX 90	1.95	SONY UXS-90	57.65
MAX 90	1.95	SONY UXS-90	58.05
MAX 90	1.95	SONY UXS-90	58.45
MAX 90	1.95	SONY UXS-90	58.85
MAX 90	1.95	SONY UXS-90	59.25
MAX 90	1.95	SONY UXS-90	59.65
MAX 90	1.95	SONY UXS-90	60.05
MAX 90	1.95	SONY UXS-90	60.45
MAX 90	1.95	SONY UXS-90	60.85
MAX 90	1.95	SONY UXS-90	61.25
MAX 90	1.95	SONY UXS-90	61.65
MAX 90	1.95	SONY UXS-90	62.05
MAX 90	1.95	SONY UXS-90	62.45
MAX 90	1.95	SONY UXS-90	62.85
MAX 90	1.95	SONY UXS-90	63.25
MAX 90	1.95	SONY UXS-90	63.65
MAX 90	1.95	SONY UXS-90	64.05
MAX 90	1.95	SONY UXS-90	64.45
MAX 90	1.95	SONY UXS-90	64.85
MAX 90	1.95	SONY UXS-90	65.25
MAX 90	1.95	SONY UXS-90	65.65
MAX 90	1.95	SONY UXS-90	66.05
MAX 90	1.95	SONY UXS-90	66.45
MAX 90	1.95	SONY UXS-90	66.85
MAX 90	1.95	SONY UXS-90	67.25
MAX 90	1.95	SONY UXS-90	67.65
MAX 90	1.95	SONY UXS-90	68.05
MAX 90	1.95	SONY UXS-90	68.45
MAX 90	1.95	SONY UXS-90	68.85
MAX 90	1.95	SONY UXS-90	69.25
MAX 90	1.95	SONY UXS-90	69.65
MAX 90	1.95	SONY UXS-90	70.05
MAX 90	1.95	SONY UXS-90	70.45
MAX 90	1.95	SONY UXS-90	70.85
MAX 90	1.95	SONY UXS-90	71.25
MAX 90	1.95	SONY UXS-90	71.65
MAX 90	1.95	SONY UXS-90	72.05
MAX 90	1.95	SONY UXS-90	72.45
MAX 90	1.95	SONY UXS-90	72.85
MAX 90	1.95	SONY UXS-90	73.25
MAX 90	1.95	SONY UXS-90	73.65
MAX 90	1.95	SONY UXS-90	74.05
MAX 90	1.95	SONY UXS-90	74.45
MAX 90	1.95	SONY UXS-90	74.85
MAX 90	1.95	SONY UXS-90	75.25
MAX 90	1.95	SONY UXS-90	75.65
MAX 90	1.95	SONY UXS-90	76.05
MAX 90	1.95	SONY UXS-90	76.45
MAX 90	1.95	SONY UXS-90	76.85
MAX 90	1.95	SONY UXS-90	77.25
MAX 90	1.95	SONY UXS-90	77.65
MAX 90	1.95	SONY UXS-90	78.05
MAX 90	1.95	SONY UXS-90	78.45
MAX 90	1.95	SONY UXS-90	78.85
MAX 90	1.95	SONY UXS-90	79.25
MAX 90	1.95	SONY UXS-90	79.65
MAX 90	1.95	SONY UXS-90	80.05
MAX 90	1.95	SONY UXS-90	80.45
MAX 90	1.95	SONY UXS-90	80.85
MAX 90	1.95	SONY UXS-90	81.25
MAX 90	1.95	SONY UXS-90	81.65
MAX 90	1.95	SONY UXS-90	82.05
MAX 90	1.95	SONY UXS-90	82.45
MAX 90	1.95	SONY UXS-90	82.85
MAX 90	1.95	SONY UXS-90	83.25
MAX 90	1.95	SONY UXS-90	83.65
MAX 90	1.95	SONY UXS-90	84.05
MAX 90	1.95	SONY UXS-90	84.45
MAX 90	1.95	SONY UXS-90	84.85
MAX 90	1.95	SONY UXS-90	85.25
MAX 90	1.95	SONY UXS-90	85.65
MAX 90	1.95	SONY UXS-90	86.05
MAX 90	1.95	SONY UXS-90	86.45
MAX 90	1.95	SONY UXS-90	86.85
MAX 90	1.95	SONY UXS-90	87.25
MAX 90	1.95	SONY UXS-90	87.65
MAX 90	1.95	SONY UXS-90	88.05
MAX 90	1.95	SONY UXS-90	88.45
MAX 90	1.95	SONY UXS-90	88.85
MAX 90	1.95	SONY UXS-90	89.25
MAX 90	1.95	SONY UXS-90	89.65
MAX 90	1.95	SONY UXS-90	90.05
MAX 90	1.95	SONY UXS-90	90.45
MAX 90	1.95	SONY UXS-90	90.85
MAX 90			

