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MARCH-APRIL 1980 \$4.35

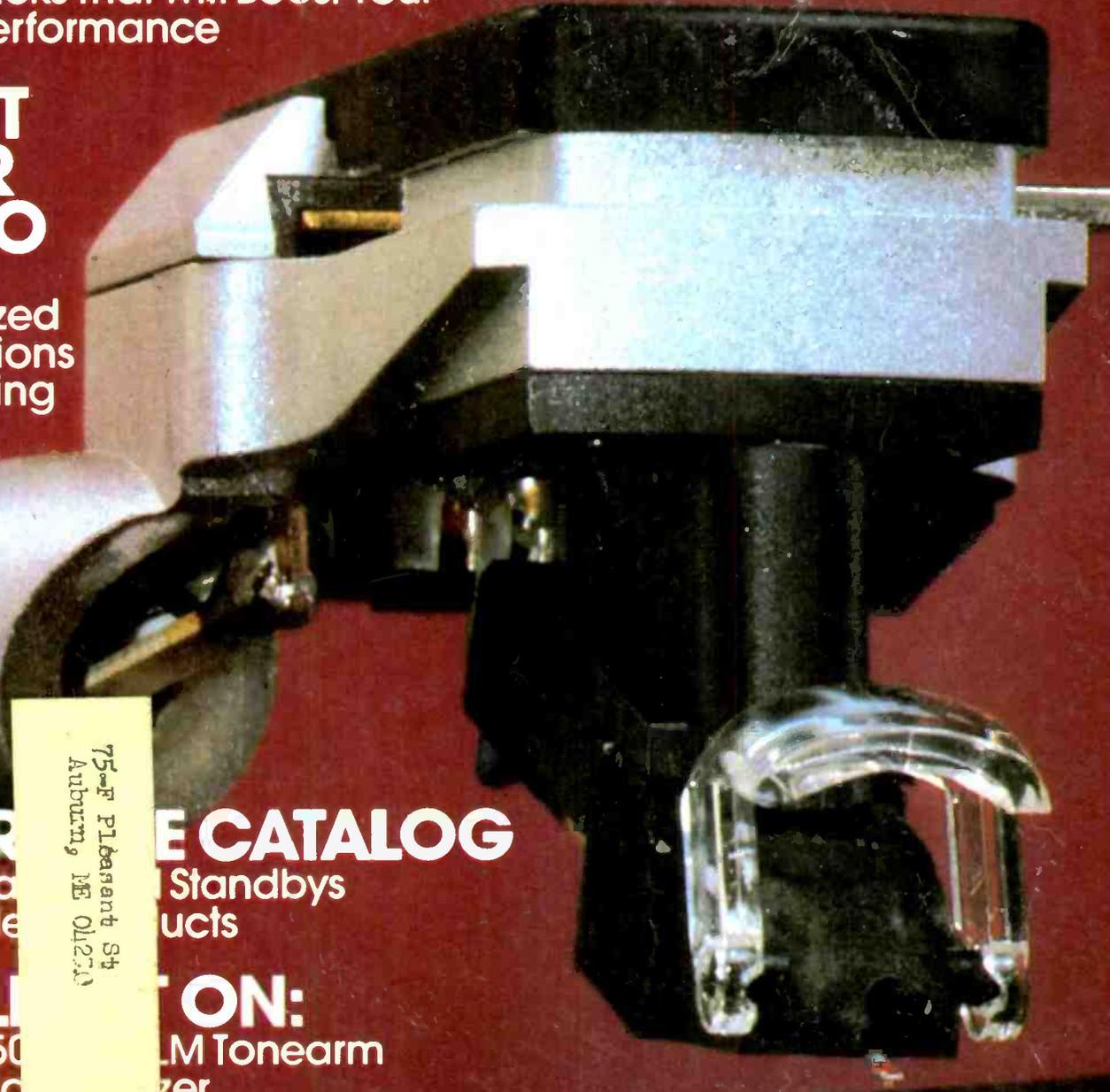
# hi-fi stereo

## BUYERS' GUIDE

**TAKE THE FEAR OUT OF STEREO SHOPPING**  
A Guide to Audio Equipment Auditioning

**MAXIMIZE YOUR PHONO PICKUP**  
No-Cost Tricks That Will Boost Your  
Phono's Performance

**SELECT  
A CAR  
STEREO**  
New  
Standardized  
Specifications  
Make Buying  
Easier



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**THE CATALOG**

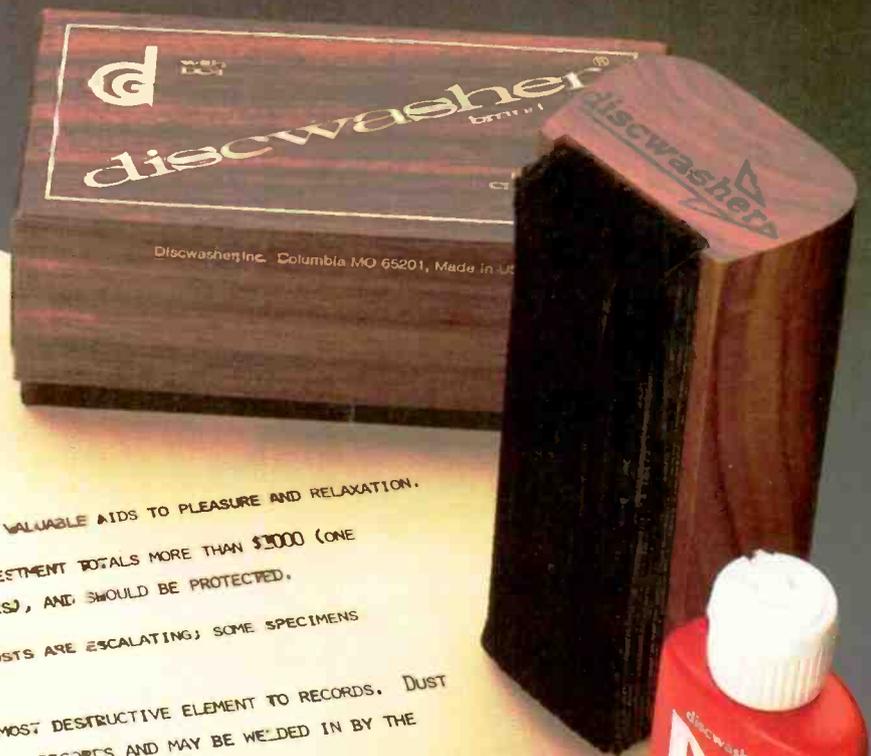
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**LAB TESTS OF  
LATEST EQUIPMENT**



# INVESTMENT LETTER



POSTULATE: YOUR RECORDS ARE VALUABLE AIDS TO PLEASURE AND RELAXATION.

POSTULATE: YOUR RECORD INVESTMENT TOTALS MORE THAN \$1000 (ONE THOUSAND DOLLARS), AND SHOULD BE PROTECTED.

SUPPORTING DATA: REPLACEMENT COSTS ARE ESCALATING; SOME SPECIMENS UNAVAILABLE.

SUPPORTING DATA: DUST IS THE MOST DESTRUCTIVE ELEMENT TO RECORDS. DUST SETTLES ON ALL RECORDS AND MAY BE WELDED IN BY THE TRACKING STALLS.

PROSPECTUS: THE DISCWASHER D3 RECORD CLEANING SYSTEM, WITH UNIQUE UNIDIRECTIONAL MICRO-FIBERS, LIFTS OFF DUST—RATHER THAN JUST LAYING IT UP. RESULTS ARE VISUAL, SONIC AND CLEARLY PROTECTIVE OF INVESTMENT. COST OF SYSTEM IS ONLY \$15 (FIFTEEN DOLLARS). HAS LIFETIME MILLED WALNUT HANDLE AND INCLUDES DC-1 PAD CLEANER.

ADDENDUM: BE GUARDED OF IMITATIONS. SOUND INVESTMENTS SHOULD BE PROTECTED BY THE PROVEN EXPERTISE OF DISCWASHER LABS.



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# Auto Sound Just Got Serious

## The Voice of the Highway™ from Altec Lansing

Are you content to use toy loudspeakers with front-end gear that sells for \$300 and more? If you are, good luck. If you're not, read on.

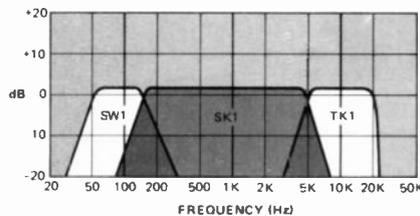
Altec Lansing has been solving the world's most serious sound problems for 43 years. So when we turned our minds to the problem of putting quality sound on wheels, we meant business.

A quick look around showed us that it hadn't worked to merely adapt conventional speakers to car interiors or make miniature versions of hi-fi components. So we began with the car—not the components.

We thoroughly explored the car's uniquely difficult acoustical environment. Then we designed *The Voice of the Highway*: A group of speakers that work with *any* car sound system, are adaptable to a wide variety of body styles, and produce quality sound that, until now, was impossible to achieve in a car.

It's a system of options. Separate high-frequency (TK1), extended range (SK1), and sub-bass (SW1) speaker components that together produce optimum results. And they can be mixed or matched to fit a variety of space needs and sound desires, or enhance a currently installed system. Plus, there's a 6" x 9" full range Duplex speaker that *installs easily in the door*.

And we built all Voice of the Highway speakers to be efficient so their clean, clear, tight sound gets through traffic noise without pushing even modestly-powered amplifiers past their limits.



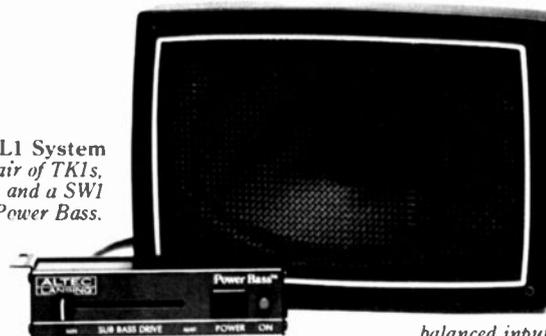
*The Power Bass and TK1  
Restore the Music You're Missing.*

And they complement virtually all quality automotive stereo systems, either as a complete speaker system or as add-on accessories.



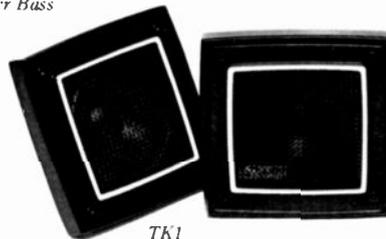
*Rear view of the Power Bass, showing built-in amplifier. When added to any tape player or radio, the Subwoofer bi-amplifies the system, improving the dynamic range and reducing distortion.*

*The AL1 System includes a pair of TK1s, a pair of SK1s and a SW1 Power Bass.*



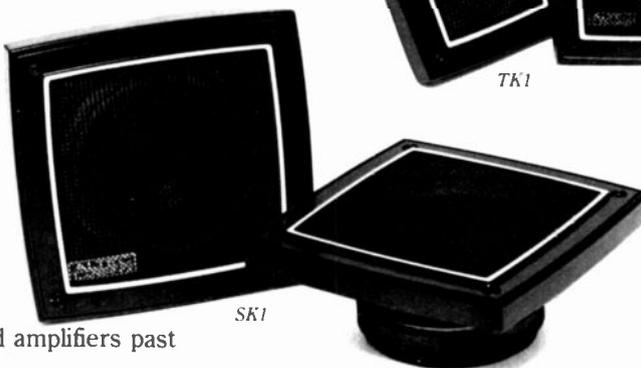
*SW1 Power Bass*

*The SW1 Power Bass self-powered subwoofer gives deep bass to auto sound where none existed before. It is destined to become THE automotive sound accessory of the eighties. Its control module balances the bass output to the rest of the system. The Power Bass' unique die cast structure houses a 40-watt power amplifier, electronic crossover, balanced inputs and active equalizer, and functions as the amplifier's heat sink.*



*TK1*

*The TK1, 3" high frequency driver covers the very top of the musical spectrum adding brilliance and clarity.*



*SK1*

*The SK1, 5 1/4" extended range speaker can stand on its own where installation space is extremely limited.*

If you're serious about putting quality sound on your wheels, contact your local Altec Lansing dealer, or Altec Lansing.

The Voice of the Highway from Altec Lansing. Auto sound just got serious.

**ALTEC  
LANSING**

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Circle No. 18 On Reader Service Card

MARCH/APRIL 1980

# No matter how good your present stereo system, we can improve it! Here's proof.



Add effortless clarity and transparency with our new Omnitec™ series Vector-Aligned™ dual magnet cartridge or AT30E moving coil cartridge with user-replaceable stylus.



Laboratory precision is the hallmark of every A-T tone arm for home, studio, or disco.



You might pay \$1000 or more for speakers almost as good as these remarkable electret stereophones.



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# hi-fi stereo

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A groove's view of the business end of a Dual ULM55E tonearm with its Dual/Ortofon cartridge. See page 44 for the Spotlight article on the Dual CS-650 RC for more details.



# THE LATEST HI-FI COMPONENTS IN OUR... AUDIO SHOWCASE

## Moving Coil Cartridge

Audio-Technica's new high-performance moving coil cartridge, model AT-32, is based on a magnetic system that positions two coils in an inverted V above the beryllium cantilever. It's done to provide low mass and an improved radial damping ring which is claimed to yield high standards of compliance. In essence, the AT-32 is a hand-tuned, light-tracking moving-coil cartridge. The working parts are contained in a bright jewelry gold finished housing with translucent brown plastic bottom. The cartridge comes with a



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factory-replaceable .2 by .7 mil, nude mounted elliptical diamond stylus with 12 mm square shank which is said to reduce mass and ensure accurate positioning of the diamond stylus. Specifications: frequency response, 15 to 25,000 Hz; channel separation, 30 dB at 1 kHz and 20 dB at 10 kHz; channel balance, 0.75 dB; recommended tracking force, 1 to 2 grams; output, 0.4 millivolts; impedance, 20 to 70 ohms. Suggested retail price is \$300.

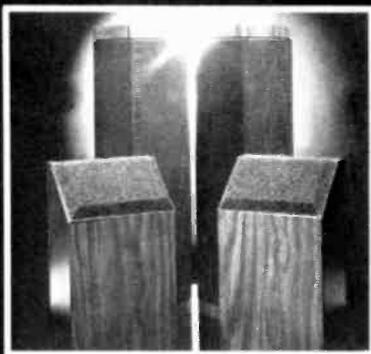
Audio Pulse Digital Time Delay is possibly the greatest advance in sound reproduction since stereo. A strong statement indeed, but we feel strongly about it. By means of time delay, the ambience of the live performance is returned to the music in a way not possible with ordinary stereo reproduction.

Stereo gave us left and right imaging — Audio Pulse gives us the realism of depth and spatial perception by digitally processing, delaying and

recirculating program material through a secondary set of rear speakers. The apparent size and acoustic treatment of that area can be adjusted by simple front-panel functions.

Digital time delay must really be heard to be appreciated... but once you do, you won't want to listen without it.

Audio Pulse offers complete digital time delay systems. Model Two, the new Model 1000 and two sets of specially designed secondary speakers.



**Audio Pulse**

YOU WON'T MISS IT UNTIL IT'S GONE...

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# Why Wait, Delay Now.



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## Digital "Missing Link"

Koss offers a Digital Delay System that is claimed to "convert your living room into Carnegie Hall." The K/4DS, priced at \$500, utilizes a patented single circuit conversion unit capable of storing nearly 17,000 bits of music information, and includes a built-in 15 watt per channel amplifier to power the rear speakers. The system also features a range of environmental settings from a small club to a theater, concert hall



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or auditorium, and includes an EQ switch for signal balance as well as an isolated stereophone function with twin jacks and stereophone amplifiers. The company says the average price of the most competitive unit is some \$300 costlier, and others in the thousand dollar price range do not provide built-in amps as does the Koss K/4DS.

## New Garrard Turntables

Garrard's six new turntables include two upgraded models plus four that are the vanguard of a new series called the "Advance Design Group." Two of the newcomers, models GT250 and GT350 are belt drive single/multiple play units; the GT250AP and GT350AP are full automatic belt drive single-play turntables. These units have front controls, low mass tonearms matched to a carbon-fiber headshell, self-centering screw guide for accurate cartridge alignment, a built-in overhang adjust-

# Introducing TDK's Optimum Dynamic.<sup>TM</sup>

## Normal bias tape taken to the optimum.



### TDK's answer to the need for a normal bias reference standard.

Optimum Dynamic is the outcome of the same, sophisticated technology which set the high bias reference standard with TDK's SA cassette. Its tape formulation consists of Optima Ferric particles. A needle-shaped, pure iron oxide that has been ultra refined to cover the tape surface evenly and densely. The result is a cassette with a sensitivity and MOL audibly superior to any normal bias cassette available in the market today.

### Well balanced sound.

Optimum Dynamic has all the sound characteristics you've been looking for. Super flat frequency response and sensitivity with a wide dynamic range. Lower noise and higher output at critical levels. For example, you'll now be able to capture the full dynamic complexity of a classical performance as well as the sustained higher output characteristic of contemporary music. In every way, Optimum Dynamic will deliver a well balanced, reference quality normal bias performance. And you'll hear it, unfailingly, for years to come.

Optimum Dynamic has the same Super Precision Mechanism as the SA cassette, protected by TDK's full lifetime warranty.\*

Supplier to the U.S. Olympic Team



\*In the unlikely event that any TDK cassette ever fails to perform due to a defect in materials or workmanship simply return it to your local dealer or to TDK for a free replacement.

### The test of success.

We believe we've been highly successful in fulfilling the need for a normal bias reference standard. But there's a simple test. Listen to an Optimum Dynamic just once. Compare it to anything else you've been using. From then on, you may want to use it as a reference.



**TDK**  
The machine for your machine

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# AUDIO SHOWCASE



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On Reader Service Card

ment calibrator and a new isolated counterbalance weight. Also featured are low-friction jewel bearings to complement the ultra-light tonearm/headshell combination. There's also a Del-glide automatic system module and a three year warranty on parts and labor. The turntables are priced to sell in the \$200 range.

## Three Mini Speakers and Bass Extender

General Sound offers Extended Range Audio systems (ERA-3) under the product name Micron, in the form of "Time-Aligned" mini speakers designated by model numbers 400, 500 and 600. These can now be combined with a "Bass Extender," model 1011 to create a "revolutionary" three-piece



Circle No. 126 On Reader Service Card

speaker system. The mini-speakers are claimed to eliminate time-smear by utilizing computer-calculated, phase controlled crossover networks and precision engineered baffle offsets. The 400 series (\$125 each) is a two-way system featuring a 4-inch woofer and 1-inch soft-dome tweeter. The 500 series (\$150 each) consists of a 5 1/4 inch woofer and a 1-inch tweeter. The top-of-the-line 600 series (\$200 each) is a three-way system incorporating a 6 1/2-inch woofer, 2 1/4-inch midrange and 1-inch dome tweeter. The Model 1011 "Bass-Extender" (\$350) is a tuned port design having true 360-degree sound dispersion, integral electro-acoustical crossover network, left and right mid/high frequency level controls and a high-compliance, low-mass dual voice coil 10-inch sub-bass driver. The Bass Extender is said to make ERA-3 capable of handling frequencies down to 25 Hz.

## Linear Motor Direct Drive Turntable

Fisher's model MT6330 "Studio Standard" semi-automatic direct drive turntable makes use a linear drive in which



Circle No. 69 On Reader Service Card

the platter is actually the rotor of the motor. The company claims that this 120-pole linear drive design virtually eliminates "cogging action" and greatly reduces rumble. The unit offers convenient front-panel operation, variable calibrated anti-skate control, stylus pressure adjustment, strobe light and speed controls, viscous damped cueing,

automatic tone arm return and shut-off, and a 2.2-pound cast aluminum platter. Specifications: wow and flutter (WRMS), 0.035%; rumble (DIN 45539B), -70 dB; speed variation, ±0.5%; speed control range, ±3%; tracking force range, 0.6 to 3.5 grams; platter diameter, 12-15 1/8 inches; record speed selector, 33 1/3 45 rpm; dimensions, 17 1/2 inches wide by 14 1/2 inches deep by 6 inches high. Tracking force adjustment is by means of a calibrated counterweight. Price: \$190.

## New Speaker Line

For the first time in this company's 25-year history of making speakers for other companies, Audio Electronic Systems is coming into the branded speaker system market with five new models under an AES label. Prices range from \$89 to \$399. All but the smallest (AES 28) employ United Speaker System "soft-dome" tweeter and/or mid-range drivers that AES has previously licensed to other manufacturers. The AES 28 is a two-speaker, two-way bass reflex system with an 8-inch woofer having a 1-inch voice coil and 2-inch cone tweeter. It has a frequency range of 50 to 15,000 Hz and a recommended amplifier power of 5 to 30 watts RMS. The next step up the line is AES 31, a three-speaker, three-way bass reflex system employing a 10-inch woofer, 1 1/2-inch soft-dome midrange and a 2-inch cone tweeter. Frequency range is 40 to 17,000 Hz and amplifier power is 10 to 50 watts RMS. The AES 32 is an air suspension system incorporating a 12-inch woofer, a 1 1/2-inch soft-dome midrange and 2-inch cone tweeter with crossovers at 700 and 3000 Hz. Amplifier power: 10 to 60 watts RMS. An-



Circle No. 122 On Reader Service Card

other three-way, three-speaker air suspension system, the AES 42, has a frequency range of 20 to 20,000 Hz and a suggested amplifier power of 25 to 100 watts RMS. Topping off the new line is model 50T, a floor standing four-speaker, three-way system featuring a 12-inch woofer with a 10-pound magnet structure, plus two 2-inch soft-dome midrange drivers with 6-pound magnet



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## HIGH PERFORMANCE

The FULTON High Performance Moving Coil cartridge was designed for the discriminating music lover who wants to recreate the live musical experience in his own home. The perfection of the FULTON cartridge can only be realized by hearing it. Its unequalled trackability, tight coupling and light weight make it an instrument of pristine musical beauty.

Hear the FULTON cartridge, the First Choice in Listening.

**FULTON MUSICAL INDUSTRIES**  
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(612) 537-7076

# The new Sansui G-4700.



## A double-digital receiver with all the right numbers.

Digital readouts and digital circuitry. Great specs. And the best price/performance ratio in the business. All the right numbers. That's the new Sansui G-4700. Just look what we offer:

**Double-Digital Design:** The front panel of the G-4700 has a bright electronic digital readout that shows the frequency of the station you've selected; and behind the front panel is one of the most advanced tuning systems in the world.



Sansui's patented Digitally Quartz-Locked Circuit uses a precise quartz crystal time base to keep your station locked in, even through many hours of listening or if you turn the receiver off and back on again.

Conventional quartz-controlled receivers use analog phase comparison circuits that can become inaccurate because of harmonic interference. Our system uses a new LSIC (Large Scale Integrated Circuit) digital processor that actually counts the vibrations of the quartz crystal to compare to the tuned frequency. The frequency is perfectly locked in the instant you find the station you want.

With this unique Digitally Quartz-Locked system, the G-4700 delivers high sensitivity (15dBf, mono); a better signal-to-noise ratio (75dB, mono);

and a better spurious rejection ratio (70dB).

**DC power amplifier:** Power is ample for almost any speaker made, with 50 watts per channel, min. RMS, both channels driven into 8 ohms from 20 to 20,000Hz with no more than 0.05% THD.

And the wide bandwidth DC power amp circuit responds quickly to transient music signals for the most accurate and pleasing music reproduction. What you hear is clean and sharp, just the way it was recorded.

**Electronic LED power meters:** Don't worry if your present speakers can't handle 50 watts. The array of fast-acting LED's (Light Emitting Diodes) on the Sansui G-4700 lets you monitor and control the output level so you don't damage your speakers.

**Electronic tuning meters:** Two fluorescent readouts help to zero-in on each station with accuracy and ease. Both the signal strength and center-tune indicators operate digitally for precise station selection, and the nearby LED verifies that the quartz circuit has locked in your station.

**Superb human engineering:** A full complement of genuinely useful knobs, switches and jacks gives you complete control over what you hear and how you hear it.

Ask your authorized Sansui dealer to demonstrate the G-4700. Listen to the music. You'll love what you hear. Look at the numbers. You'll love what you see.

### SANSUI ELECTRONICS CORP.

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SANSUI ELECTRIC CO., LTD., Tokyo, Japan  
SANSUI AUDIO EUROPE S.A., Antwerp, Belgium  
In Canada: Electronic Distributors

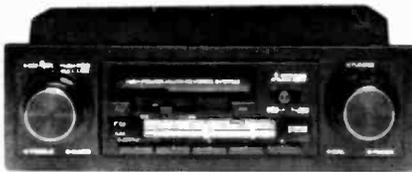


# AUDIO SHOWCASE

structures. The tweeter is a 1-inch soft-dome driver. Frequency range: 25 to 20,000 Hz. Amplifier power, 50 to 125 watts RMS.

## High Power Car Audio

New from Mitsubishi Car Audio is the High Power Model RX-79 cassette unit with AM/FM/MPX. The unit features 20 watts RMS per channel maximum, 14 watts at 1% total harmonic distortion. Other features include separate



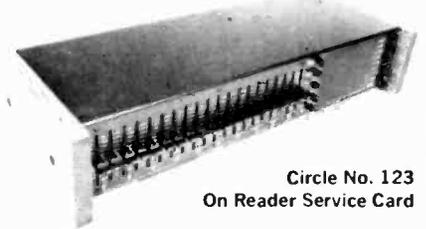
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bass and treble controls, separate balance and fader controls, automatic reverse, auto shut-off/eject, program selector, DX/LOC switch and five-by-five pushbutton tuning. There's separate illumination for AM and FM, four

speaker capability, locking fast forward and rewind, and stereo/mono switch. The suggested list price is \$259.95.

## Equalizer/Spectrum Analyzer

Audio Control's C-101 audio control is claimed to be the world's first graphic equalizer with a real time spectrum analyzer built into it. "For the first time," you can actually see music broken down into 10 separate frequency bands and watch the effect of equalizer controls. The company believes that the spectrum analyzer has been a tool only for professionals while it's the consumer who needs the most help in visualizing what their stereo is doing. The Audio Control Spectrum Analyzer Equalizer features a 92 LED display divided into 10 frequency bands with nine vertical level LEDs and two green center level reference LEDs activated in the sound pressure level mode. Four pushbuttons control speed of display change, metal range, choice of sound pressure level or real time analyzer and on/off. A center detent input level control is for calibrating input sensitivity, and you also get a built-in high-quality pink noise generator for room acoustic analysis, tape bias and speaker adjustment. The equalizer portion features stereo-paired center detent slide pots in ten octave bands from 32 to



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15.5 kHz. An 18-dB per octave Techebychev subsonic filter is included to aid in using the equalizer to improve bass response of a stereo system. Finally, there's a phase correlation rumble reducing circuit for minimizing rumble, phase and intermodulation distortion below 200 Hz. Frequency response is put at 3 to 100,000 Hz with THD at less than 0.025%. The EQ range is  $\pm 15$  dB. Price: \$549.

## Electromagnetic Tower Speaker

Cerwin-Vega's Metron Suft-Fet-2 tower speaker system makes use of 72 Spiral Uniform Force Thin Film Electromagnetic Transducers having a response from 200 to 30,000 Hz. The tower is coupled with a Metron subwoofer which uses boundary layer "air bearing" bass and sub-bass drivers for response down to 20 Hz. The Suft-Fet tower system has distortion typically 0.05% at 100 dB, full bandwidth. Crossovers and multiple drivers are eliminated through use of the thin film



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transducer, as are the phase aberrations associated with the multiple driver/crossover type of speaker system. The thin film is capable of operating over eight octave ranges with a dispersion of 120 degrees, horizontal, at all frequencies. The 1.5-inch thin film diaphragm is said to be driven to "near perfect" piston motion; linear arrays of these units are used in each Metron Suft-Fet speaker tower. Suggested retail price: \$3600.

## Compact Power Amplifier

Linear Power's rugged, compact Model 60A power amplifier delivers 30 watts per channel, minimum RMS, both chan-

**THE CELESTION DITTON 332.  
ITS RANGE-ABILITY HITS YOU  
RIGHT IN THE EARS.**

From the incredible bravura of a diva's high C to the seemingly subliminal low E of a string bass. From the explosion of a faraway cannon to the fragile ting of a triangle floating across the room.

That's Range-ability™ in the Celestion Ditton 332.

Celestion's Range-ability is also pure pronouncement at any volume — from a level barely perceptible to an overpowering 107dB. Through it all, the Ditton 332 maintains exceptional linearity, imaging, dynamic range and high efficiency.

Celestion manufactures each com-

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ponent for its speakers. The result is an integrated acoustic suspension system of superbly efficient elements backed by over 55 years of speaker manufacturing craftsmanship.

Your pair of Ditton 332 cabinets will look as good as they sound. Finishes of oiled American walnut or elm are available.

Range-ability. Finally, listening becomes an experience.

celestion  
international

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nels driven into 4 ohms, 20 to 20,000 Hz with no more than 0.25% total harmonic distortion. The unit features delayed turn-on and built-in noise suppression. The amplifier is designed to drive high performance car or home speakers. The mechanical layout consists of a one-piece printed circuit board for all components and connectors. Power transistors are clamped directly against heavy, extruded aluminum heat sinks to achieve "near perfect" heat transfer while eliminating all mechanical stress. The high efficiency ultrasonic power supply is based on an exclusive oscillator-driven, push-pull inverter circuit driving a ferrite-core power transformers and fast-recovery rectifiers. The power supply is said to be able to deliver in excess of 150 watts of power. Other specifications: signal-

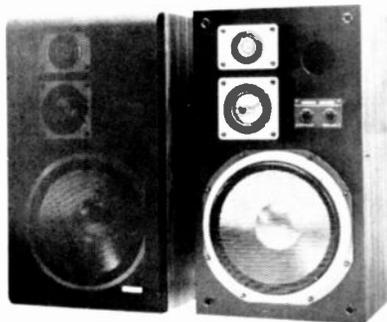


Circle No. 125 On Reader Service Card

to-noise ratio, 90 dB; low level input sensitivity, 0.25 volts RMS at 22k ohms; high level input sensitivity, 2.5 volts RMS at 10k ohms; minimum load impedance, 4 ohms; dimensions, 6 inches by 3 inches by 8½ inches. \$149.95.

#### Metal Cone Speaker

Hitachi's HS-430 is said to be the first metal cone, gathered edge speaker to be offered with a 12-inch woofer. A new cosmetic approach is taken with



Circle No. 72 On Reader Service Card

offset, die cast framed drivers. The system also features a 2½ inch mid-range driver and a 1-inch tweeter. \$399.95

#### Metal Capable Decks

Toshiba's broad line of metal capable cassette decks includes three "advanced state-of-the-art" units. The PC-X60 top-



Circle No. 99 On Reader Service Card

of-the-line model features IC logic solenoid controls, record mute editor switch, an AS (All Sendust) record/playback head, and a ferrite erase head. It offers a low 0.035% wow and flutter, and a high 73dB signal-to-noise ratio using chrome tape and Dolby. Wired remote control is optional for this \$400 deck. The PC-X40 (shown) also has the AS record/playback head and ferrite erase head, plus a digital IC controlled programmable multimusic quick sensor system able to program up to 12 different selections as well as a skip/play function. The \$380 price tag also brings two LED peak meters with changeable bar/dot readout, and auto-repeat functions combined with cue and review and soft eject mechanism. The PC-X20 has similar features but is priced at only \$300. Next in the price line is a \$270 D-10 micro component metal capable deck featuring a super AP (hard permalloy) record/playback head and an all-ferrite erase  
*(Continued on page 16)*

# It sounds like it's made better. It is.

There's less than an inch from the stylus tip to the connector pins on the back of a cartridge. But what's in that inch determines what reaches your ears. And it's why you'll hear such an improvement when you try an Osawa MP cartridge.

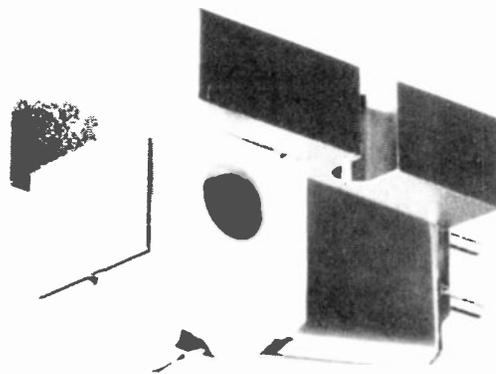
**Non-resonant structure.** The MP-50's aluminum cartridge frame has a precisely machined, squared oversize mounting flange for perfect contact with your cartridge headshell. It assures that all the stylus vibrations reach the magnetic circuit for a strong, clear signal. The stylus doesn't just clip to the cartridge—it's held securely by two Allen fasteners to maintain perfect alignment with the cartridge body.

**Cobalt/permalloy magnetic circuit.** All Osawa MP cartridges employ a unique Moving Permalloy element that modulates the magnetic field generated by a Samarium cobalt magnet. This powerful combination gives you high S/N ratio and high compliance. Stereo separation is dramatic.

**Multi-laminated pole pieces** of 0.1mm super permalloy reduce eddy currents to provide unusually good sensitivity and strong high frequency output.



**Unique cantilever structure.** Made of Boron in the MP-50, MP-30 and MP-20, it's exceptionally strong and weighs almost nothing. And it's machined to micron tolerances for linear response with minimum distortion.



If you want to see how better sounds are made, visit your Osawa dealer.

## OSAWA

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Circle No. 27 On Reader Service Card



# As You Get Better, So Does It.

If you are an audio engineer, you'll get the most out of the new Mitsubishi DT-30 in a day or two.

You get dynamics, fidelity, color and subtlety like you never dreamed of.

If, however, you are merely a gifted amateur, it will take longer.

Because the DT-30 is somewhat like a race horse.

It runs best under a great jockey.

It is more sophisticated, more complex, and more challenging than systems costing twice as much.

It has, for example, recording head azimuth

adjustment, so you can fine tune for optimum performance with any cassette.

It has internal standard oscillators, so you can make accurate and minute bias adjustments.

It has a 3-head structure, so that you can monitor what you're recording while you're recording.

Although a professional would be accustomed to this level of instrumentation, you may not be.

Just remember this. The DT-30 is only a machine. With time and care and devotion, you can master it. And produce tapes that are as good as any in the world.

Consider the features you have on your side.

A dual-capstan transport system that's guaranteed

to reduce wow and flutter by 30% or more.

An automatic spacing-pauser that adds a short blank space between each segment you are recording.

A peak-hold switch that freezes the dB indicator at its highest level, long enough for you to make adjustments.

We proudly introduce our potent, eager, demanding, sensitive, beautiful DT-30 cassette deck.

You may never take it as far as it can go.

But even half-way is better than most.

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AUDIO SYSTEMS

*For the name of your nearest dealer, please call (800) 621-5199 (in Illinois, (800) 972-5855). For more information write Melco Sales, Inc., Dept. 44, 3010 East Victoria Street, Compton, California 90221. In Canada, contact: Melco Sales Canada, Markham, Ontario.*

Circle No. 9 On Reader Service Card

# AUDIO SHOWCASE

(Continued from page 9)

head. This unit has wow and flutter of 0.05%, signal-to-noise ratio of 68 dB using chrome tape and Dolby, and a frequency response of 35 to 18,000 Hz. Comes with visual peak reading LED meters. Rounding out the Toshiba metal capable decks is the PC-X12 priced at \$200. Its specs: wow and flutter, 0.06%; signal-to-noise ratio, 68 dB (chrome tape plus Dolby).

## Balanced, Ducted-Port Speaker System

Unitronex' Model 8 balanced, ducted-port speaker system features "time-aligned" transducers to deliver the "Disco Sound of the 80's." The number of ports, and their locations, were determined through "exhaustive testing" including placement of "time-aligned" transducers which are said to automatically compensate for the slight phase variations between the bass, mid-range and high-frequency drivers. The oak veneer cabinets use glue-block construction throughout. Grilles are of



Circle No. 102 On Reader Service Card  
chocolate-brown double-knit polyester stretched over removable heavy-duty wood frames. The speaker complement consists of a 12-inch woofer, 7-inch mid-range, and a 2 by 5 inch tweeter. Specifications: nominal impedance, 8 ohms; crossover frequencies, 300 Hz and 7,000 Hz; crossover controls, tweeter level  $\pm 3$  dB, mid-range level  $\pm 3$  dB; sensitivity measured at one meter from mike with test voltage of 2.83 volts, 105 dB SPL; operational frequency response, 30 to 23,000 Hz; operational power range, 10 watts to 150 watts RMS; dimensions, 26.8 inches high by 17.3 inches wide by 12.6 inches deep; weight, 64 lbs. Price: \$399.

# fact: ERA IV Began...

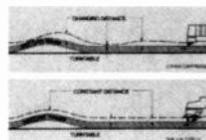
## and nothing remained the same

fact: viscous-damping straightens out all your records



your favorite record may be a tangle of warps

There are three main reasons why your records are warping. The first is the way the record is pressed. The second is the way the record is stored. The third is the way the record is handled. The Dynamic Stabilizer helps to straighten out all your records.



the role of the Dynamic Stabilizer:

The Dynamic Stabilizer is a unique feature of the Shure V15 Type IV cartridge. It helps to straighten out all your records, so you can enjoy the music as intended.

V15 Type IV the viscous-damped cartridge by



Shure Brothers Inc., 220 Huron Ave., Evanston, Ill. 60201



The creation of the new Shure V15 Type IV is a true audio breakthrough. It's the result of years of research and development. The challenge was to design a cartridge that could reproduce the full range of frequencies with accuracy and clarity. The V15 Type IV does it all.

...much more! ...much more! ...much more!

fact: calling this a "brush"

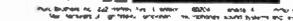


is like calling this a "radio"

we call it a Dynamic Stabilizer ...critics call it a major innovation

The Dynamic Stabilizer is a unique feature of the Shure V15 Type IV cartridge. It helps to straighten out all your records, so you can enjoy the music as intended.

V15 Type IV...the stabilized cartridge



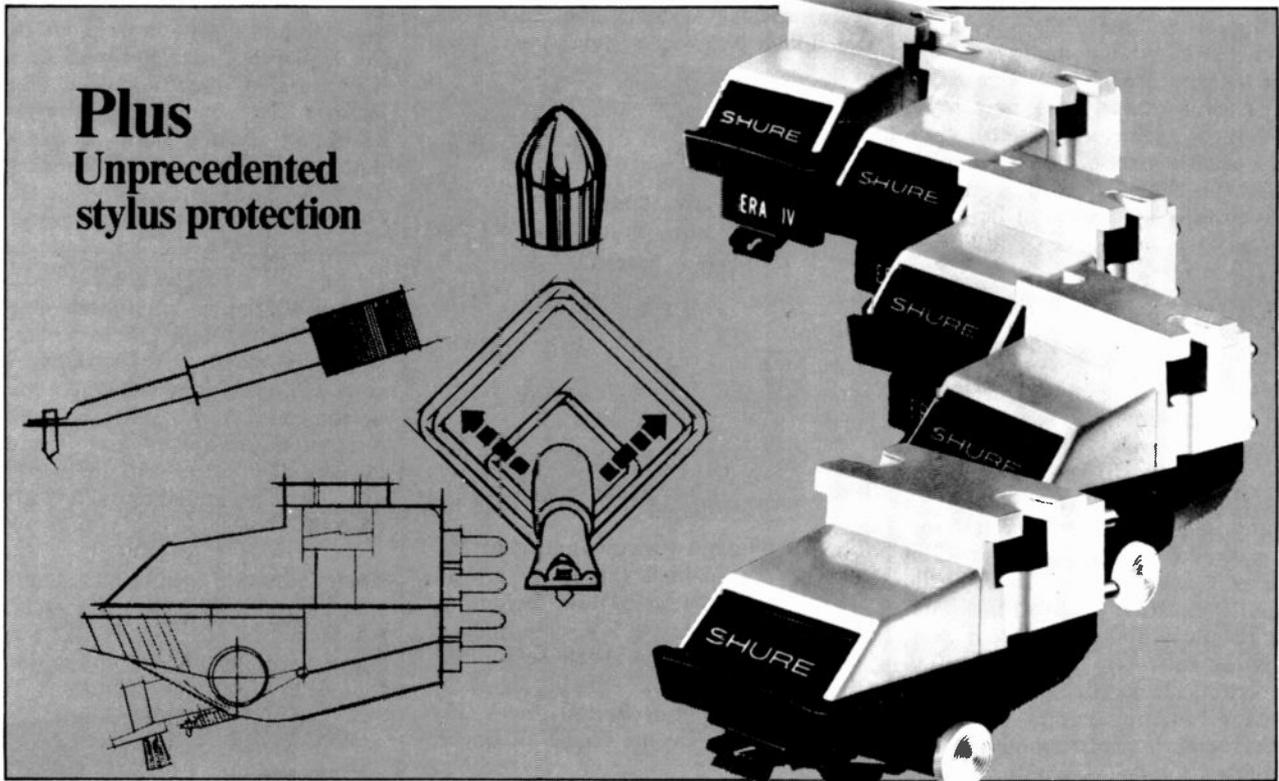
Shure Brothers Inc., 220 Huron Ave., Evanston, Ill. 60201

The V15 Type IV astounded the audio community with such technological breakthroughs as the Dynamic Stabilizer, the telescoped stylus shank, and the Hyperelliptical stylus tip. It was these innovations that helped the V15 Type IV set new standards of performance in trackability, ultra-flat frequency response, and low distortion.

The result: incredible critical acclaim; an enthusiastic audiophile following. The New Era had begun!

## NOW! ERA IV continues in five new mid-priced cartridges!

# fact: five new Shure Cartridges feature the technological breakthroughs of the V15 Type IV



## the M97 Era IV Series phono cartridges

Model	Stylus Configuration	Tip Tracking Force	Applications
M97HE	Nude Hyperelliptical	$\frac{3}{4}$ to $1\frac{1}{2}$ grams	Highest fidelity where light tracking forces are essential.
M97ED	Nude Biradial (Elliptical)	$\frac{3}{4}$ to $1\frac{1}{2}$ grams	
M97GD	Nude Spherical	$\frac{3}{4}$ to $1\frac{1}{2}$ grams	Where slightly heavier tracking forces are required.
M97EJ	Biradial (Elliptical)	$1\frac{1}{2}$ to 3 grams	
M97B	Spherical	$1\frac{1}{2}$ to 3 grams	For 78 rpm records.
78 rpm Stylus for all M97's	Biradial (Elliptical)	$1\frac{1}{2}$ to 3 grams	

Shure has written a new chapter in the history of affordable hi-fi by making the space-age technological breakthroughs of the incomparable V15 Type IV available in a *complete line* of high-performance, moderately-priced cartridges: the M97 Era IV Series Phono Cartridges, available with five different interchangeable stylus configurations to fit every system and every budget.

The critically acclaimed V15 Type IV is the cartridge that astonished audiophiles with such vanguard features as the Dynamic Stabilizer—which simultaneously overcomes record-warp caused problems, provides electrostatic neutralization of the record surface, and effectively removes dust and lint from the record—and, the unique telescoped stylus assembly which results in lower effective stylus mass and dramatically improved trackability.

Each of these features... and more... has been incorporated in the five cartridges in the M97 Series—there is even an M97 cartridge that offers the low distortion Hyperelliptical stylus! What's more, every M97 cartridge features a unique lateral deflection assembly, called the SIDE-GUARD, which responds to side thrusts on the stylus by withdrawing the entire stylus shank and tip safely into the stylus housing before it can bend.

**NEW! M97 Series Era IV Phono Cartridges...**  
**Five new invitations to the new era in hi-fi.**



Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204 In Canada: A. C. Simmonds & Sons Limited  
Outside the U.S. or Canada, write to Shure Brothers Inc., Attn: Dept. J6 for information on your local Shure distributor.

Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

# AUDIO SHOWCASE

## In-Dash FM/AM Cassette

Alpine Electronics' new top-of-the-line, model 7308 in-dash FM/AM cassette unit features digital phase-lock-loop synthesizer, digital station read-out and tape counter, a five FM/AM-station preset memory with automatic scan and seek, a music sensor system that scans the tape for the start of a new song, and Alpine's exclusive cassette glide and electronic cassette eject. Priced at \$699.95, the 7308 offers 6 watts per channel (RMS) for a total of 24 watts,

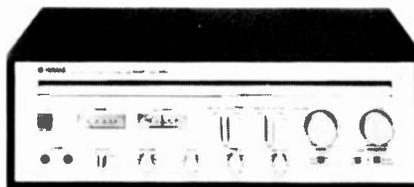


Circle No. 103 On Reader Service Card

Dolby noise reduction, separate bass and treble controls, four-way fader, chrome and ferro chrome tape switch, locking fast forward and rewind with automatic eject at the end of fast forward automatic replay at the end of rewind. All controls are electronically activated for feather-touch softness and instant reaction. The glide system gently pulls the tape into playing position and electromechanically locks the tape against the head for precise alignment. The 7308 includes built-in muting, balance control, noise eliminator switch, stereo indicators and FM/AM switch. Measurements: 50 millimeters high by 180 mm wide by 160 mm deep.

## "Popular Priced" Receivers

Yamaha rounds out its receiver line with a couple of new full-featured high-performance receivers selling at "popular" price levels. The Model CR-440 sells for \$320, for example. It is



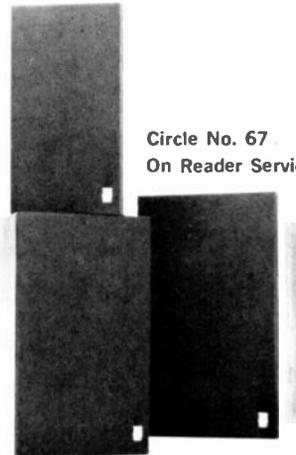
Circle No. 101 On Reader Service Card

rated at 30 watts per channel with 0.02% total harmonic distortion, and offers two tuning meters, for signal strength and center-zero tuning. The signal Q meter also shows FM signal quality by indicating multipath interference. Other new features include a DC amplifier, solid state IC chip, and

visible heat sink. The phono signal-to-noise ratio is 94 dB, and the receiver has a continuously variable loudness control plus Rec Out selector that permits recording from one source while listening to another source selected by the Input switch. Exterior styling includes a satin-finish front panel and ebony wood grain cabinet.

## Encore Speaker Systems

Electro-Voice offers three new "Encore" speaker systems: the Encore 33, an 8-inch two-way system; the Encore



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On Reader Service Card

55, a 10-inch two-way unit; and Encore 77, a 12-inch three-way system. These speakers represent an "evolution" from the company's EVS loudspeaker line. Cosmetics have been totally updated, and two-zone pricing is eliminated. The suggested retail prices: Encore 33, \$120; Encore 55, \$175; Encore 77, \$215.

## "Fatigue-Free" Headphones

A new Centrex headphone line by Pioneer Electronics features featherweight construction along with highly efficient sound reproduction, according to the manufacturer. Three models currently available include the CII-340 (\$39.95), CII-350 (\$49.95) and the top-of-the-line CII-360 selling for \$59.95. All feature slim, lightweight headbands with a clickstop adjustment to provide a custom fit; for bedtime listening the drivers can be removed for use as pillow speakers. The use of very thin, 25-micron polyester film in the drivers provides crisp but smooth reproduction of a full range of sound, even in the lowest price headphone, according to Pioneer. And the tangential dome-edge design of the drivers enhances sensitivity up to 100 decibels and allows handling of up to 200 milliwatts of power with virtually no distortion. The CII-360 is notable for its special variable chamber diaphragm construction that is said to yield greater realism of



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sound reproduction throughout the entire audio spectrum and with even further reduced distortion. The unit also features soft chamois-like earcups and headband padding, plus simple push-button mechanism for removing the drivers.

## Integrated Amplifier

Kenwood's new integrated amplifier, Model KA-501, offers an exclusive high-speed circuitry to provide the same fast response to complex musical signals as do the company's other four high speed integrated amplifiers—this despite a lower \$375 price tag. The amplifier delivers 65 watts minimum RMS per channel, both channels driven at 8 ohms from 20 to 20,000 Hz with 0.03% total harmonic distortion. The high-speed circuitry is claimed to react "instantaneously" to dynamic transient signals without the common time lag that causes spurious distortion (Transi-



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ent Intermodulation Distortion, or TIM). The rise time is 1.0  $\mu$ S and the slew rate is put at  $\pm 100V/\mu$ S. Another benefit of the high-speed design is its damping effect on speakers. By minimizing slew rate limiting, the unit effectively controls excessive speaker cone vibration, thus providing a flat and constant damping factor throughout the audible range. The new amplifier's Power Amp Direct circuit can simplify signal flow whenever tone controls are not needed or desired. This feature allows the signal from the phono input to be fed directly into the high gain power amplifier to virtually reproduce the original input down to the lowest audible frequencies with minimal phase distortion. The phono signal-to-noise ratio is 92 dB at 5.0mV input. Other features include: peak power meters; low-distortion tone control circuitry;

two tape inputs for recording and monitoring tapes simultaneously; and a subsonic filter to eliminate ultra-low frequency distortion such as turntable rumble.

### "Quality" Car Speakers

The "jewel" of Avid's new line of quality car speakers is the Ten Plus System priced at \$250 per set made up of a pair of rear deck Avid Model Ten drivers, each with the company's new 6½ inch woofer and 1-inch soft dome tweeter, plus a pair of door-mounted full-range Avid 4½ inch cone speakers. The system is also available without the



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door speakers, at a \$25 saving in cost, and there's also a Model Five System priced at \$150 per pair surface, or \$135 pair sub-surface. All carry a limited five year warranty.

### Car Stereo Graphic Equalizer and Amplifier

Sparkomatic's Model GE-1000 High Fidelity Graphic Equalizer and Amplifier is claimed to be the only "moderately priced" (\$189.95) unit of its kind on the market. It is capable of producing 50 RMS watts of power per channel at an "incredibly" low distortion point of 0.01%. Seven slide controls enable flexible adjustment of frequencies to modify the tone produced by the sound source. Also included is a protective relay circuit to apply power gradually to protect speakers. A fader control provides front-to-rear speaker adjustment and a linear switch allows a by-pass of tone controls for linear



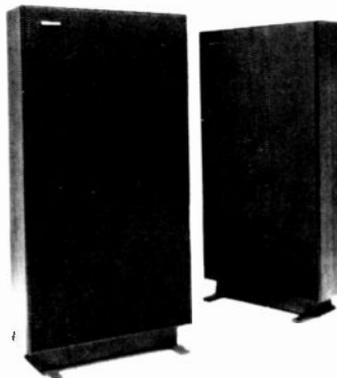
Circle No. 106 On Reader Service Card

performance of the amplifier. Tri-color LED indicators (for each channel) flash sequentially in relation to the changing volume impulses. Other specs: frequency response, 20 to 20,000 Hz;

input impedance, 52 ohms; output impedance, 4 to 8 ohms; dimensions, 7½ inches by 2½ inches by 9¼ inches (compact enough to permit use in most vehicles).

### Three-Way Acoustic-Suspension Speaker System

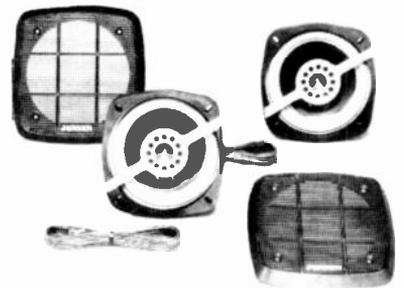
Boston Acoustics offers a new three-way acoustic-suspension loudspeaker system, the Boston A200, featuring a 10-inch woofer, 4-inch midrange, and a 1-inch dome tweeter with crossover frequencies at 450 and 3000 Hz. These components are mounted in a slim floor-standing cabinet that is specially designed to enhance uniform response. The speaker system which measures 21 inches wide by 41 inches tall by 6¾ inches deep, is intended for placement against a wall. The A200 has a nominal impedance of 8 ohms, is recommended for use with any amplifier rated at 15 watts per channel or more, and carries a suggested retail price of \$350. The A200 is said to take advantage of recent findings about the colorations caused by off-axis radiation when it reflects off parts of the speaker, is diffracted at cabinet edges, and—especially—is strongly reflected off floor and wall surfaces near the speaker. Because of the cabinet's slim design, the woofer behaves as if it were flush-mounted at the floor-wall intersection; this keeps all



reflections in phase. Also, the wide-dispersion midrange and tweeter are flush-mounted in an unusually large and smooth front-panel area to keep the components well away from edge or other reflecting objects; hence these drivers are said to behave as if mounted on an infinite baffle. For information write to Boston Acoustics Inc., 130 Condon St., E. Boston, MA 02128.

### Expanded-Size Speakers

As part of a "Series 1" introduction, Jensen now offers a new, larger size speaker in both the coaxial and dual cone lines. It's a 4½-inch woofer that replaces an original 4-inch size to provide 17% more cone area and thereby

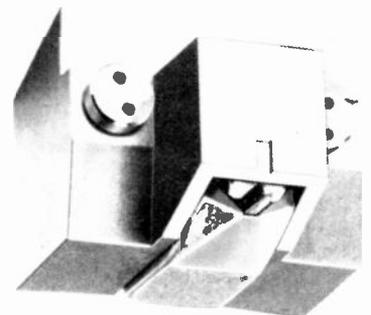


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increased efficiency. Although the radiating surface is larger, the speaker still mounts in conventional 4-inch cutouts. The new coaxial speaker has a 10-ounce magnet. Specs: 40 watts of continuous power delivery; frequency range, 65 to 18,000 Hz ±3 dB; sensitivity 97 dB (4V@1M). The tweeter is a whizzer cone. Suggested list price for the 4½ inch dual cone is \$42.95 per pair.

### New Generation Moving Coil Cartridges

Dynavector's new generation of moving coil cartridges includes the DV-100 Ruby priced at \$275. The major difference between this cartridge and a diamond version costing a cool \$1,000 is the use of a less expensive ruby cantilever designed to keep all parts in as small a proportion as is possible in order to help control the dispersion properties of the cartridge. A major objective is the elimination of "rubbery" sound described as the "creeping time effect of rubber." This means that the cartridge is not affected by temperature or the non-linearity of rubber dampers found in all other MC cartridges. Additionally, the very light weight of the new series and its higher compliance, make it an easy mate to modern low mass tonearms. Specifications for the DV-100: output voltage, 0.2mV at 1kHz, 5cm/sec; separation, over 20 dB at 1 kHz; frequency response, 20 to 50,000 Hz; stylus, line contact (0.1 x



Circle No. 109 On Reader Service Card

0.1 mm); cantilever, 0.4 by 0.4 by 2.5 oblique cut naked ruby; compliance, 15x10<sup>-6</sup>cm/dyne; wiring impedance, R=30 ohms and L=80µH; tracking force, 1.5 grams (+1.0, -0.3).

(Continued on page 74)

# McIntosh

## "A Technological Masterpiece..."



McIntosh C 32

### "More Than a Preamplifier"

McIntosh has received peerless acclaim from prominent product testing laboratories and outstanding international recognition! You can learn why the "more than a preamplifier" C 32 has been selected for these unique honors.

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# JAZZ



## Hank Jones / by J.R. Taylor

□ Acclaim and popularity are attributes not enjoyed by many classical jazz musicians, in spite of the brilliant artistry that has emerged on records as a tribute to their careers. Hank Jones, even among jazz enthusiasts, was often spoken of as one of the more "dependable" or "flexible" jazz pianists. He has been tagged as such because of his long years as a broadcasting studio staff musician with the CBS network, until it dissolved in 1976.

During the late 1950s and early 60s, Hank Jones was among the most demanded pianists for freelance recording, but he found his place in the jazz world growing more and more restricted since he was called more often than not for commercially intended sessions, or for backup work on albums featuring a single soloist or arranger, leaving little room for sideman solos. At times the assumption that Jones could play anything well enough to warrant recognition bore interesting fruit—long before the ragtime revival of the 1970s, he recorded an entire album of rags (now long out of print) in 1964.

Jones was born near Detroit into perhaps the most musical of jazz families. His youngest brother Elvin was the drummer for the groundbreaking John Coltrane quartet from 1960 until 1966, and has led his own groups ever since. Between Hank and Elvin came

Thad, noted as a cornetist-flugelhornist with Count Basie from 1954 until 1963, and currently as co-partner of the Thad Jones-Mel Lewis Jazz Orchestra which began in 1965.

Jones came to New York City in 1944. There he heard the younger modern pianists Bud Powell and Al Haig, and set about working their innovations into his interpretation of the styles of Art Tatum, Teddy Wilson and Fats Waller. (Later Detroit pianists, including Tommy Flanagan, Barry Harris and Roland Hanna, have reflected a remarkably similar confluence of styles.) A wide variety of jobs followed—the very different small groups of John Kirby and Lips Page, big bands led by Andy Kirk and Billy Eckstine, and a spell with the great saxophonist Coleman Hawkins. A 1947 tour with a "Jazz at the Philharmonic" concert package led to a five-year tenure as Ella Fitzgerald's accompanist. At this point Jones began to infiltrate New York's recording circles, and in 1959, after a couple of years of frequent work with Benny Goodman, he joined the

*(Continued on page 71)*

J. R. Taylor is with the Smithsonian Institution's Jazz Program. He has written on music for the *Washington Post Book World*, the *Village Voice* and others.

The Experts Agree...it really works"

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Static-Free Records Permanently!

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"Stanton Permostat kills record static forever"

**Stereo Review.**

"permanently desensitizes records with a single application"

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"Dramatic results from Permostat Record Preservative"

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"Eliminates static charge with just one application"

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**DISCO**

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**audio digests**

"Stanton Permostat...eliminates static charges"



The only record care product selected for an award at the 1979 Consumer Electronics Show Design & Engineering Exhibition.

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THE CHOICE OF THE PROFESSIONALS

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# Ohm's Law 9:

It is possible to make a loudspeaker that gets loud and still sounds good.

Ohm introduces another new loudspeaker that defies the traditional laws of loudspeaker design. The new Ohm I.

It used to be, if you liked listening to music as loud as life in your home, you had a tough choice to make. You could buy high efficiency "monster" loudspeakers, and put up with the boom and shriek. Or, if you wanted something smoother, you could buy low efficiency systems. But then you'd need an amplifier big enough to power Toledo.

The new Ohm I solves the problem. It can achieve concert hall levels in your home, effortlessly. With no sacrifice in bandwidth, linearity, or imaging ability. It gets amazingly loud with as little as 10 watts input. But it will handle 1000.

It's the world's first good and loud loudspeaker. And it's already earning rave reviews. *The New York Times* said, "...speakers whose sound is almost like real music are still rare... These remarks are occasioned by our recent acquaintance with the Ohm I, surely one of the best speakers we have ever heard. A speaker priced at \$675 can be called a bargain only if one considers that there is probably no better sound to be had at any price."



For 13 complete reviews, and full specifications, please write us at: Ohm Acoustics Corp., 241 Taaffe Place, Brooklyn, N.Y. 11205

## A GUIDE TO RECENT STEREO RECORDINGS

by THOMAS D. KELLY

An avid record collector for nearly 20 years, Thomas D. Kelly has a keen ear for both live music and full-fi sound. Mr. Kelly played the records he reviews here on equipment consisting of an Empire 39 transcription system with a Shure V15 III cartridge, a C/M Labs 911 stereo amplifier, a Marantz 7T pre-amp, and two Bozak B-400 speakers.

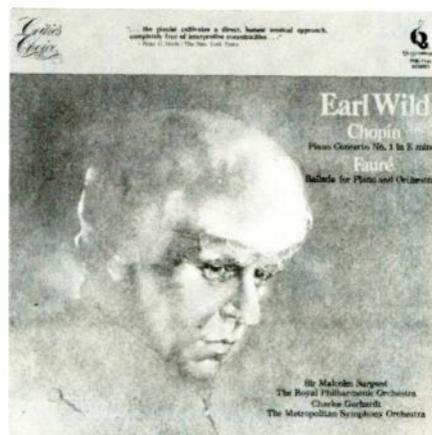
© Rodrigo: *Concierto de Aranjuez* (Pepe Romero, guitar); *Concierto Andaluz* (Celedonio, Pepe, Celin and Angel Romero, guitarists); Academy of St. Martin-in-the-Fields, cond. Neville Marriner, Philips 9500 563.

The *Concierto de Aranjuez* is Rodrigo's most popular work, and for good reason. The wistfully beautiful second movement adagio is eloquent, the focal point of the entire concerto. Rodrigo doubtlessly never envisioned that the general television audience would be humming his lovely tune after hearing it as background music for car commercials. The *Concierto Andaluz* was composed in 1967 (almost three decades after its companion), specially for the Romeros, who recorded it at that time with the San Antonio Symphony under Victor Alessandro's direction, a disc currently available as a Mercury Golden Import (75021). The composer and the Romeros have made some minor revisions in the *Concierto Andaluz*, and the revised version is what is heard on this new recording. Although the four guitars make a delightful sound, it would seem that the music itself would be just as compelling if it were written for just one guitarist. But when one is commissioned by a guitar quartet to write a concerto, you can be sure it will be for four soloists. Marriner and his forces offer impeccable accompaniments, and the engineering is superb. The older version was a marvel sonically for the time and still sounds wonderful. If you own it you need not bother to replace it, unless you insist on the authenticity

of the composer's minor revisions to the *Concierto Andaluz*.

© Chopin: *Piano Concerto No. 1 in E Minor, Op. 11*. © Faure: *Ballade for Piano and Orchestra, Op. 19*. Earl Wild, pianist; Royal Philharmonic Orch., cond. Sir Malcolm Sargent (Chopin); Metropolitan Symphony Orch., cond. Charles Gerhardt (Faure), Quintessence PMC 7141.

Chopin's *Concerto No. 1* has surprising popularity on discs, far more than one would expect with its rather limited appearances in the concert hall. There are a number of fine recordings of the score, particularly the distinctive Artur Rubinstein-Skrowaczewski RCA version, which fortunately is available as a single disc in a twin-LP set, the preferred way to own it. The second disc has a sonically inferior version of the *Concerto No. 2* with Rubinstein accompanied by Ormandy and the Philadelphia Orchestra. Also of interest is the Martha Argerich-Claudio Abbado Deutsche Grammophon LP, the quite old but still excellent sounding Emil Gilels-Ormandy-Philadelphia LP on Odyssey (far better sonically than the much later Rubinstein version on RCA), and the distinctive recording of young Maurizio Pollini with Paul Kletzki and the Philharmonia Orchestra, a model of aristocratic pianism available at budget-price on Seraphim. Earl Wild recorded this concerto in 1962, a performance originally issued on the *Reader's Digest* label and available by mail only. It is good to have it available again, for this is a richly romantic reading, glistening in its pianistic virtuosity, and sensitively accompanied and recorded with stunning realism. A definite plus is the lovely Fauré *Ballade*, an exquisite pastorale interlude of idyllic beauty, making it a perfect coupling for the Chopin. The "Metropolitan



Romantic reading

Symphony Orchestra" is of course the disc name for a studio pickup orchestra, but they are a splendid group. There is excellent value on this reissue.

© Dvorak: *Symphony No. 8 in G Major, Op. 88*. Amsterdam Concertgebouw Orch., cond. Colin Davis, Philips 9500 317.

The Concertgebouw Orchestra is not new disc-wise to Dvorak's delightful Eighth Symphony, having recorded it twice before, once monophonically for London/Decca with George Szell conducting, and again in stereo for Philips with Bernard Haitink directing. Colin Davis, who is in the process of recording all of the Dvorak symphonies with this orchestra, already has to his credit quite outstanding versions of the *Symphony No. 7 in D Minor* (9500 132) and the *Symphony No. 9 in E Minor* (9500 511). The same high qualities that marked the first two releases also distinguish this new recording of the *Symphony No. 8*. This is perhaps the most expansive performance of this symphony I've heard on records. Nothing is rushed, yet there is no sense of lethargy. The third movement (*Allegretto grazioso*) is particularly lilting, and the brass fanfare opening the finale has never before sounded more vibrant. Particularly outstanding in this recording is the lustrous string tone, so naturally captured by the Philips engineers. To have this symphony spread out onto two full sides is perhaps a bit of a luxury, although this practice is rather common on most recordings of the work; there easily would have been space for a substantial filler.

© Gliere: *Symphony No. 3 in B Minor, Op. 42, Ilya Mourometz*. Royal Philharmonic Orch., cond. Harold Farberman, Barclay-Crocker quarter track-tape, 7½ ips, Unicorn UNC 0500 (two reels).

Most audiophiles agree that the finest reproduction to be had is on open reel tape rather than cassettes or cartridges, regardless of the convenience of the latter. Some years ago there was an extensive library of open-reel quarter-track tapes available, with fine releases by London, RCA, Columbia and others. Unfortunately, most of these have been discontinued, a lamentable situation for those who want the finest sound. Barclay-Crocker however, has issued a number of quality items from the catalogs of Argo, Musical Heritage Society, Telefunken, Unicorn and Vanguard. These Dolby-equalized tapes generally represent state-of-the-art reproduction and

those I have heard can be highly recommended. Barclay-Crocker's release of Gliere's sprawling symphony (as of this writing not yet available on discs in the United States), is a remarkable achievement, with an absence of background noise thanks to the Dolby processing, and an ultra-wide dynamic range. The Royal Philharmonic, expanded here to meet the massive instrumental demands of this vast symphony, plays very well indeed, although not without a bobble here and there. According to reports, this performance was recorded in lengthy takes, with little editing. This is a clean, close-up sound, although there is the lack of opulence heard on Columbia's LP version with Nathan Rakhlin directing the Large Orchestra of the Moscow Radio and Television. Farberman's performance is presented totally uncut, a blessing or a curse, depending on your opinion of the score. There are many treasures for the audiophile to be found on Barclay-Crocker.

For a copy of their catalog, send \$1.00 to the following address: Barclay-Crocker, 11 Broadway, New York, N.Y. 10004.

© Stravinsky: *The Firebird* (complete ballet). Amsterdam Concertgebouw Orch., cond. Colin Davis, Philips 9500 637.

*The Firebird* is one of Stravinsky's most imaginative ballets, an instant success at its premiere in 1910, and a score that to this day holds audiences with its imagery and sheer beauty. It is also made to order for the audiophile, with its shimmering strings, brilliant brass interjections, chattering woodwinds and the mighty moments of the Infernal Dance and the Finale. It can be a glorious tapestry of orchestral sound, and it surely is here. What a delight it is to hear this heavily-scored masterpiece played so vividly and so sumptuously captured by the engineers. Davis has chosen tempi that are somewhat slow, but there is still plenty of impact and power to this interpretation, placing it right on the top of my list of preferred versions of this work. I still would not want to be without Columbia's disc with the composer himself conducting, which still sounds remarkably fine in spite of its age, or the splendid Boulez-New York Philharmonic version also on Columbia. With this new *Firebird* Philips has completed their traversal of the three great early Stravinsky ballets (*Firebird*, *Petrushka*, *Rite of Spring*) with Davis and the Concertgebouw. It is a totally distinguished enterprise that can be recommended without reservation. ▲

**fact:**  
**this small  
record collection  
represents a  
\$1,000 investment**



It's true—the largest investment in almost any hi-fi system is frequently the cost of the records played on it ... and it is equally true that a badly worn phono stylus tip may ruin a valuable (or irreplaceable) record in a single playing!

With the rising cost of new phonograph records—and the difficulty of replacing treasured, older favorites—it's the worst kind of false economy to risk damaging them with a worn stylus.

### Check your stylus (needle) at least once a year

Always insist on a Genuine Shure replacement stylus. Substitutes will not restore the Shure cartridge to its original performance standards.

Look for the name "Shure" on the stylus grip.



Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204  
In Canada: A. C. Simmonds and Sons Limited

Outside the U.S. or Canada, write to Shure Brothers, Inc. Attn: Dept. J6 for information on your local Shure distributor. Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

# SOUND DOOR SOUND PROBE SOUND PROBE

What the poet Robert Burns said about the best-laid plans of mice and men seems to apply especially to loudspeakers. Even a speaker designed with the greatest engineering finesse and the most impressive specs may sometimes turn out a lemon. It probably wouldn't sound all that bad. It just wouldn't sound quite right. That's why the ear must remain the ultimate judge.

What we present in this series are explanations of a particular speaker's design principles combined with subjective listening evaluations. Together these two critical considerations may give the reader a useful notion of the speaker's character.

by HANS FANTEL and CHRISTOPHER GREENLEAF



Circle No. 127 On Reader Service Card

## KLH-3

### Description:

This highly unconventional speaker system offers a unique answer to the perennial question: How do you get big sound from small speakers? To cut the suspense, let's say right away that this particular answer is a good one. The KLH-3 is a mini speaker that doesn't sound like a mini speaker. In fact, it sounds in every respect like a very good full-size speaker. On first acquaintance, it's downright impossible to believe that all this sound comes from a speaker no bigger than a shoebox.

KLH gets these remarkable results by breaking with tradition and risking radical departures. Their engineers conceded at the outset that it just isn't natural for a tiny speaker with a 15-cm woofer in an enclosure measuring just  $\frac{1}{4}$  cubic foot to sound anywhere like a real bull fiddle. There just is no way



Circle No. 60 On Reader Service Card

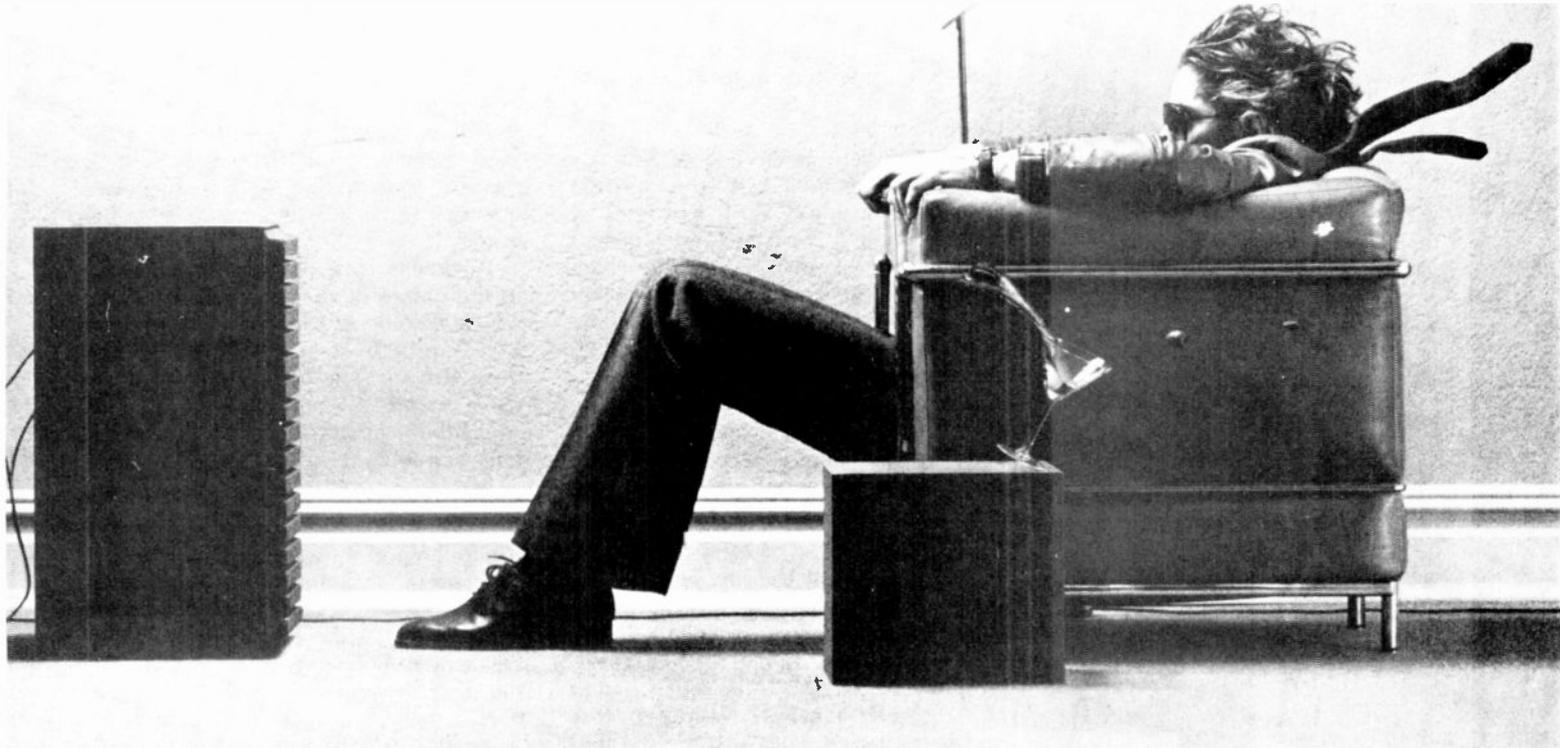
## Acoustic Research AR92

### Description:

Weighing in at a welterweight 46 lbs., the AR92 is a tall, narrow, floor-standing speaker which contains the design approach Acoustic Research has so successfully launched with its famous Models AR9 and AR90. In this case the basic concepts are translated to the requirements of a smaller and less expensive speaker. Still, essential similarities are readily recognized. There is the vertical arrangement and critical spacing of the three drivers—woofer, midrange, and tweeter—carefully calculated to avoid mutual interference and resulting in particularly smooth overall response, along with the happy absence of phase cancellation in the crossover ranges.

A 10-inch woofer has been especially designed for the AR92, and its large, 8900 gauss magnet gives this woofer the same degree of electromag-

# AFTER 500 PLAYS OUR HIGH FIDELITY TAPE STILL DELIVERS HIGH FIDELITY.



If your old favorites don't sound as good as they used to, the problem could be your recording tape.

Some tapes show their age more than others. And when a tape ages prematurely, the music on it does too.

What can happen is, the oxide particles that are bound onto tape loosen and fall off, taking some of your music with them.

At Maxell, we've developed a binding process that helps to prevent this. When oxide particles are bound onto our tape, they stay put. And so does your music.

So even after a Maxell recording is 500 plays old, you'll swear it's not a play over five.

**maxell**  
IT'S WORTH IT.

Circle No. 25 On Reader Service Card

# SOUND PROBE SOUND PROBE SOUND PROBE



Circle No. 127 On Reader Service Card

netic damping as that of the 12-inch woofers found in AR's larger models. The result is a notably well-damped low end, only 3 db down at 44 Hz: in short, clear and ample bass.

Yet another distinguishing feature of the AR92 is its liquid-cooled dome-type midrange driver (1½ inches in diameter) and its ¾-inch dome tweeter, which is also liquid cooled. The question arises as to the whys and wherefores of liquid cooling.

Like any mechanism converting energy into motion, loudspeakers generate heat as a by-product. At normal volume levels, this heat is negligible. Nothing was done about it in the past, and none was the worse for it. But cultural and technical change has blessed us with hard rock, high wattage, and a new generation of listeners insistent on sound levels equal to that of a dynamic blast. With hundreds of watts driving a speaker (and innocent bystanders) to distraction, the incidental heat generated by the speaker coil ceases to be incidental. It literally turns loudspeakers into resistive heating devices, like hair-dryers and cooking ranges. As a result, the moving parts of a speaker become thermally deformed and scrape rather than glide along their appointed path with ear-

grating effects. In extreme cases, speakers literally burn out at temperatures sufficient to fry eggs.

Maybe that's the just reward for sonic excess, but audio designers don't take such a moral view. They regard speaker burn-out as a purely technical challenge to be surmounted by providing some form of cooling for the overheated parts. They now do this by immersing voice coils in a magnetic fluid which is far more thermally conductive than the air in the formerly unfilled magnet gap. In consequence, the heat build-up is quickly dissipated and the speaker can thus absorb more wattage—and project louder sounds—without disintegrating. And aside from providing greater power-handling capacity, the liquid coolant also helps attain better damping of the cone motion, thereby contributing to smoother frequency response over an extended range.

Particular care has also been taken in the design of the crossover networks which employ a 12db-per-octave slope to assure effective separation of the three drivers. The components of these networks include such high-grade items as computer-quality electrolytic capacitors, non-inductive high-power ceramic  
*(Continued on page 65)*



Circle No. 60 On Reader Service Card

for such a speaker to come even close to flat response at the low end. So, instead of trying to stretch the range acoustically—as most conventional designers would—KLH did it electronically. They linked the little speaker with an outboard analog computer that makes up for the speaker's natural limitations by skewing the frequency response of the amplifier. Connected to the tape *in* and *out* terminals of the receiver or amplifier (or between pre-amp and power amp, if separate components are used) the computer boosts the lows in exact proportion to the speaker's bass drop. It makes the amplifier response zig exactly where the speaker response zags. The net result is a flat overall response all the way down to frequencies never before touched by a speaker this size. Where most mini-speakers start falling off around 85 Hz, this goes down low enough to put a sonically convincing tuba right in your lap. In fact, response at 40 Hz is only 3 db down—a quite respectable figure even for a full-sized speaker.

The kind of electronic compensation applied here is known as "response tailoring." Judging by the results obtained here, it may well be the most effective way to get around those otherwise ob-

stinate laws of nature which ordain that only large structures can emit deep sounds. Of course, it takes considerable engineering finesse to get a natural effect while playing tricks on nature, but the KLH team has evidently brought it off.

Beefing up the bass is not the only task for the computer in this speaker system. It also lets the little speakers handle power levels as yet unattained by any other speaker of comparable size—an astonishing 200 watts per channel! The computer monitors the amplifier output, and whenever it reaches a point that would make the woofer cone swing out too far—thereby causing distortion and possible damage—the computer automatically limits the amplitude of the bass. Yet as soon as the signal drops back to a naturally lower level, full bass response is restored.

In most types of music, only the swiftly passing bass transients exceed the speaker's power capacity. Consequently, the computer restrains cone motion only during the brief time span occupied by the transient power peak. Full response returns so swiftly that the ear is usually unaware of any limiting action at all. And since the *average* bass amplitude permissible with this  
*(Continued on page 65)*

Equipment used in our listening sessions:  
Sony STR-5800 stereo receiver,  
Philips 212 turntable,  
Pickering XSV 3000 phono pickup.

## A review of the latest popular music releases

by KEN IRSAY

**Bob Marley & The Wailers: "Survival." Island. \$7.98.**

In the soft, easy reggae style that belies the political intensity of his lyrics, Marley issues his most fervent call for unity of purpose and spirit among the Black people of the world, particularly the nations of the Third World. Some songs bear universally understood messages, while others spring from Marley's Rastafarian religious beliefs. This is straight reggae, with no sweeteners for mass palatability.



**Fleetwood Mac: "Tusk." Warner Bros. \$15.98.**

The fact that this vastly entertaining album doesn't sound anything like its smash predecessor "Rumours" seems to have upset many critics. I say Bravo! to Fleetwood Mac for daring to experiment, when they could have easily recorded "Rumours, Volume II." "Tusk," with all its quirkiness and loose-jointedness strikes me as the group's equivalent of the Beatles' double "White Album." The sound quality is excellent, the songs are diverse to be sure, and there's a welcome element of whimsy.

**Fabulous Poodles: "Think Pink." Epic. \$7.98.**

This follow-up to last year's "Mirror Stars" finds the Great British pups taking sarcastic yet fun-filled aim at some recent American syndromes like the advent of bionics, the Hollywood star schtick and the desire for almost invisible skinniness among some young



women. The music is hook-laden, high-spirited, high-camp pop rock.

**Rick Derringer: "Guitars and Women." Blue Sky. \$7.98.**

When he's out to sell lots of albums, rather than indulge his non-mainstream artistic proclivities, Todd Rundgren, who co-produced this disc, delivers the aural equivalent of the Rockettes—splashy, production-number rock. This album combines that quality with Rick Derringer's screeching guitar vocal style. A pretty ballad change-of-pace in this mostly supercharged set is "Don't Ever Say Goodbye," written by Derringer five years ago.

**Captain & Tennille: "Make Your Move." Casablanca. \$7.98.**

With crystal clear pop-rock orchestrations enhanced by seductive saxophones and silky strings, Toni Tennille wraps her golden voice around a variety of slow and upbeat songs of love, with "Captain" Daryl Dragon filling the spaces with acoustic and electronic keyboards.



**Toto: "Hydra." Columbia. \$8.98; Friendship: "Friendship." Elektra. \$7.98.**

When the most ubiquitous studio musicians in the record industry come out from behind the "superstars" and play as a group, the results belong in millions of record collections. Toto, whose members may be heard supporting any number of rock luminaries, play somewhat heavy, progressive, guitar/bass/drums/synthesizer rock with frequently soaring guitar lines and vocal harmonies. Friendship, headed by guitarist Lee Ritenour, and featuring such jazz-pop notables as keyboardist Don Grusin, saxophonist Ernie Watts and bassist Abraham Laboriel, offer an amalgam of instrumentals skirting just about every musical form, but generously laced with funk.

**Boomtown Rats: "The Fine Art of Surfacing." Columbia. \$7.98.**

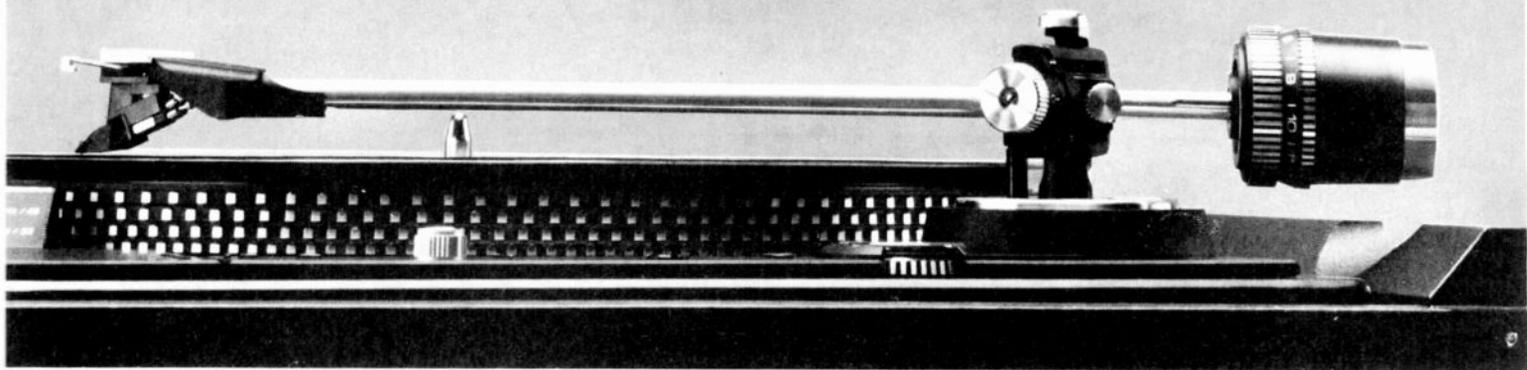
Cynical songs of personal tragedy and social alienation sung in a curt New



Wave style bear more than a superficial resemblance to the Kinks. In fact, this is what Ray Davies' group would sound like if it were still angry. The guitar lines are raw and cutting, as are many of the lyrics.

*(Continued on page 66)*

These records were reviewed using the following equipment: Technics SL-5300 turntable with a Discwasher anti-static mat; three interchangeable phono cartridges—Shure V-15 IV, Stanton 681-EEE/S and Audio Technica AT-25; Kenwood KA-8500 integrated amplifier; ADC Sound Shaper 3 parabolic equalizer; BIC F-4 speakers; and Koss Pro-4 AAA headphones.



## All your records will sound better with Dual's new ULM tonearm and cartridge system.

*Even if they look like this.*

Although none of your records may be in such bad shape, many are probably warped enough to present serious problems to conventional turntables.

The high inertia of a typical tonearm and cartridge combination, with approximately 18 grams total effective mass, causes the stylus to dig in riding up the warp and to take off on the way down. Tracking angle and tracking force vary widely—as much as 30 percent. And a warp as small as 1.5mm (which is barely discernible) can generate harmonic distortion of 2.7 percent. That's audible!

These problems have now been solved by Dual's new Ultra Low Mass tonearm and cartridge system.

The potential for this solution has existed ever since the development of Dual's dynamically-balanced tonearm with its gyroscopic gimbal suspension and straight-line tubular design.

Dual's research into the effects of mass on record playback led to a collaboration with Ortofon. A cartridge was developed with substantially less mass than any in existence. It weighs just 2.5 grams, including mounting bracket and hardware.

At the same time, the mass of the Dual tonearm was further reduced so that a perfectly matched tonearm and cartridge system emerged. Its total effective mass is just 8 grams. That's less than half the mass of conventional tonearm and cartridge combinations.

Tracking a record with the same 1.5mm warp, the ULM system reduces harmonic distortion to only 0.01 percent. That's 270 times less than that produced by the conventional tonearm and cartridge.

Not only is the overall sound audibly improved, but stylus and record life are significantly extended.

To experience the demonstrable advantages of ULM, bring a badly warped record to your Dual dealer. Listen to it played with the ULM tonearm and cartridge. (All nine new Dual turntables feature this system.)

You will hear the difference that ULM can make on all your records.

For the complete ULM story, please write to United Audio directly.

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State-of-the-art audio buffs on the lookout for "radical breakthroughs" or "hot news" in the phono cartridge field generally find slim pickings. This segment of the hi-fi industry is not given to producing short-lived products that become "obsolete" in a year or two, as other segments of the industry sometimes do—mainly in order to spotlight technological advances at the earliest possible moment.

**Refined Technology.** Cartridges by and large have a catalog life of several years before they are replaced by newer models. The major reason is that cartridges are so highly refined already that technological advances can only be miniscule; not able to justify replacement of established models with excellent performance (and sales) records.

In some instances manufacturers upgrade existing models without making a fuss about it, merely passing on the benefits. A good example is AKG, which upped the channel separation of its top-selling P-8ES and P-8E at 1,000 Hz from the original 30 dB to 35 dB, and the channel separation at 10 kHz from 25 to 30 dB on the P-8ES, and from 20 to 30 dB on its P-8E cartridge.

In other instances manufacturers run with two versions of a given cartridge—the original model,



and the update, sometimes indicated by a numeral designation or the word "Improved" to show that it is a later model or version. Shure, for example, is now in its fourth generation of V15 series cartridges, offering the V15 Type 4, and V15 Type 3, simultaneously. These, incidentally, are the firm's two best sellers, listed at \$165 and \$103 respectively. In a look-see at the world of phono cartridges two years ago, we noted that the top seller in the Shure line then was the V15 Type 3. The third best seller in the Shure line is the "ancient" classic M95ED at \$84.50. It is expected to drop to fourth place as its update, the M95HE at \$97.50 becomes better known. (For budget-conscious buffs wanting a Shure, there's the brand new M72EJ, at \$51.)

**Low Mass.** But there are some noticeable overall trends in cartridges that are worth pointing up. One is the growing popularity of low-mass types, made for lighter weight tone arms, for lower tracking forces, for better trackability and the ability to track warped records. Another is the burgeoning of moving coil types, which are the latest "status symbol" for the advanced audiophile. A third is the growing integration of cartridge and headshell, as offered by several companies. A fourth is a deepening of the ownership of multiple cartridges for optimization of reproduction of certain types of records or music.

A complete guide to phono pickup selection

# CARTRIDGE CATALOG

And, somewhat of a mini-trend, is the move of a few audio component companies such as Dual and SME to produce proprietary tonearm / cartridge combinations for optimum results. (Both the above firms utilize Ortofon cartridges in their combination units.)

And, despite its shortcomings as a "newsy" industry, a fair amount of news does occur in it . . . in terms of individual new products, new technology, new companies, etc. Following are some of the highlights of what's been happening since we last checked phono cartridges:

The new technology news from ADC - Audio Dynamics Corp., is the "Omni-Pivot System." It features an armature that is micro-machined at a 90-degree angle so there is no need for adhesives or "foreign matter" to lock it in the high definition suspension block; it locks automatically. This gives the stylus greater freedom of linear movement, or "omni-movement," for more accurate tracing of all record groove undulations.

The Omni-Pivot System (trademark) is the "Improved" designation attached to the firm's three best-sellers—one, the XLM Mark Two at \$100, two, XLM Mark Three at \$110, and three, the QLM36 Mark Three at \$79.95. It is also available with the firm's top-priced ZLM cartridge at \$135. ADC also advises that if you already own an ADC cartridge, the Omni-Pivot System "is yours for just the price of a replacement stylus."

**No Pre-preamp.** The big news from Empire Scientific Corp. is the Model EDR.9, a luxury moving iron cartridge priced at \$200. Reflecting its merits is the fact that it has already won an award—as

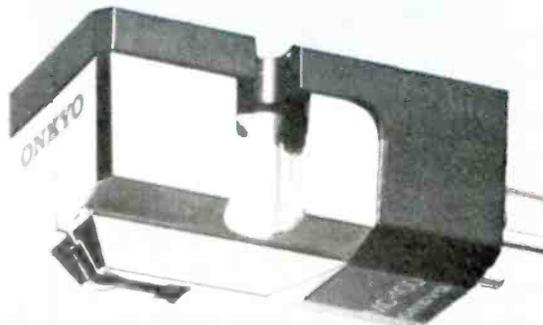
# CARTRIDGE CATALOG



The Audio Technica AT-23 is a moving magnet pickup with an elliptical stylus and a calibrated adjustable overhang with built-in gauge. It has a recommended VTF of 0.9 to 1.7 grams. \$225. Circle 115.



The product of years of development, the Shure V15 type IV, is currently that company's hottest seller. It is a moving magnet cartridge with a built-in dust brush. \$165. Circle number 93 for info.



Onkyo's MC-100 is a moving coil cartridge that is only manufactured at the rate of three per day. Uses an elliptical stylus. \$170. Circle number 80 for info.



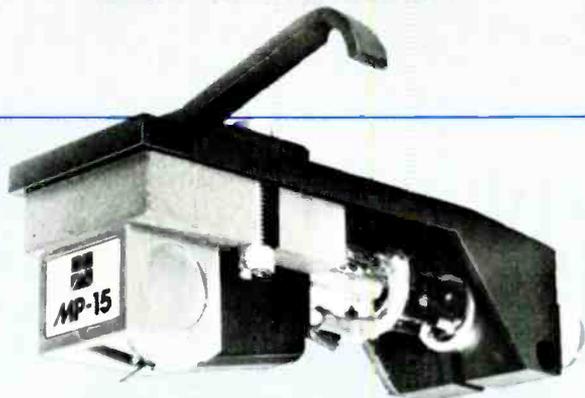
The Nagatron 350E is a moving iron cartridge from the Nagatronics Corporation. The elliptical stylus is user replaceable. \$95. Circle 116 for more information.

one of the "most outstanding innovative products of the year (1979)" in the audio industry, in a competition sponsored by the Electronic Industries Association. It provides three significant features / advances. One is a new stylus design, with a smaller radius and larger contact area than conventional cartridges (for "total" tracking of musical signals and lowest possible record wear). The second is a new stylus mounting system. It consists of using a miniature iron bar mounted inside the hollow cantilever tube (which holds the diamond stylus). The bar acts like a tuning fork, moving only in a specified frequency range and operating like an inertial damper to the peak frequencies. This "tuned" stylus system acts as a mechanical equalizer to eliminate what engineers call "vinyl-tip" resonance that colors some sounds with a metallic character. The third benefit of the EDR.9 is that it can be connected to virtually any preamp. The electrical elements of the unit have been designed to be unaffected by any normal variations in load capacitance, for smooth frequency response and accurate transient-reproduction capability in any music system, regardless of loading conditions—the amounts of capacitance and resistance provided by a preamp. (Load conditions vary widely from one preamp to another.)

Its frequency response is given as 20 to 35,000 Hz, plus/minus 1.75 dB, and its separation at 500 to 15,000 Hz is 30 dB.

The EDR.9 also qualifies for coverage under Em-

Osawa's MP-15 moving magnet phono pickup is shown here mounted on an Osawa headshell. Has user-replaceable elliptical stylus. \$150. Circle number 117.



pire's new phono cartridge warranty — extended from one year to two years. (This is said to be the longest warranty in the industry.)

Goldring, a brand long popular in the United Kingdom and European markets, is now available at audio specialty shops in the United States. Priced from \$33 to \$300, the line consists of 14 moving magnet models. The best-seller is the Model G-820E, priced at \$66, and the next best-seller is the Model G-900E, at \$104.50. The latter is one of three low-mass (4 gram) models in the line, and tracks in the one to three-gram range. Its frequency response is 20 to 20,000 Hz, plus/minus 3 dB.

Goldring's latest offering is the ultra-low-mass G-900-IGC (Improved Groove Contact) with an optimum tracking weight of 1¼ grams. It features "a completely new form of diamond point," called the Van Del Hul point, and the firm claims "It is the nearest approach to the shape of the original cutter, having a minor radius of only 4.5 microns compared with 7 microns for an elliptical point." Thus, it is said to track high frequency modulations better, for more sharply defined sound. Price (tentative at press-time), \$300.

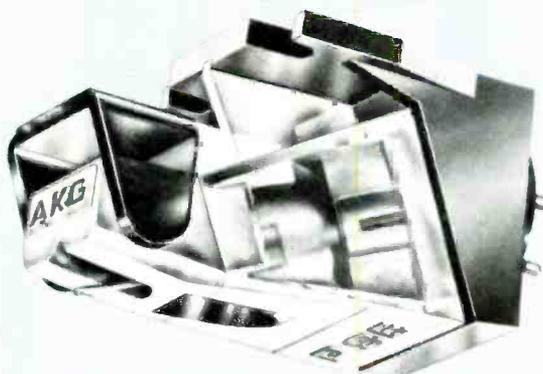
**Trading Ability.** Nagatronics, a new company with an initial line of 12 models, has added two more for 1980. One is the Model 9600, priced at \$225, a "super IM (induced magnet)" cartridge that incorporates a newly-developed tapered tubular Boron cantilever and a new semi-line contact triangle tip



Signet's moving magnet TK3E features a unique flip-down integral stylus guard. The elliptical stylus has a VTF of from 1 to 1¼ grams. Loading capacitance is 270 pF. \$55. Circle number 118.



One of the latest additions to Pickering's long line of audiophile cartridges is the XSV-4000 moving magnet pickup with a Stereohedron, user replaceable stylus. Costs \$140. Circle number 119.



The AKG P-8E has been constantly updated and improved even though its model designation has remained the same. This moving iron cartridge costs \$115. Circle number 63 for information.

stylus with an effective mass of 0.031 milligrams. The company says that "incredibly low mass is one of the principal reasons for the ability of this cartridge to rival the performance of the most advanced moving coil cartridges." It develops an output of 2 millivolts, which is sufficient to drive many high-gain magnetic phono inputs. The firm recommends a special head amplifier, the Model 9500, for low-gain inputs for proper gain and impedance match for optimum performance.

The other model is the 344 DE, with bonded diamond elliptical stylus priced at \$70, a unit that tracks in the 1½ to 2-gram range, and features a frequency response of 20 to 25,000 Hz, plus/minus 3 dB.

Best-sellers in the Nagatronics line are, in one, two, three order: Model 185E at \$45, 195IE at \$55, and 350E at \$95.

The buzzword at Stanton Magnetics is "Disco Sound!" The Firm reports it has cornered over 56 percent of the disco phono cartridge market with three models — two meant for broadcasters, and one for home users. The latter is the 680SL, featuring the firm's patented "Stereohedron" stylus tip that assures long life for records. It is list-priced at \$87.50.

Best-sellers in the Stanton line are the 881S at \$170, 681EEE at \$105, and the 680EE at \$59.95.

Pickering has also hopped on the disco bandwagon, namely in the form of its Model 625-DJ, a moving magnet unit priced at \$60. This ruggedized model — widely used by DJs around the country, features a specially-coated fluorescent stylus assembly, which the company says, "allows you to cue on the exact cut you want for uninterrupted Disco Fever." The 625-DJ has a frequency response

# CARTRIDGE CATALOG

of 20 Hz to 20 kHz, and its tracking force range is one to four grams. This model was designed for home users, to accommodate "the many home discos that are coming into being in more and more American homes."

Pickering's best-sellers are: Model XSV4000 at \$160, XSV3000 at \$115, and XV625E at \$69.

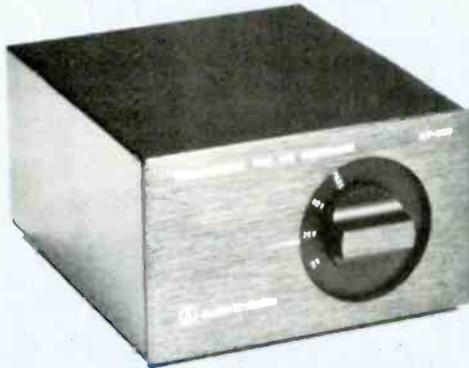
Osawa, a relative newcomer to the United States market, introduced two series of moving magnet cartridges recently, under the Osawa brand name, in addition to a series of moving coil types under the Satin brand name (described elsewhere on these pages). The six-unit MP series ranges from \$40 to \$200, and features moving permalloy magnets for high output and wide dynamic range, and mounting plates designed for firm contact with the headshell for minimal resonance. The two highest priced units—Models MP30 and MP50, at \$130 and \$200, also feature a special stylus assembly mounting system, complete with miniature Allen wrench that assures perfect placement and alignment of replacement styli.

The second Osawa group—the OS series, consists of three models priced from \$35 to \$70, to replace an earlier, higher priced trio bearing the MP series designation.

**Combinations.** Ortofon, in promotion of its "Concorde" series of integrated cartridge/headshell combinations, heralds them as "launching a new era in the reproduction of music from records." What does the Concorde offer? "A spectacular reduction in mass," of up to 40 percent, says the company, noting that the combination weighs less than most headshells alone. "This



Another moving iron cartridge is the Empire EDR.9 that features an integral stylus guard and "large area of contact" stylus. It weighs just 5.5 grams for accurate tracking. See the test report in this issue. \$200. Circle number 120.



The low outputs of moving coil cartridges require some sort of step-up transformer if your preamp has no MC input. This Audio Technica AT-650 transformer will work with most MC pickups. Cost \$250. Circle number 115.



Sony is moving into the world of pickups with their model XL-55 moving coil cartridge. It is built in to an integrated magnesium headshell. This unit sells for \$300. Circle number 94 for info.

The new Concorde 30 by Ortofon is an integrated headshell/cartridge that is designed to minimize the moving mass of the tonearm/pickup combination. It has moving magnet electronics and a "fine line" stylus. \$165. Circle No. 82.

substantially lower mass allows the tonearm to follow the ups and downs of record warps, resulting in longer record life and stylus life. And there is audible benefit as well; lower intermodulation distortion." The Concorde 30 with nude fine-line stylus is \$165, the Concorde 20 with fine-line stylus is \$125. Each is packed with a universal counterweight for use with tonearms that now have counterweights too high in mass to accommodate this new development, an Allen wrench for overhang adjustment, an azimuth gauge, tracking force gauge, and stylus cleaning brush.

Ortofon also produces the special cartridge used on Dual's low-mass tonearm system (see the "Spotlight" article elsewhere in this issue).

Signet is a recent entrant on the cartridge scene. Originally intended as a "high-end" line priced at \$90 and above, it has been broadened to include lower priced models—starting at \$40. Six moving magnet models in the line feature a U-shaped stylus guard which, in its down position, guards the stylus from accidents or abuse. A touch of the finger pushes the guard up into the headcase for play position. The lowest priced model, TK-1E at \$40, is available with an integrated headshell as the TK-1E/H at \$45. This headshell has an overhang adjustment. The line also includes a moving coil model at \$300, the MK111E, which is available with integrated headshell as the 112E at \$325.

Best selling Signet models are: TK-1E and 1E/H at \$40 and \$45, TK-3E at \$60, and TK-7E at \$100.

**Moving Coil Cartridges.** As noted, one of the key trends in cartridges is the burgeoning of the moving

(Continued on page 66)



□ The phono cartridge is a tiny, finely engineered device that plays a crucial role in the reproduction of sound. With the great number of cartridges and styli on the market, it is helpful to have some idea of the differences between them and which will best suit your needs.

Most high-fidelity phono cartridges are magnetic types, that is, they generate an output by the relative movement between a magnetic field and a coil. One of the two may be fixed; the other must move in response to the wiggles of the record groove. The stylus assembly transmits the vibrations induced by the record groove up into the cartridge. It consists of the stylus itself, usually a polished diamond, and the cantilever or arm that carries the vibrations to the cartridge innards.

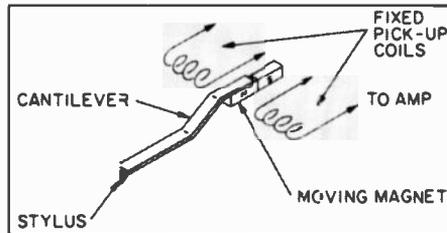
#### Cartridge Types

**Moving Magnet.** In a moving-magnet cartridge, a tiny permanent magnet is affixed to the end of the cantilever. The magnetic field (or lines of flux) emanating from the magnet pass through fixed coils within the cartridge. The coils consist of many turns of wire wrapped around soft-iron polepieces that collect the flux and direct it through the windings. As the magnet moves in response to the vibrations, the amount of flux passing through the coils changes, and this induces a voltage across the coils. Moving-magnet cartridges are relatively sensitive since many turns of wire can be used to generate the voltage. They are also of relatively high impedance and are usually meant to be terminated with a 47,000-ohm resistor and a certain capacitance (of from 100 pF to 450 pF). This "load" is presented by your preamp.

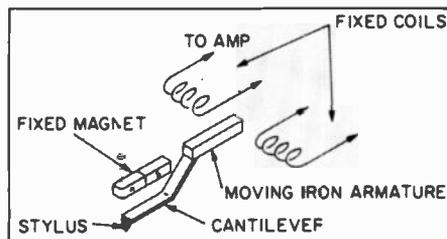
**Moving Iron.** In a mov-

## A SHORT COURSE ON PHONO PICKUPS

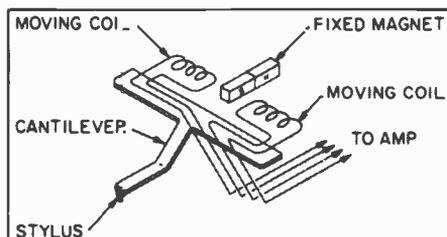
by William S. Gordon



In a **Moving Magnet** phono cartridge the magnet moves, generating a strong electric current in the pickup coil.



In a **Moving Iron** pickup neither the coils nor the magnet move, just a small fixed conducting iron armature.

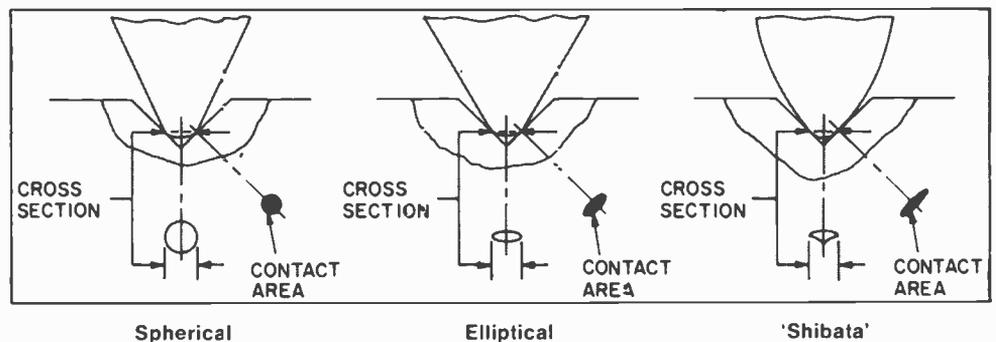


**Moving Coil** cartridges have tiny coils that vibrate in the magnetic field. Small moving mass—but have low output.

ing-iron or variable-reluctance cartridge, both the coil and the magnet are fixed, but a small iron bar is attached to the end of the cantilever. Things are arranged so that the field from the magnet is coupled to the coil through the moving iron. As the iron moves, it changes the amount of flux through the coils, and the signal is generated. Since the magnet itself needn't move, a much larger and stronger one can be used as compared with a moving-magnet design. And, many turns of wire can be wound around the polepieces to maximize the sensitivity. Moving-iron cartridges have roughly the same sensitivity as the moving-magnet types and are designed to be terminated in comparable loads.

An induced-magnet cartridge is quite similar to the moving-iron type although the internal arrangement of the elements is different. Both coil and magnet are fixed, and a magnetic bar is attached to the end of the cantilever. The magnet is located so that its flux does not couple with the coils directly but instead induces magnetism in the magnetic bar. The bar becomes a magnet itself and then acts much in the same fashion as a moving

*(Continued on page 67)*



While there are dozens of different types of styli on the market, most fall into three categories: spherical, elliptical and, the so-called, Shibata. The taller and thinner the contact with the groove wall, the better the high-frequency response of the stylus will be.

# MOST MUSIC LOVERS HAVE A PROBLEM. OVERWEIGHT.

No matter what brand of turntable you own or plan to buy, there's an easy solution to the kind of overweight that chews up your records, wears out your stylus and distorts the music.

An Ortofon low mass (LM) cartridge weighs 2.6 grams, just about half the weight of a conventional cartridge. And, an Ortofon LM cartridge can reduce effective tonearm mass by up to 40%!

Ortofon's patented Variable Magnetic Shunt (VMS) system makes low-mass design possible, but it also reduces distortion to the vanishing point.

An Ortofon LM cartridge solves a lot of problems: low frequency distortion, sound coloration, inaccurate transient performance, inability to track record warps, unwanted resonant frequency. All solved.

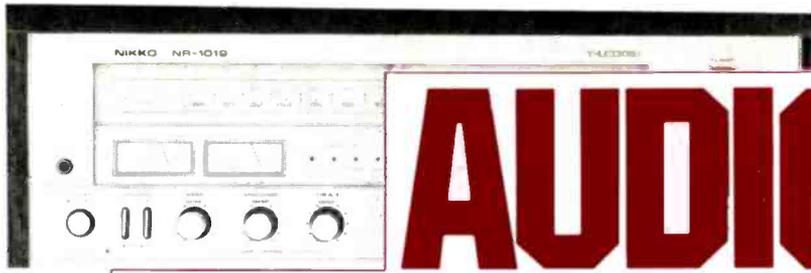
Why not visit your Ortofon Dealer's Weight Reduction Center now?

For full information, write:

**ortofon** 122 Dupont St.  
Plainview, N.Y. 11803



Circle No. 22 On Reader Service Card



# AUDIO AUDITIONING:

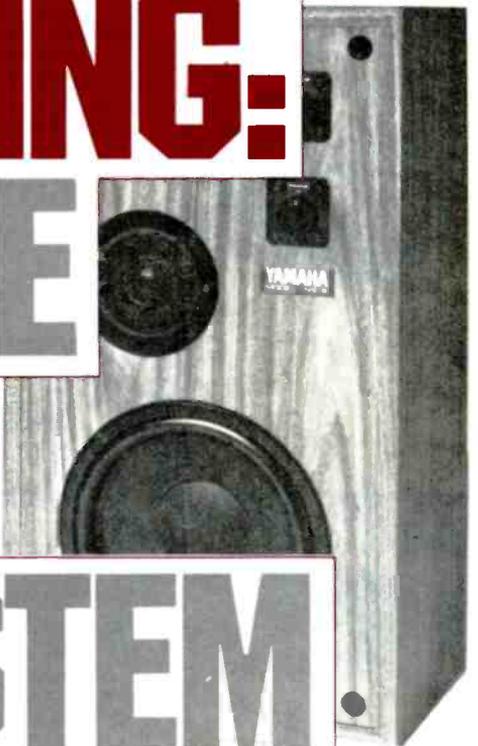
## CHOOSE

## THE

## RIGHT SYSTEM

## AT THE

## RIGHT PRICE



by FRED PETRAS

**T**he average music lover going out to buy a stereo system generally does so with trepidation. He or she feels jumpy, irritable and tense. As the pressure to spend all that hard-earned cash builds the buyer often gets short tempered and confused by all the different products and specifications, and ends up buying a poorly matched system.

The cause of all this is lack of preparation. Just as no pilot would ever leave the ground without a flight plan, no would-be audiophile should set foot, or cash, in a hi-fi store without an "audio

plan." It is the key to successful audio auditioning. If you watch your step and follow your plan you'll come home with the best possible audio system for the money.

**Audio Plan.** Before you set out, draw up a "map" as part of your audio plan. That map will be a rough sketch of the listening room. Multiply the floor length by its width by the distance from floor to ceiling, for a cubic-foot number that will figure importantly in your buying decisions. Draw in major pieces of furniture and indicate their finish (hard



# SPEAKERS

The first hi-fi component selection you'll make is the speakers. Speakers set the tone of a system—hot and crisp or soft and musical. Speaker manufacturers don't change their line every year. The Koss CM-1010, here, has been around for a few years and is still popular. \$350. Circle 76.

Choose your speakers by what your ears tell you is right. Take some records that you are familiar with and listen hard to a number of different types. Whether you buy a \$50 two way or a high performance four way like this Jensen System B (\$550, circle 107) it pays to audition.



# RECEIVERS



Choosing a receiver is no easy task—there are dozens of different brands and models to choose from. Sansui has a full line of full-feature receivers, such as this G-4700 with 50 watts per channel and 0.15% total harmonic distortion. \$430. Circle No. 89 for info.



This Kenwood KR-3010 receiver is a good example of a low to medium priced receiver with full features to make it the central component of an economical system. It has an output of 27 watts RMS per channel with no more than 0.05% total harmonic distortion. It has outputs for two sets of speakers and two tone controls. \$280. Circle 75 for info.

## AUDIO AUDITIONING

finish, plush, etc.), indicate the type of floor covering material, the type of drapery fabric, the nature of walls and panelling, etc., and the position of room dividers, windows, doors, or other sound-affecting objects or areas. This is to help determine the acoustical nature of the listening room—namely if it is "live," with a tendency to bounce sound around, or "dead," with a proclivity for absorbing or deadening sound.

Indicate on your map where you propose to place the new equipment, and also secondary positions for a bit more flexibility. Measure the places/areas where you intend to place the equipment, indicating height, width, as well as depth.

Next, consult your check book or savings account book, cash on hand, etc., and come up with a budget figure. Set a budget range—like \$850 to \$1,000 or whatever, to make your selection easier, and to make it easier for a salesman to help fill your needs.

A hi-fi system can be simply a receiver and a pair of speaker systems. This will provide radio reception,

It can be a receiver and speakers plus a turntable for playing records, giving you two sources of program materials. Or it can be a combination of the latter plus a cassette, reel-to-reel or cartridge tape deck, for three sound sources.

A system can also be made up of "separates," individual audio components, each with specific duties. Such a system could be comprised of a tuner, preamplifier, power amplifier, along with speakers and tape equipment. It could be simplified by substituting an integrated amplifier—which combines a preamplifier and amplifier on one chassis.

The trick now is to apportion your budget to each piece of equipment. There are no hard and fast rules, in that the variables are so many. But a *general rule of thumb* is that if you're buying a receiver-oriented system you'll apportion about 35 to 40 percent for the receiver, 20 to 25 percent for the turntable/cartridge and 35 to 40 percent for the speakers.

If you decide on a separate-component system you might apportion 40 to 45 percent for a tuner and integrated amplifier, 35 to 40 percent for the speakers, and 20 to 25 percent for the turntable.

Whatever you spend, the idea is to achieve a balanced ensemble—relating price, quality, performance, power, and

# TURNTABLES



If you like to stack on a pile of records and let the machine do the rest then a record player like this BIC 60 Z is ideal. It is a record changer with belt drive, automatic repeat, variable pitch and anti-skate, 33 and 45 rpm speed control and oil-damped cueing. \$179.95. Circle 65 on reader coupon.

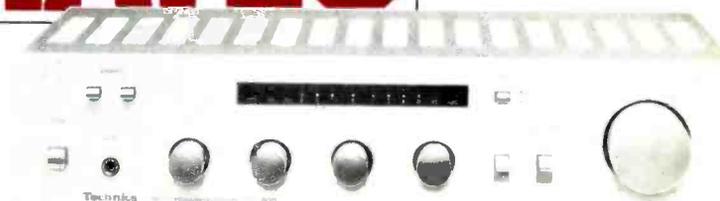


Some audiophiles prefer a single-play turntable such as this DP-EC7 from Mitsubishi. All tone arm movement is totally automatic and damped to minimize record wear and damage. The direct drive motor is designed for low wow and flutter. Sensors keep tonearm from dropping on the platter. \$350. Circle 78.

# SEPARATES



For the audio enthusiast who wants the best possible performance, hi-fi separates, such as this Onkyo T-4040 FM/AM tuner, can be the answer. Has LED tuning indicators. \$229.95. Circle 80.



If you don't have the budget for a separate preamplifier and power amplifier then an integrated amplifier might be for you. It combines the two units. This SU-8011 by Technics has an output of 27 watts per channel RMS with no more than 0.08% THD from 20 to 20,000 Hz. \$175. Circle number 98.

features, so that your particular listening and operating needs are satisfied.

Next, list the type of music you like. Then evaluate it in terms of listening levels—that is, how loud or soft you like to hear it. Low listening levels suggest use of lower-powered (and lower-priced) equipment, loud volume levels mean you'll need higher-powered, higher-priced equipment. This information will be of value in determining the speakers and power output you'll buy.

**Reference Records.** Next, get fresh copies of two or three of your favorite records whose sound you know well. These will be your aural reference points when you go out to buy; something to guide you through the equipment comparisons, to the right equipment.

At this point, you're ready to take off. . . .

At the hi-fi store, courteously tell the salesman who asks if he can help you, "Not just yet . . . I'd like to look around." The vast majority of salesmen accept such a response, and let you look.

And this is your chance to check out what's available, what fits your budget, what pleases your eyes, and what's right for your ears. It's also a chance to pick up product brochures and catalogues for perusal later, should you not reach a buying decision. Take notes!

**About The Equipment.** The heart of most hi-fi outfits is the receiver. It is, in effect, a three-component ensemble in one housing, made up of a Tuner—that brings in radio broadcasts, a Preamplifier—that boosts the broadcast signals (and signals from turntable and tape decks) to a certain degree, and a Power Amplifier—that amplifies the signal(s) to a much louder level, so that they can work the Speakers.

**Features.** All worthy receivers have at least one *Tuning Meter* to make tuning more precise. The most desirable is the *Center Tuning Meter*; you line up its pointer to dead center of its scale as you rotate the tuning knob. The other type is the *Signal Strength Meter*, whose pointer is adjusted to the highest reading on the meter scale, again as you rotate the tuning knob. On some, not all, of the latest receivers you'll find the dial scale replaced by glowing numbers (digital display) and the tuning meters replaced by flashing, light emitting diodes—LEDs. They accomplish the same duties—not necessarily better—in a visual manner that some buffs find more appealing than traditional dials and meters.

The *Mode Switch* activates the AM or FM section of the receiver is often incorporated in the *Selector Knob*, which also brings the phono section, the tape section, or



Reel-to-reel tape machines are making a bit of a comeback in the audio world. Akai's GX-620 is a four-track two-channel deck with three-motor drive. On slow speed with a big reel you can pack a lot of playing time on one tape, or get high quality at high speed. \$725. Circle 62.

# TAPE MACHINES

Cassette tape recorders are compact and convenient to use and the audio quality is excellent, especially with the newer tape formulations. Hitachi's new D-3300M has an automatic tape bias adjusting system that peaks tape performance. \$750. Circle number 72 for information.



## AUDIO AUDITIONING

the auxiliary section into action when needed.

Higher priced receivers usually have a switchable FM Mute control. Its basic duty when in the on position is to eliminate inter-station noise as you tune across the FM dial—to make tuning a far more pleasant matter.

Some state-of-the-art receivers have a switch marked "25  $\mu$ S Dolby." This is used to decode Dolbyized FM broadcasts, in conjunction with a Dolby adaptor.

The preamplifier/power amplifier section of the receiver has the tone controls—Treble and Bass, and Mid-range in higher priced models. These alter the character of low, high and middle frequencies of the sound spectrum.

The Volume control use is obvious, but most receivers also have a Loudness compensation control. Switching it in when listening at low volume levels will balance the sound by automatically boosting the bass (and sometimes the treble) response, so that you hear a "full" sound even at low volume levels.

Many receivers have one or two filters. The High Filter, operating generally in the 9 kHz and up region, reduces record scratch, tape and FM station hiss, for improved overall sound quality. The Low or Subsonic Filter, operating at 50 Hz and below, cuts turntable rumble, vibrations and extraneous noise.

Another control found generally on higher priced receivers is Audio Muting. This drops the sound level at the flick of the switch. It's used when the phone or doorbell rings, permitting you to answer without changing the volume setting.

The Balance Control, found on every stereo receiver, is for adjusting individual sound levels to compensate for program material with one channel louder or softer than another, or for room conditions that affect balance.

The Mode Switch on some receivers is confined to stereo/mono, permitting single or double-channel listening. In the mono position you'll hear the two stereo channels combined as one. Some receivers also have switch positions that permit either right or left channel listening. A Reverse position on the mode switch in a few deluxe models permits reversal of the channels.

The Tape Monitor switch permits listening to a program as it's being recorded. It also allows monitoring from a tape as it's being recorded on a three-head machine, enabling adjustment of recorder controls for optimum results.

A Dual Tape Monitor or Tape Dubbing switch enables you to dub (copy) a tape being played on one deck connected to the receiver onto a second deck hooked to the receiver. This allows you to dub from one format to another, as for example, reel to cassette.

The Speaker Selector permits switching from one pair of speakers to another; to a second position that combines both pairs; and possibly to a headphone setting. Some receivers allow three pairs of speakers.

Output Level displays are frequently available in the latest receivers. These, in meter, LED or fluorescent form, indicate power output peaks during operation. Some offer individual channel readouts, some a combined readout.

The controls and features also appear on separate tuners, preamplifiers, power amplifiers and integrated amplifiers. In some cases you'll find additional refinements for greater operating flexibility or control as, for example, Turnover Switches on some preamps that permit a broader range of tone alteration.

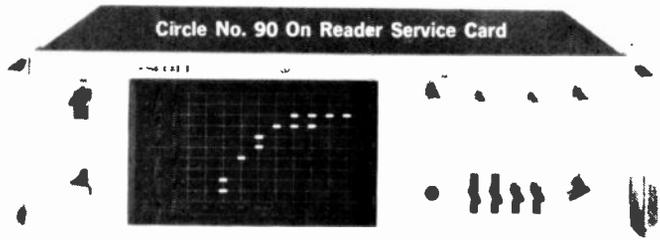
Turntables come in two basic types—single-play or multi-play, the former for one-record use, the latter for "stacking" of up to six records for playback in sequence with no attention. There is a further breakdown: manual, semi-automatic, and fully automatic. The manual type

*(Continued on page 68)*

# SPOTLIGHT ON...

## SCOTT 830Z AUDIO ANALYZER

Circle No. 90 On Reader Service Card



### IT'S ALMOST LIKE HAVING A TEST LAB IN YOUR LISTENING ROOM

□ To a professional soundman the most important piece of equipment is the *real time analyzer*, a device that shows what's happening between the frequency limits of approximately 20 to 20,000 Hz *as it happens*. It allows you to measure the frequency response of any component in a hi-fi system plus check out a room's acoustics. Does your hi-fi lack bass regardless how much boost you pump in? Maybe the room simply isn't large enough to support deep bass from the speakers—a real time analyzer will show this immediately. Do the highs scream at you from a particular direction? Again, a real time analyzer will show you which surface must be tuned with cloth or sound treatment.

The professional RTA (real time analyzer) tells you what's happening when it happens through the use of full-time filters spaced  $\frac{1}{3}$ -octave apart. Some sort of indicating device, often LEDs, indicate the level through each filter in dB; referenced either to a fixed sound pressure level (SPL), or + or - a user established reference value.

As you might expect, RTAs with their support hardware, such as a pink-noise generator and computer, costs upwards of \$3,000. But an amazing thing happens if two thirds of the filters are

stripped out so the instrument indicates in full-octave bands: the price plummets, as low as \$599, which is the cost of Scott's Model 830Z Audio Analyzer system intended for the serious audiophile. Note we said *system*. The 830Z includes a sweeping oscillator for amplifier tests, a sweep record for phono tests, and a calibrated microphone for speaker and room acoustics checks and measurement.

Depending on the selected operating mode and the signal source—either the internal sweeping oscillator through an aux or tape input, or the phonograph record through a pickup, and the analyzer input signal—either from an amplifier's tape or line output, the speaker output, or through a microphone plugged into the analyzer—the Scott 830Z will show the actual frequency

response of any part of the amplifier system, or the sound as reproduced by the speakers, including any and all variations produced by tone controls, filters and equalizers.

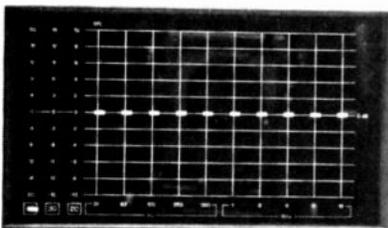
**Checking It Out.** For example, let's assume your system is short on the deep bass; nothing you do can bring it up to the desired value. With the Scott analyzer you first observe the speaker output and determine that the bass between 30 and 60 Hz is really boosted by the amp's tone control or equalizer. Then you observe the signal in the room *at the listening location* and discover 20 to 60 Hz is so far down even full amplifier bass boost, which is starting to muddy the upper bass, still doesn't bring up the bass so it can be heard. Assuming the speakers are known to be okay—try them in a larger room—you can be certain the listening room simply isn't large enough, or the correct proportion, to support deep bass frequencies. (No amount of money you spend on new speakers will improve this condition.) What you can do is reposition the speakers for better deep bass at the listening location. This is easily done by simply placing the analyzer's mike where your ear will be

(Continued on page 72)

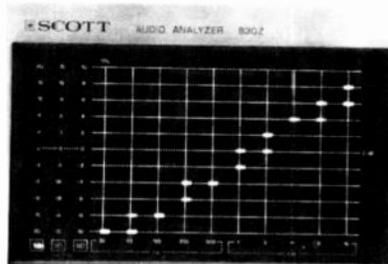


● *With all that's going on, the connections are rather simplified. Phono jacks for the test oscillator output and line level input, and spring-loaded binding posts for the speaker connections.*

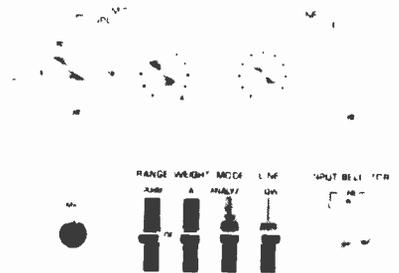
SCOTT AUDIO ANALYZER 830Z



● *Lighted LEDs indicate the readout. This is the flat response of the built in sweeping oscillator. Note the boxed 40 dB range has been selected and the vertical screen values are those directly above the boxed 40. If the 20 or 30 dB range was selected the appropriate box would be lighted.*



● *The same test signal after passing through some rather heavy frequency equalization. Note that some frequency bands have two vertical LEDs lit. The true value is between the two values indicated by the lighted LEDs on the display.*



● *The control center. The analyzer input can be switched immediately between the microphone and line inputs. Similarly, the line input can be switched between the Low (line) and High (speaker) connections. The microphone input level attenuator(s) are calibrated directly in sound pressure level (SPL).*

# Commit Yourself.



## Mitsubishi Car Audio.

Funny thing this stereo business. The world's full of advanced technology—so how do you make a better unit? More features? More power?

Not necessarily so.

Our equipment stands on its own merit as being reliable, rugged, and the highest in quality car audio. Mitsubishi has never had to rely on the easy way out.

AM/FM cassettes and 8-track. In-dash, under-dash units. Speakers. And something we're especially proud of... the Mitsubishi component separates. Tuners, tape decks, amplifiers, amplifier/equalizers. All engineered as separate units designed to ulti-

mately come together in an awesome collective system.

See your nearest Mitsubishi dealer and point to, poke at and above all, listen to our exciting new line of car audio products.

Shown here are the RX-79 in-dash cassette with AM/FM MPX, the CV-23 control amplifier and equalizer, the CX-20 component cassette deck, the SX-30SA 2-way speaker enclosures and the SB-2SA super tweeters.

 **MITSUBISHI<sup>®</sup>**  
**CAR AUDIO**  
SOUND US OUT



# CAR STEREO MADE EASIER

STANDARDIZED SPEC'S LET YOU COMPARE  
ONE SET TO ANOTHER

by WILLIAM S. GORDON

**F**or some time now, knowledgeable consumers have been grumbling about the lack of measurement standards for car-stereo equipment.

Everyone was using different specifications in their advertising, and you couldn't compare one unit's power and sensitivity to another's because they were measured differently. Well, they need grumble no more, for standards do exist.

If you think they've been a long time coming, you're both right and wrong. Considering the relative youth of the car-stereo industry, it has really moved quite quickly in putting the house into order. It took the home hi-fi boys a decade or more to devise standards; their automobile counterparts did it much faster.

Of course, the home high-fidelity industry had done the spadework.

Measurement standards *did* exist when the car-stereo people started work. It was a matter of applying them to on-the-road gear. (Unknown to many people, the IHF measurement standards always did apply to battery-operated equipment—which is what car-stereo equipment is. It's just that no car-stereo manufacturer had the guts to follow them.)

**Spec Inflation.** When car stereo became big business it's reputed to gross more than home hi-fi equipment right now—reputable home-equipment manufacturers obviously wanted to get a slice of it. But they were put off by the inflated specs that were claimed for automotive gear. Power was specified without regard to speaker impedance, bandwidth,

The Kenwood KTC-767 FM/AM tuner, typical of the new generation of car stereo equipment, is packed with features and performance. \$259, circle 75.



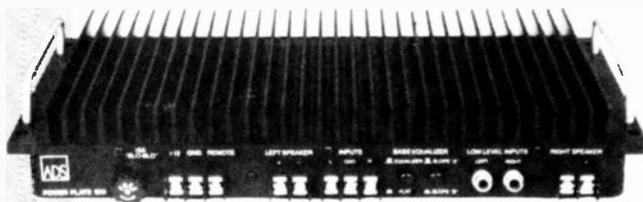


# CAR STEREO

or distortion, FM sensitivity was given without regard to quieting, etc. Obviously, something had to be done to bring order out of chaos and to prevent the shoddy specs race that characterized the mass-market home-entertainment industry a few years back.

At that time, you will recall that we were regaled with music power, peak power, and even instantaneous peak power (whatever that means) to make a cheese-crate console seem the equivalent of a component system. The FTC stepped in to legislate how amplifier power must be measured to

Good guys don't always wear white. If ADS used the committee's 14.4-volt standard instead of 13.5 volts, they could claim more power for their 50 WPC Power Plate 100 amplifier. \$295. No. 112.



A popular new car stereo accessory is the control amplifier/graphic equalizer combination. The Mitsubishi CV-23 shown here has a 30-watt BC (Before Committee) rating. \$150. Circle No. 78.



For the car stereo buff who wants everything in one neat package there is this Sanyo FT645 AM/FM receiver with a tape player and digital clock. "Total system power:" 9 watts. \$179.95. No. 113.



qualify for advertising—on a *continuous* power basis with *both* channels driven, into a *stated* impedance, over a *stated* bandwidth, with less than a *stated* amount of distortion.

Unfortunately, the FTC formulated a rule that covered only "home" entertainment systems. By oversight, car-stereo equipment was exempted. Several of the better car-stereo manufacturers petitioned the FTC to widen the scope of the ruling to include them—and obviously their competitors. (While some manufacturers wanted tighter spec standards, obviously, no one wanted to be first on the block with honest specs that inevitably would look poorer than their competition's.) To date, the FTC has not seen fit to widen the regulatory scope. Whether it's because they're too busy or because they just don't want to open another round of hearings is anybody's guess.

**Good Guys.** The good guys then went to the IHF. There they were told that extant standards already covered battery-operated equipment. All that was needed was to follow them. So an Ad Hoc Car Stereo Manufacturers' Committee—yep, that's the name—was set up by Clarion, Craig, Jensen, and Pioneer. After a year of study and discussion of the standards, they have produced their own document which relies heavily upon IHF standards (where they exist).

Advent, Alpine, Audiovox, Fosgate, Fujitsu-Ten, Grundig, Kenwood, Magnadyne, Magtone, Marantz, Mitsubishi, Motorola, Panasonic, Sanyo, Sparkomatic, Super-scope, Tenna and Visonic have already joined the pioneering Car-Fi foursome. By endorsing the standards, participating companies agree that by June 1, 1980, all of their printed catalogs, spec sheets, advertisements, and other literature will have product specifications based on measurements made in accordance with the Ad Hoc Committee's standards. In return, they may use the statement: "The specifications for this product were determined and are presented in accordance with specification standards established by the Ad Hoc Committee of Car Stereo Manufacturers." That statement is your clue to sensible (and comparable) specs so look for it carefully when you buy.

The existing Ad Hoc Committee standards are in three sections covering amplifiers (or the amplifier portion of a receiver or tape deck), FM tuners, and tape decks. The first two sections are based on IHF-A-202, the current IHF Amplifier standard, and on IHF-T-200 (1975), the current IHF Tuner standard. Since the IHF Tape-Deck standard is still in committee, the Ad Hoc group concocted their own. And, they are currently considering an AM-tuner and auto-speaker standard. Plus mechanical and

electronic standards for connections between components.

**Amplifiers** The Ad Hoc standards are not so complete as the IHF ones but they *do* include the most salient points, and, for those specs that are covered, the measurements are performed in the same fashion so you can interpret these car specs in the same way that you do home-equipment ratings. Since that be-all-and-end-all spec — *power output* — depends directly on the power-supply voltage, the car-sound manufacturers had to agree on a particular value — not so easy as it might seem. When the engine is off (and the battery is not under charge), its voltage is about 12 volts. When being charged rapidly, the battery could reach as much as perhaps 16 volts. The new standards call for a 14.4-volt test supply, probably typical of normal cruising operation. (The IHF amplifier standard gave no guideline although the tuner standard did suggest 14.4 volts.)

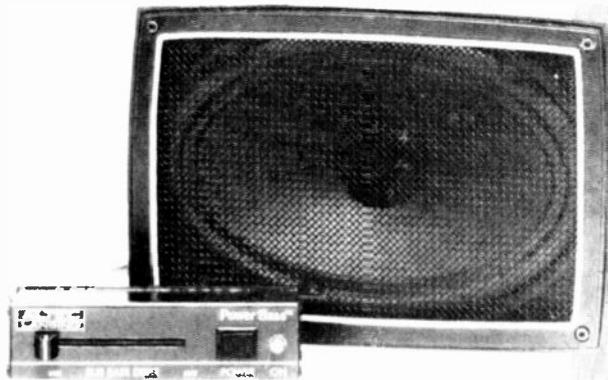
Output power will be specified exactly as per IHF (and FTC) dictates as “\_\_\_ watts per channel minimum continuous power into \_\_\_ ohms, both channels driven from to \_\_\_ hertz with no more than \_\_\_% total harmonic distortion.” Typical ratings might be 4 watts into 4 ohms from 30 Hz to 15,000 hertz with no more than perhaps 3% THD. Car speakers typically are 4-ohm units not 8-ohm units as is the case with home loudspeakers. Bridged amplifiers will supply more power from a 14.4-volt source, and, of course, some manufacturers might have wider bandwidth and/or lower distortion than others. What’s important is that you can now **compare** specs on a meaningful basis.

Amplifier *frequency response* will be specified at the one-watt output level with a  $\pm$  \_\_\_ db tolerance. (Past practice has omitted the tolerance which, of course, made the spec meaningless.) *Signal-to-noise ratio* will be A-weighted to reflect the audibility of the noise and be referred to the 1-watt level with standardized control settings. (Previous practice referred the noise to maximum output to achieve better looking numbers.) *Signal-to-noise ratio* will be A-weighted to reflect the audibility of the noise and be referred to the 1-watt level with standardized control settings. (Previous practice referred the noise to maximum output to achieve better looking numbers.) *Sensitivity* will also be measured as the input voltage required to reach a 1-watt output. As an *additional* option, the sensitivity for rated output can be given as well. The minimum *input impedance* of a power amp will also be specified in ohms to aid in matching separate components, and the *tone-control range* will be called out as “ $\pm$  \_\_\_ dB at \_\_\_ Hz and \_\_\_ Hz.” The recommended test frequencies are 100 hertz for the bass control and 10 kHz for the treble. For equalizers, the appropriate center frequencies would be used.

**Tuners.** Tuner measurements are based on IHF-T-200(1975) and promise to be much more meaningful than those heretofore

used for car receivers. For one thing, sensitivity will be measured both at the point of 30-dB suppression of noise and  
(Continued on page 63)

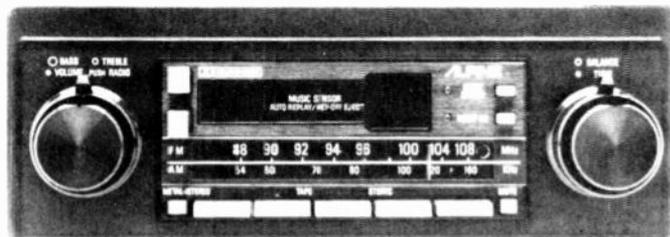
The Ad Hoc Committee plans to study complex issue of speaker specs this spring. Meanwhile the companies are going to town. Here’s a sub-woofer/amp from Altec Lansing. \$219.95. Circle 64.



Jensen, one of the prime movers behind the new specs, has the R405 FM/AM cassette receiver with auto reverse. BC (Before Committee) specs of 10 watts RMS \$279.95. Circle No. 107.

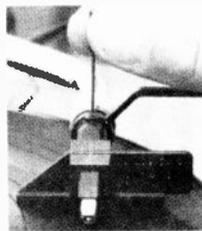
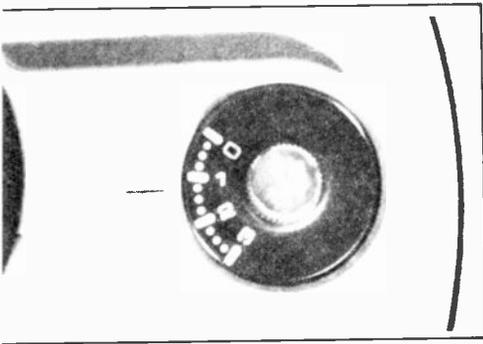


Alpine, new to the U.S. audio market, has introduced its 7123 FM/AM cassette receiver that puts out 6 watts RMS per channel. Has many features for easy and safe operation. \$319.95. Circle 103.



Clarion’s pre-committee specs for its PE-751B AM/FM cassette receiver claim 10 watts RMS per channel at 1% (that’s good for car stereo) THD. Has a so-called “smart” tuner. \$339.95. No 114.





The modern magnetic phono pickup is a miraculous device. Its tip is a diamond, one of the hardest substances known to man, yet one of the most fra-

gile. The diamond in turn is mounted on a metal cantilever, which to reduce mass is often a mere sliver that can be deformed by the most insignificant pressure of a fingertip. We then require these two fragile devices, part of a total assembly of the most precise tolerances, to literally drag a massive tonearm across a record while at the same time accurately reproducing the electrical equivalent of the wiggles contained within the grooves of a record. And to further complicate the "system," we expect the pickup and its diamond tip, which is one of the finest commercial cutting instruments, not to damage the soft plastic grooves of the record.

Three centuries back the inventor of such a device would have been accused of witchcraft and boiled in oil to exorcise the devil. Today, it's what we accept as the minimum acceptable norm.

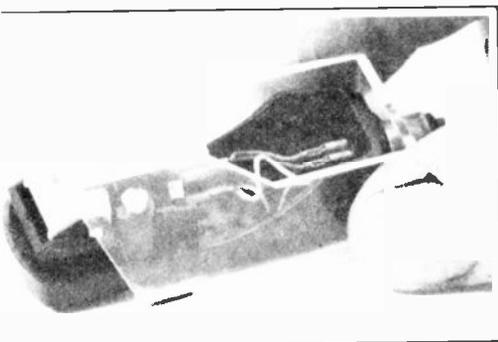
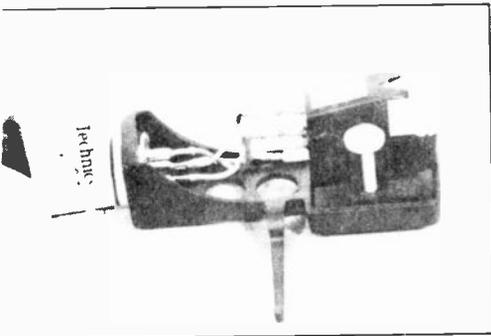
**Tolerance.** For all its miraculous qualities, however, the phono pickup must be handled and installed with extreme care if you're to realize the optimum sound quality of which it is capable, for even a barely discernable misalignment can spell the difference between *just good* and *superb* sound quality.

For example, let's take something as simple as overhang, the distance

the stylus tip extends beyond the turntable spindle, when the cartridge is centered over the spindle. The proper overhang insures that the pickup will be as tangent as is possible to the grooves within the area that the tonearm tracks the grooves. Obviously, since the tonearm doesn't track any grooves in the label area, or at the spindle hole, we don't care about the relationship of the pickup within the label/hole area. Fact is, we use a misalignment in that area (overhang) to force the pickup into a tangent orientation within the groove area.

It sounds simple enough to install the pickup in a tonearm so it has the correct overhang. Actually, it might not be all that easy for your particular turntable. To start with, most record players in the hi-fi marketplace use the so-called universal head shell, which plugs into the tonearm. Though the physical appearance might vary, any pickup with standard 1/2-inch mounting hardware will fit any universal shell, and any universal shell will plug into any universal tonearm. But that's where the similarity ends. To attain the proper overhang each universal shell has some means whereby the pickup can be positioned so the stylus is located in a precise location: this is where the problem arises. Most, but not all, turntables—regardless of the type of pickup/tonearm assembly—are supplied with a stylus overhang gauge. You slip the pickup shell, or carrier, into the gauge, move the pickup until the stylus is under a "crosshair," or V-notch, and then tighten the pickup's mounting screws.

**Standards.** Unfortunately, there is



no standard for the "standard" universal shell. According to some manufacturers, 50 mm overhang is the universal standard. Not so: 50 mm is this year's popular standard. If your turntable is a couple of years old the tonearm might require 52 mm, or even 55 mm. Also, not all recent tonearms use 50 mm. Some tonearms require 52 mm overhang, others 54 mm. No one value is better than another; the correct stylus overhang is the value required by your particular record player/tonearm.

Even if you start out knowing the overhang for your particular player you simply cannot borrow a gauge from a friend, because with the exception of Technics who prints the overhang value on gauges supplied with their record players, gauges are devoid of markings or values other than the "arrows" indicating the stylus position for the universal shell and tonearm for which the gauge was originally intended.

So here we are. We haven't even mounted the pickup yet and already we're faced with a problem whose resolution will directly affect the final sound quality attained from the pickup. So let's do things the right way: we'll start at the beginning and install a pickup so we realize the optimum performance of which the pickup is capable. (We will assume you have selected the general category of pickup required by your record player or tonearm.)

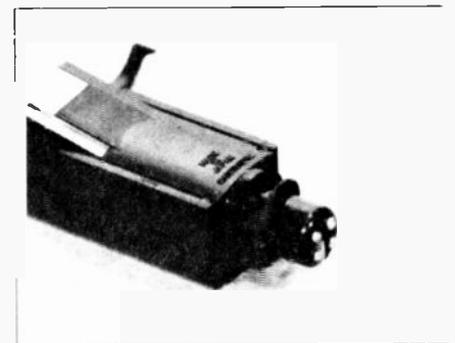
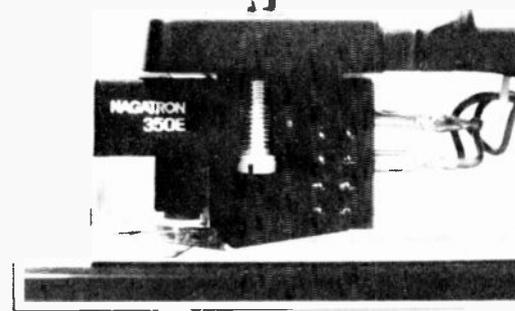
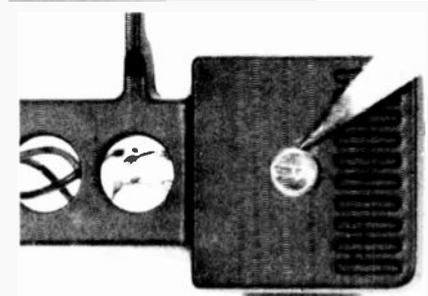
**Installation.** Firstly, the pickup must be installed in the shell or carrier. Remove the stylus assembly first, even if the pickup has an integral stylus guard; the slightest damage to the stylus makes it worthless, while

the most insignificant bend in the cantilever (the *gizmo* to which the diamond is attached) will degrade sound reproduction. If the stylus cannot be removed (the stylus assembly of most moving coil pickups cannot be user removable) tape the little plastic guard in place with a  $\frac{1}{16}$  or  $\frac{1}{8}$  inch wide strip of cellophane tape.

Install the pickup in the shell or carrier with the hardware supplied with either the pickup or the shell/carrier. Use whatever hardware does the job.

If your carrier is a universal shell with slots on the top so the mounting screws can be moved back and forth for overhang adjustment, you'll find installation and adjustment is easier if you install the screws upside down with the mounting nuts on top. It's less esthetic, but it sharply reduces the possibility of damaging the stylus when making the overhang adjustment. Next, attach the wire terminals. They are infamous for their ability to break in two at the slightest extra pressure. Best method is to grab the *stem* of each wire terminal with long nose pliers directly behind the barrel; then press the barrel in the pickup's lug(s). As you press the terminal on the lug the barrel will push against the pliers and simply be driven forward. If you grasp the lug too far behind the barrel the lug will generally fold up and perhaps break as you press the fitting on the pickup. If you don't have long nose pliers, use eyebrow tweezers.

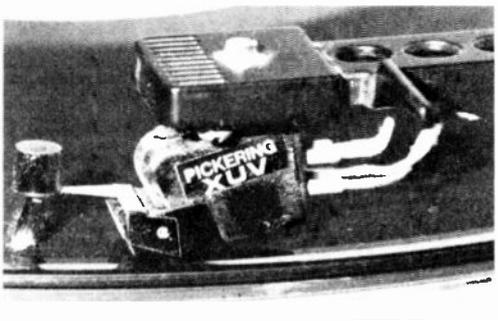
Affix the stylus overhang gauge to the shell/carrier and position the pickup so the stylus is directly under the V-notch, "arrows," or whatever else the gauge uses for an indicator.





Most gauges simply establish the overhang, you might have to shim the pickup later with washers between the pickup and shell to compensate for pickup height. Dual, most Garrard, and a few other not as popular turntables, are supplied with a gauge for both overhang and height. Use spacers supplied with the shell/carrier and pickup to raise the pickup so the stylus is directly in a V-notch, or directly under the cross-hairs. This is the best type of gauge because it insures optimum overhang and height.

Okay. Now look at the pickup. Its imaginary centerline should be over the shell/carrier's imaginary centerline. First time you try you'll probably find the pickup is cantered because there's a lot of slop in both the pickup and carrier mounting holes. If the pickup is cantered it undoes the overhang adjustment, so give the pickup a nudge with your thumb till it's straight.



Now sight directly into the front. Is the stylus exactly at right angles to the carrier? If not, see what's wrong. One very famous pickup line (who will go nameless here) has difficulty with some of their plug-in styli, which end up at a slight angle. If the stylus holder, the part you hold with your fingers when installing the stylus, is angled sidewise, try to get it straight with a gentle push from a finger, but keep your fingers off the diamond for body oil is not only a great attractor of dust, it turns the dust into cement.

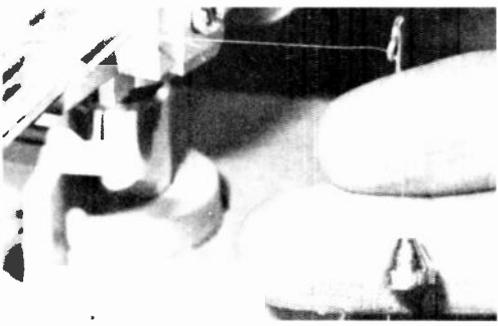
**Tracking.** Install the shell/carrier in the tonearm. Following the manufacturer's procedure, balance the tonearm and then set the VTF (verti-

cal tracking force) to the recommended value for the pickup. Don't try for too light a VTF thinking "less is better." A pickup set for a VTF less than the specified minimum value will result in accelerated groove wear. At this point, set the tonearm's anti-skate adjustment to zero. (You set it to the manufacturer's recommended value after all adjustments are completed.) If you are using a pickup with an integral dust brush—a Pickering, Stanton, or Shure V15-IV—make certain you add the negative tracking force of the brush to the VTF. For example, if you require a VTF of 1.5 grams and the brush exhibits a 1 gram *negative* force the *applied VTF* must be 2.5 grams.

Place a record you don't value too highly (it might get damaged) on the turntable, position the pickup as close as possible to the edge and lower the tonearm. If you have a record player whose tonearm lift is motor powered, requiring power be applied to the motor, just be a little bit more careful because you'll be handling the tonearm and making adjustments with the record rotating.

**Stylus Angle.** With the stylus in a groove, sight into the side and check that the stylus is perpendicular to the record's surface. Don't try to estimate whether the bottom of the pickup is parallel to the record, many pickups have a tapered bottom and making the bottom of the pickup parallel to the record results in an improper tracking angle. If you cannot be certain the stylus is perpendicular it should at the worst be *lagging*. If the stylus *leads*, that is, it

*(Continued on page 69)*



# Opera

For Today

## Sherrill Milnes

by Speight Jenkins

□ During the mid 1900s, European opera singers seemed to dominate the entire soprano to bass vocal tonal range; however, there was one voice the U.S. seemed to claim as its own: the baritone. John Charles Thomas, Lawrence Tibbett, Leonard Warren, Robert Merrill, these were the artists who did some of the most spectacular baritone singing anywhere in the world. By 1960 the four baritones named had been reduced to one, Robert Merrill, and in that same decade some of the prominent Italians such as Tito Gobbi and Ettore Bastianini began to drop out of performance because of age or sickness, respectively. Plenty of young singers followed in their stead.



Luisa Miller in Verdi's opera of the same name. In this opera he had a show-stopping Verdi aria in the first act. When Milnes finished this aria's concluding fast section, he capped his performance with a high A—a tenor note—and the house all but came down. In the eleven years since, this American baritone has sung in every major opera house in the world, has become one of the world's most sought-after baritones and is almost surely the highest paid American male singer of our time.

His voice was made to sing Verdi, particularly the rich roles of Verdi's mature period — from the Count di Luna in *Il Trovatore* through Posa in *Don*  
(Continued on page 70)



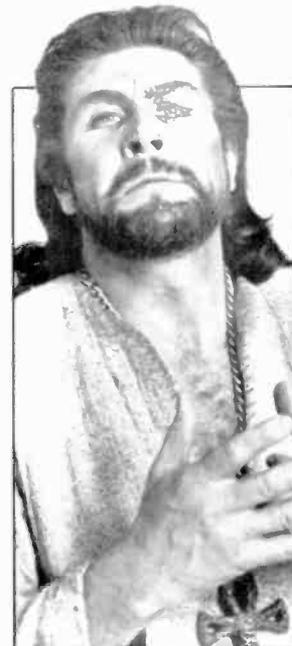
In a scene from Act II of Verdi's *Otello*, Milnes played Iago with Placido Domingo in the title role.

Sherrill Milnes' rich vocal texture has made him one of the world's most sought after baritones.

but few had the vocal power, ring, and commanding stage presence necessary to the male voice to fulfill the tonal area between tenor and bass.

In 1964, at the New York City Opera, however, a young Lochinvar from the West—or at least from a small Illinois town just west of Chicago—made his debut, and there was talk that a spectacular representative of the genus *baritono Americano* had appeared. Further performances there proved that he had a strong and well-trained instrument, and on December 22, 1965, Sherrill Milnes made his Metropolitan Opera debut as Valentin in *Faust*. The night was an interesting one, because it

also saw the debut of Montserrat Caballé as Marguerite. Miss Caballé did not make a real impression in the role; Milnes almost took off the top of the house with his voice and his success. Recently, he recalled that he almost missed the opening of his aria, for he expected the conductor to give him a measure of introduction, which he did not do. Almost without breath, Milnes realized that he had to start—and he did. But the role of Valentin is only found in two scenes which don't particularly dominate the opera. In the spring of 1968, however, Milnes took a decisive step into superstardom with his interpretation of the father of



Milnes has expanded his repertoire to include the operas of French, German and Russian composers.

## SPOTLIGHT ON...

# DUAL 650 RC WITH ULM TONEARM



Circle No. 27  
On Reader Service Card

## AN INTERESTING COMBINATION THAT PRODUCES FANTASTIC SOUND

□ For almost the entire history of modern high fidelity—some thirty years—we have gone through cyclic “break-throughs in the state of the art of tonearm design.” First, the experts with credentials as long as Methuselah’s beard claimed the *straight* tonearm was the ideal design. Then, when everyone owned a straight tonearm they claimed the *curved*—or S-curve—tonearm was ideal. When we all had S-curve tonearms they rediscovered the straight tonearm was best. Next, it was on to S-curve tonearms; and after some years of proving curves are better, we now have experts using computers to prove that straight is best.

Throughout the years of diverse opinion there was a small minority who proposed that the pickup and tonearm must be treated as a complete system; that you could not just mount a well designed pickup in a well designed tonearm and assume it would all work out to the best in sound reproduction. Several attempts at an integrated pickup and tonearm system were highly successful from the viewpoint of high fidelity sound. Unfortunately, they came about at the wrong time: the stereophile was not ready to give up preconceived opinions, and the integrated record player and pickup was generally

too expensive to develop the mass-marketing needed to carry new technology.

**Dual System.** But times do change, particularly when we have Dual—one of the most respected names in record players—involved in integrated design; and as you can read in the test report elsewhere in this issue, they have evolved an integrated system that produces what many in our listening panel consider the best in record reproduction.

In basic terms the Dual integrated record player system consists of the Dual CS 650RC (\$400) record player and Dual ULM55E (\$110) pickup, which is really an Ortofon pickup specifically designed for the CS 650RC record player.

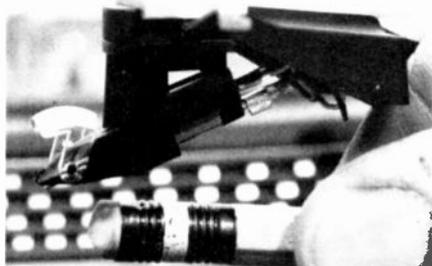
The record player is representative

of the typical automatic turntable. Featuring a direct drive platter, the 650RC operates at 33 and 45 rpm, with automatic selection of tonearm indexing: 12” for 33 rpm; 7” for 45 rpm. A button built into the platter senses when the platter is empty and restrains the tonearm drop until the button is depressed by placing a record on the platter.

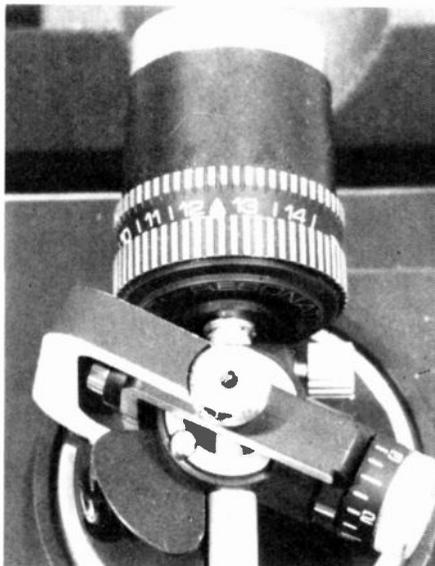
A single control serves as both the 33 and 45 rpm pitch adjustment. Full-time illuminated 33 and 45 rpm strobes are embossed around the rim of the platter.

The *power*, *start*, *stop* and *lift* push-button controls are mounted on the front of the integral base. The *power* switch controls standby power to the complete system. The *start* switch provides automatic start; the *stop* switch provides automatic stop with a tonearm lift, return to the rest, and motor off. (The motor starts when the tonearm is manually moved off its rest; stops when the tonearm is manually returned to the rest.) The *lift* switch lifts or drops the tonearm. This is in addition to the usual tonearm lift lever built into the motorboard itself. The reason all this is on the front panel is because the *start*, *stop* and *lift* are the three operating modes available through an accessory infra-red wireless remote control (the RC in the CS

(Continued on page 71)



● The “heart” of the Dual record player is this specially designed Ortofon pickup no larger than a pencil eraser. It is specifically intended for the CS 650RC record player, whose headshell finger lift also serves to lock the stylus assembly. The swing-down stylus guard is also part of the stylus assembly.



● No, it's not two VTF adjustments. The vertical stylus force is set by the small knob at the lower right which provides torque around the tonearms horizontal pivot. The dial on the counterweight is an anti-resonance tuning device for which values for common pickups, as well as a calculator, are provided in the instruction manual. The anti-resonator optimizes a particular pickup/tonearm combination.

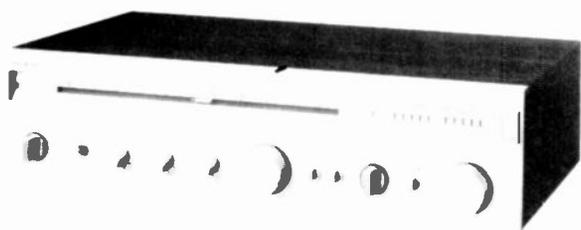


● Complete mounting hardware for other pickups is provided, as are the extra counterweights to accommodate the heavier pickups. You utilize one or two screw-on weights as needed.

# TEST REPORTS

RECEIVERS/	<b>45</b>	<b>52</b> /RECORD PLAYERS
TUNERS/	<b>48</b>	<b>56</b> /CASSETTE DECKS
PREAMPLIFIERS/	<b>49</b>	<b>61</b> /EQUALIZERS
POWER AMPLIFIERS/	<b>50</b>	<b>62</b> /CARTRIDGES
INTEGRATED AMPS/	<b>51</b>	

## RECEIVERS



Circle No. 72 On Reader Service Card

### HITACHI SR-4010 AM/FM RECEIVER

When used with efficient speakers this receiver is the way to get quite good overall performance at a rock-bottom price. \$250 in metal cabinet.

**DESCRIPTION:** An AM/FM stereo receiver FTC rated for 8 ohms at 25 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.05% THD.

Features include: left and right 5-step LED output power indicators, calibrated at 0.01, 0.1, 1, 10 and 30 watts into 8 ohms, that also serve as an FM tuning indicator (left meter) and AM/FM signal strength meter (right meter); an FM stereo beacon; an FM mute that is applied automatically when the receiver is in the stereo mode (the mute is off when the receiver is set for full time mono); and a subsonic filter that is applied automatically when the LED indicators are switched to the tuning indicator mode (the subsonic filter is off when the meters are switched to indicate output power).

There are inputs for magnetic phono, and tape. Outputs for two speaker systems, tape, and phones.

Controls are provided for tuning, volume, balance, ganged bass, ganged treble, speaker selection, and input selection/FM muting. There are switches for

loudness compensation, tape monitor, and meter mode/subsonic filter.

The FM antenna input is 75/300 ohms. An internal antenna and external connection are provided for AM. There is one unswitched AC outlet.

Overall dimensions measure 17 $\frac{1}{8}$ -in. wide x 4 $\frac{3}{8}$ -in. high x 11 $\frac{1}{8}$ -in. deep.

**PERFORMANCE: FM TUNER:** Full limiting was attained with 2.8  $\mu$ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8  $\mu$ V. The stereo high fidelity sensitivity (55 dB quieting) was 90  $\mu$ V. Full mute release was attained with 6  $\mu$ V.

At standard test level the stereo frequency response measured +0.2/-1.5 dB from 40 to 15,000 Hz, down 2.2 dB at 30 Hz. Monophonic distortion measured 0.2% THD; stereo distortion was 0.5% THD. The signal to noise ratio measured 67 dB. Stereo separation was 36 dB. Selectivity was very good.

(Note. The 19 kHz FM pilot leakthrough is somewhat higher than average. Make certain the mpx filter on a Dolby recorder is switched in when recording from FM. On most recorders the mpx filter is automatically applied with the Dolby.)

**PERFORMANCE: AM TUNER:** Background noise was higher than average.

**PERFORMANCE: AMPLIFIER:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 27 watts RMS. The frequency response at 27 watts/8 ohms measured +0/-3 dB from 20 to 20,000 Hz at a distortion no higher than 0.06% THD at any frequency. The subsonic filter produced 2.5 dB attenuation at 20 Hz.

The tone control range measured +11/-12 dB at 50 Hz;  $\pm$ 8 dB at 10,000 Hz.

The magnetic input hum and noise was -69 dB; stereo separation was into the noise level.

## TEST REPORTS / RECEIVERS

**PERFORMANCE: METERS:** The LED output power indicators, because of the broad range between values, indicate approximate power. They serve as a reference rather than as a precise value. Their frequency response is essentially "flat." When used as tuning meters the right indicator functions as a light-bar (or

bar-graph) signal strength meter, while the center LED in the left indicator serves to indicate proper tuning—it snaps *on* when an FM station is tuned properly; essentially, the LED substitutes for a center-channel tuning meter. ▲



Circle No. 75 On Reader Service Card

### KENWOOD KR-5010 AM/FM RECEIVER

A medium priced receiver that provides wide and narrow FM IF selectivity to provide extra, alternate channel rejection (selectivity) when needed. \$399.95 in wood cabinet.

**DESCRIPTION:** An AM/FM stereo receiver FTC rated for 8 ohms at 45 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.03% THD.

Features include a stereo beacon, combination FM center-channel and AM signal strength tuning meter, left and right output power meters calibrated 0.01 to 100 watts into 8 ohms and  $-40$  dB to  $+3$  dB with 0 dB representing 50 watts, wide and narrow FM IF bandwidth selector, an FM mute automatically applied in the auto stereo mode (mute is always off in the mono mode), and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for magnetic phono and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for tuning, volume, balance, ganged bass, ganged treble, input selection, and speaker selection. There are switches for loudness compensation, hi-filter, tape monitor A, and tape

monitor B.

The FM antenna input is 75/300 ohms. A rod antenna and external connection are provided for AM. Switched and unswitched AC outlets are provided.

Overall dimensions are 18½-in. wide x 5½-in. high x 14⅞-in. deep. Weight is 19 lbs.

**PERFORMANCE: FM TUNER:** Full limiting was attained with 1.6  $\mu$ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 7  $\mu$ V. The stereo high fidelity sensitivity (55 dB quieting) was 55  $\mu$ V. Full mute release was attained with 1.6  $\mu$ V.

At standard test level the stereo frequency response measured  $+0.1/-1.5$  dB from 30 to 15,000 Hz. With the receiver set for wide selectivity the distortion measured 0.15% THD for mono; 0.6% THD for stereo. With narrow selectivity the distortion measured 0.11% THD for mono, 0.4% THD for stereo. The signal to noise ratio was 69 dB. Stereo separation measured 40+ dB. Selectivity was fair (wide) to very good (narrow).

**PERFORMANCE: AM TUNER:** Distortion was a little higher than average.

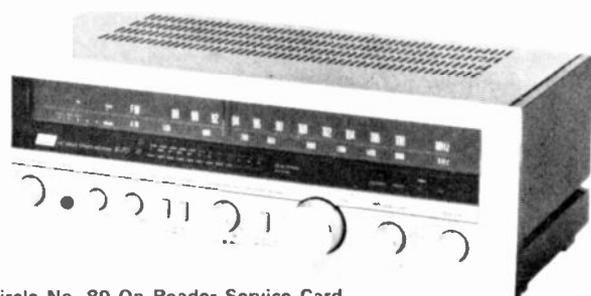
**PERFORMANCE: AMPLIFIER:** The power output at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 43 watts RMS per channel. The frequency response at 43 watts/8 ohms was  $+0/-0.2$  dB from 20 to 20,000 Hz at a distortion no higher than 0.035% THD at any frequency.

The tone control range measured  $+11/-9$  dB at 50 Hz;  $+9/-8$  dB at 10,000 Hz.

The magnetic input hum and noise measured  $-62$  dB; stereo separation was into the noise level.

Within the power capabilities of the amplifier the power meters were within 10% accuracy at their calibrated values. Frequency response was essentially "flat" from 20 to 20,000 Hz. ▲

**Readers often ask** what we mean when we say that the performance of a piece of equipment is average. We have established high critical standards for all pieces of equipment that are reviewed on these pages. After all, we are concerned with high fidelity components—not just any gear that produces sound. An *average* rating means that the component meets our rigid performance standard and is a good buy in its price range. For example, if a \$1000 receiver is rated *average*, this means that it is the equal of other average \$1000 receivers, superior to an average \$600 receiver, and far superior to an average \$200 receiver.



Circle No. 89 On Reader Service Card

**SANSUI R-70  
AM/FM RECEIVER**

Essentially a better quality general entertainment receiver that can dub directly from either recorder input. \$400 in metal cabinet.

**DESCRIPTION:** An AM FM stereo receiver FTC rated for 8 ohms at 65 watts RMS per channel, 20 to 20,000 Hz, at a distortion no higher than 0.08% THD at any frequency.

Features include a stereo beacon, three-step LED FM center channel tuning indicator, five-step LED AM FM signal strength/tuning indicator, left and right twelve-step LED output power indicators calibrated 0, 0.005, 0.01, 0.02, 0.05, 0.1, 0.5, 1, 2, 10, 50 and 80 watts into 8 ohms, and automatic copy (dub) from/to either of two recorders.

There are inputs for magnetic phono, aux, and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for tuning, concentric-clutched left and right volume (labeled *volume/balance*), ganged bass, ganged treble, tape monitor/copy selection, input selection and speaker selection. There are switches for high filter, loudness compensation, and FM muting (auto for stereo, off for mono).

The FM antenna input is 75/300 ohms. An internal antenna and external connection are provided for AM. Switched and unswitched AC outlets are provided.

Overall dimensions are 16<sup>15</sup>/<sub>16</sub>-in. wide x 5<sup>15</sup>/<sub>16</sub>-in. high x 9<sup>1</sup>/<sub>16</sub>-in. deep Weight is 16.5 lbs.

**PERFORMANCE: FM TUNER:** Full limiting measured 6  $\mu$ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 13  $\mu$ V. The stereo 55 dB quieting high fidelity sensitivity could not be measured because unusually high pilot and mpx subcarrier leakage blocked the test equipment at -38 dB. Full mute release was attained with 3  $\mu$ V.

The stereo pilot and subcarrier leakthrough is high and requires the use of an mpx filter when recording with Dolby. This is no problem since all Dolby noise reduction systems have the mpx filter; if yours is switchable make certain it is switched *in*.

At standard test level the stereo frequency response measured +0.5/-0.4 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.18% THD; stereo distortion was 0.35% THD. The signal to noise ratio measured 75 dB. Stereo separation was 40+ dB. Selectivity was good.

**PERFORMANCE: AM TUNER:** Background noise level was higher than average.

**PERFORMANCE: AMPLIFIER:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 43 watts RMS. The frequency response at 43 watts/8 ohms measured +0/-0.6 dB from 20 to 20,000 Hz at a distortion no higher than 0.065% THD at any frequency.

The tone control range measured +11/-12 dB at 50 Hz;  $\pm$ 10 dB at 10,000 Hz.

The magnetic input hum and noise measured -58 dB; stereo separation was into the noise level.

The output power meters are broadly calibrated—1, 10, 100 watts, etc.—and are reasonably accurate at the calibration marks. The frequency response of the meters is essentially "flat" 20 to 20,000 Hz, and can be relied on for tests if the reference is one of the calibration marks. The pointers have a moderately fast rise and a slow decay, providing a form of semi-peak indication. ▲



Circle No. 90 On Reader Service Card

**DESCRIPTION:** An AM/FM stereo receiver FTC rated for 8 ohms at 40 watts RMS per channel, 20 to 20,000

**SCOTT 350R AM/FM RECEIVER**

This receiver features fast-rise slow-decay output power meters which give a more accurate-than-usual indication of the program power delivered to the speakers. \$399, metal cabinet, wood trim.

Hz, at no more than 0.06% THD.

Features include: a stereo beacon; FM center chan-

## TEST REPORTS/RECEIVERS

nel and AM/FM signal strength tuning meters; left and right output power meters calibrated 0.001 to 100 watts and -30 to +20 dBW for 8 ohm loads; automatic dubbing from one tape to another; and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for magnetic phono, aux, and two tape. Outputs for two speaker systems, two tape, and phones.

Controls are provided for tuning, volume, ganged bass, ganged treble, input selection/FM mpx filter, and speaker selection. There are switches for FM muting, high filter, loudness compensation, mono-stereo mode, copy (dub tape 1 to tape 2), and tape monitor selection.

The FM antenna input is 75  $\Omega$  ohms. A rod antenna and external connection are provided for AM. There are switched and unswitched AC outlets.

Overall dimensions measure 17 $\frac{3}{4}$ -in. wide x 5 $\frac{1}{4}$ -in. high x 11 $\frac{1}{8}$ -in. deep. Weight is 24.5 lbs.

**PERFORMANCE: FM TUNER:** Full mute release was attained with 5.5  $\mu$ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 7  $\mu$ V. The stereo high fidelity sensitivity (55 dB quieting) was 75  $\mu$ V. Full mute release was attained with 12  $\mu$ V.

At standard test level the stereo frequency response measured  $\pm 3$  dB from 70 to 14,000 Hz, rising to +3.5 dB at 15,000 Hz. The monophonic distortion measured 0.65% THD. The stereo distortion was 0.95% to 0.8% depending on the tuning adjustment (the indicators permit a relatively broad center-channel tuning range). The signal to noise ratio (mono) measured 69 dB. Stereo separation was 32 dB. Selectivity was good.

**PERFORMANCE: AM TUNER:** Background noise was relatively higher than average.

**PERFORMANCE: AMPLIFIER:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 88 watts RMS. The frequency response at 88 watts, 8 ohms measured +0/-1.5 dB from 20 to 20,000 Hz at a distortion no higher than 0.06% THD at any frequency.

The tone control range measured +9/-11 dB at 50 Hz;  $\pm 11$  dB at 10,000 Hz.

The magnetic input hum and noise measured -62 dB; stereo separation was into the noise level.

The LED output power indicators are instantaneous and track the peak program level. Calibration is approximate. The frequency response is "flat" from 20 to 20,000 Hz in terms of a single LED staying lit across the entire band of test frequencies. ▲

## TUNERS



Circle No. 31 On Reader Service Card

### HEATHKIT AJ-1600 AM/FM STEREO DIGITAL TUNER

In addition to a direct digital frequency readout for both AM and FM, this unit features user-selected FM wide IF selectivity for minimum distortion or narrow selectivity for essentially interference-free reception. \$379.95 in kit form with metal cabinet and 19-inch rack front panel.

**DESCRIPTION:** An AM/FM stereo tuner with digital frequency readout featuring: a stereo beacon; FM center-channel tuning meter; combination FM multipath/AM-FM signal strength meter; FM Dolby decoder that automatically switches the FM deemphasis from

75 to 25  $\mu$ Sec.; user-selected wide and narrow FM, IF selectivity; an FM RF antenna attenuator to reduce the possibility of overload from local FM transmitters; and an mpx noise filter (hi-blend).

Outputs are provided for variable line level and for an oscilloscope multipath indicator.

There are controls for tuning, and AM/FM/FM Dolby/mpx filter/mono-stereo mode selection. Switches for power, signal strength/multipath meter mode, wide/narrow FM selectivity, RF attenuator, and FM muting. The rear apron has left and right output level adjustments and switches for 300/75 ohm FM antenna input, and frequency display brightness.

The FM antenna input is 300 ohms. A coaxial jack is provided for the 75 ohm FM input. A rod antenna and external connections are provided for AM. Switched and unswitched AC outlets are provided.

Overall dimensions are 19-in. wide x 5 $\frac{3}{4}$ -in. high x 14-in. deep. Weight is 20.7 lbs.

Note. This tuner was assembled from a kit and aligned by the builder. The alignment procedure does not require special test equipment if done by the builder. However even better performance can be

expected from an instrument-aligned unit.

**PERFORMANCE: FM TUNER:** Full limiting was attained with 2.5  $\mu$ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 9  $\mu$ V. The stereo high fidelity sensitivity (55 dB quieting) was 60  $\mu$ V. Full mute release was attained with 10  $\mu$ V. Once the mute is released it stays off until the signal level drops to 1.8  $\mu$ V, slightly below the full limiting level. (A somewhat unusual mute release operation.)

At standard test level the stereo frequency response without Dolby (75  $\mu$ Sec. deemphasis) measured +0.1/-1 dB from 20 to 15,000 Hz. With the Dolby active and 25  $\mu$ Sec. deemphasis the stereo frequency response measured  $\pm$ 0.5 dB from 20 to 20,000 Hz. In the wideband mode the monophonic distortion measured 0.13% THD. The Stereo distortion measured 0.4% THD. In the narrow bandwidth mode the monophonic distortion measured 0.4% THD. The stereo distortion was 0.8%. (Slightly off the meter indicated center channel tuning the narrowband stereo distortion fell to 0.2% THD.) Signal to noise ratio was 75 dB.

In the wide mode selectivity was fair-to-good. In the narrow mode it was excellent, and could easily separate two strong alternate channel signals, as well as dig out the weaker of two alternate signals.

Stereo separation measured 34 dB; 40+ dB slightly off the meter indicated center-channel tuning.

The RF attenuator provides approximately 15 dB

attenuation to the FM antenna input. It is used to prevent receiver overload and/or cross modulation when there is a local FM transmitter in your neighborhood. Effectively, it increases the limiting level from 2.5 to 14  $\mu$ V.

The maximum output level corresponding to 100% modulation of the transmitter was 1.2 volts.

(Note. The distortion and separation is sharply determined by the care taken by the builder during alignment. Factory aligned units, deliver, at the worse-case, the specified performance levels.)

**PERFORMANCE: AM TUNER:** Outstanding. Selectivity is much better than average with a clean, crisp (for AM) high frequency response. Sensitivity is about average. Receiver is very effective at receiving stations spaced 10 kHz apart without mutual interference or "whistles." (Good choice if you're into AM listening.)

**PERFORMANCE: DIGITAL READOUT:** The relatively large, green display devices provide an "odd" FM display (91.1, 91.3, 91.5, etc.) and a 10 kHz AM display (860, 870, 880, etc.). The tuning is conventional, not digital. The digital display is actually a counter interpolating the tuning oscillator. It's accurate, it puts the tuning right on top of the desired signal, but the final tuning is done in the usual manner by adjusting the tuning knob for the correct meter readings, or sound quality—which ever is preferred. ▲

## PREAMPLIFIERS



Circle No. 87 On Reader Service Card

### ROTEL RC-1000 STEREO CONTROL PRE-AMPLIFIER

An unusual control preamplifier with a built-in graphic equalizer and moving coil input. Broad-band equalization is a nice feature. \$320 in a metal cabinet.

**DESCRIPTION:** A stereo preamplifier/control center featuring a ten-octave graphic equalizer with center frequencies of 32, 63, 125, 250, 500, 1k, 2k, 4k, 8k, and 16kHz. Other features include: a magnetic phono input with selectable loads of 35k, 50k, and 70k ohms;

a moving coil (MC) phono pickup input; automatic dubbing from/to either of two recorders; and a subsonic filter for the phono input.

There are inputs for magnetic phono, MC phono, tuner, aux, and two tape. One set of stereo line level outputs is provided.

There are controls for volume, balance, ten equalizers, tape monitor/tape dubbing selector, and phono input load selection. Switches for power, octave equalizer on-off, subsonic filter, stereo/mono mode, loudness compensation, 20 dB audio muting, and input selection. Two switched AC outlets are provided.

Overall dimensions are 16 $\frac{1}{4}$ -in. wide x 3 $\frac{3}{4}$ -in. high x 11 $\frac{1}{2}$ -in. deep. Weight is 10.8 lbs.

**PERFORMANCE:** Note. The rated output is 1 volt, and all tests were conducted at this value.

With the equalizers in the center, or off, position, the frequency response measured  $\pm$ 1 dB from 20 to 20,000 Hz at a distortion no higher than 0.03% THD at any frequency. The output clipping level measured 4.2 volts, with a worse-case distortion of 0.8%.

## TEST REPORTS/PREAMPLIFIERS

The equalization range for each equalizer control was nominally  $\pm 12$  dB at the center frequency. The worse-case distortion with full equalization applied and no more than 1 volt output measured 0.05% THD.

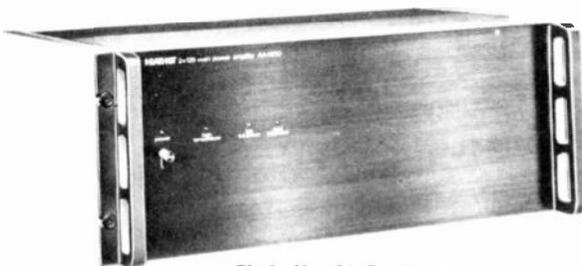
The equalizers are relatively broad band and can function either as graphic equalizers or standard tone controls if two or more controls are used to contour the frequency response. Because of their broad char-

acteristic, the equalizers avoid the usual "peaky" midband equalization generally associated with octave equalizers.

The subsonic filter, which is in the phono channel, provides 6 dB attenuation at 10 Hz with absolutely no effect from 20 Hz up.

The magnetic input hum and noise measured 70 dB; stereo separation was into the noise level. ▲

## POWER AMPLIFIERS



Circle No. 31 On Reader Service Card

### HEATHKIT AA-1600 POWER AMPLIFIER

Runs exceptionally cool to the touch. Even at full rated (125 WPC) continuous power for extended time periods this amplifier feels like it's coasting. \$359.95 in kit form with metal cabinet and 19-in. rack front panel.

**DESCRIPTION:** A stereo power amplifier FTC rated for 8 ohms at 125 watts RMS per channel, 20 to 20,000 Hz, at less than 0.05% THD. Features include: LED front panel indicators for high temperature, left full power output and right full power output; five-way binding post output connections; and an output hold-off that prevents power supply turn-on transients from being fed to the speakers. (Same protective circuit also disconnects speakers before power is turned off.)

One set of inputs at line level is provided. There is one set of speaker outputs. The power switch is located on the front panel. Left and right input level adjustments are located on the rear apron.

Overall dimensions are 19-in. wide x 7.25-in. high x 13-in. deep. Weight is 38.25 lbs.

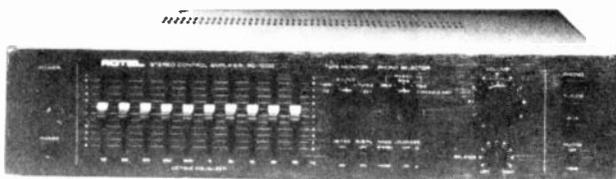
**PERFORMANCE:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz measured 128 watts RMS. (Good design is generally the rule when the clipping output power is as close as possible to the FTC-rated output power.) The frequency response at 128 watts/8 ohms measured "ruler flat" from 20 to 20,000 Hz at a distortion no higher than 0.035% THD at any frequency.

The maximum input level required for 125 watts output was 1.3 volts.

The signal to noise ratio referenced to rated power output measured 92 dB wideband.

The LED full power indicators were right on the mark, snapping on at precisely 125 watts/8 ohms at any frequency. (Actually, they snap on whenever the peak voltage at the output terminals exceeds 45 volts regardless of the load. In simple terms, there's essentially no distortion as long as the LEDs are off; if they turn on the amplifier is clipping.)

Overall, this amplifier, though sold for home use, is an excellent choice for commercial applications. ▲



Circle No. 87 On Reader Service Card

### ROTEL RB-1000 STEREO POWER AMPLIFIER

No impressive appearance. No spectacular measurements. But a notably pleasant sound quality. A very comfortable sound to listen to for long stretches of time. \$320.00 in a metal cabinet.

## TEST REPORTS / POWER AMPLIFIERS

**DESCRIPTION:** A stereo power amplifier FTC rated for 8 ohms at 65 watts RMS per channel, 20 to 20,000 Hz, at a distortion no higher than 0.03% THD.

There is one set of line level stereo inputs. Outputs for two speaker systems. An output hold-off prevents power supply turn-on transients from being fed to the speakers.

The front panel has controls for left input level and right input level. Switches for power, speaker system A, and speaker system B. Two switched AC outlets are provided.

Overall dimensions are 16 $\frac{1}{4}$ -in. wide x 3 $\frac{3}{32}$ -in. high

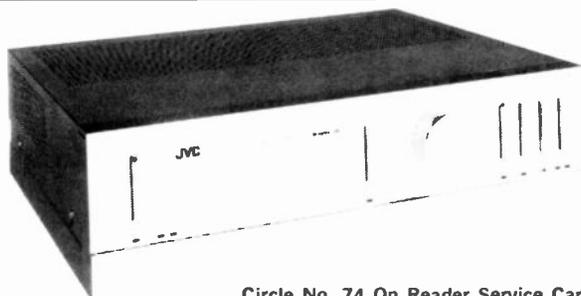
x 11 $\frac{1}{2}$ -in. deep. Weight is 15.6 lbs.

**PERFORMANCE:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz measured 66 watts RMS. The frequency response at 66 watts/8 ohms was "ruler flat" from 20 to 20,000 Hz at a distortion no higher than 0.022% THD at any frequency.

The signal to noise ratio referenced to full power output was 98 dB.

A 0.9 volt input was required for the 66 watt output. ▲

## INTEGRATED AMPLIFIERS



Circle No. 74 On Reader Service Card

### JVC A-X5 INTEGRATED AMPLIFIER

Exceptionally clean signal. What appear to be "soft" highs is really lack of distortion, which more closely resembles the distortion of vacuum tubes than transistors. \$449.95 in metal cabinet.

**DESCRIPTION:** An integrated stereo amplifier FTC rated for 8 ohms at 70 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.005% THD. Features include a built in head amplifier for MC (moving coil) pickups, the input/output connections for one of two recorders duplicated on the front panel, automatic dubbing from/to either of two recorders, a subsonic filter for the phono input, and an amplifier hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for two magnetic (MM or MC) phono, aux, tuner, tape No. 1, tape No. 2 and tape No. 2/front panel. Outputs for two speaker systems, two tape, tape No. 2/front panel, and phones.

The front panel has an exposed volume control and switches for power, muting, tape monitor, and input selection. A hinged access door conceals the input/

output phono jacks for the duplicate No. 2 tape recorder connections, controls for balance, ganged bass, and ganged treble; and switches for speaker system No. 1, speaker system No. 2, tone control defeat, loudness compensation, mono/stereo mode, dubbing/source recorder input, dubbing selector, tape monitor selection, subsonic filter, MC/MM phono input, and No. 1/No. 2 phono input selection.

One unswitched and two switched AC outlets are provided.

Overall dimensions are 17.7-in. wide x 5.8-in. high x 16.7-in. deep. Weight is 25.4 lbs.

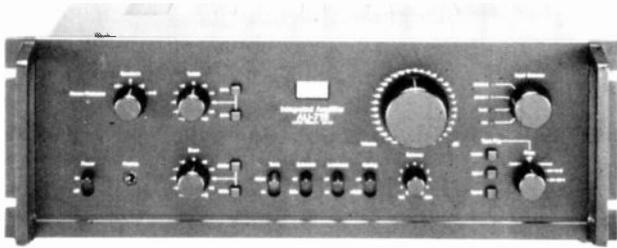
**PERFORMANCE:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 75 watts RMS. The frequency response at 75 watts/8 ohms measured "ruler flat" from 20 to 20,000 Hz at a distortion no higher than 0.07% THD at any frequency. (Note, The amplifier has the "soft" clipping characteristics common to vacuum tubes, rather than the "hard" clipping common to solid state devices. This results in an exceptionally clean sound at volume levels high enough to drive into amplifier clipping.)

The tone control range measured  $\pm 10$  dB at 50 Hz; +9/-8 dB at 10,000 Hz. The subsonic filter, which is effective only for the phono input(s), was 2 dB down at 20 Hz, falling sharply to 15 dB down at 10 Hz (a notably "sharp" and effective filter).

The magnetic input hum and noise measured -78 dB; stereo separation was into the noise level.

Note. The phono input is particularly sensitive to ground loops; the ground wire from the turntable must be connected at the amplifier, and it might be necessary to experiment with power plug reversal for minimum phono input hum/noise. ▲

## TEST REPORTS / INTEGRATED AMPLIFIERS



Circle No. 89 On Reader Service Card

### SANSUI AU-719 INTEGRATED AMPLIFIER

Has an unusually outstanding deep bass, and dual range tone controls with full deep bass shelving that permits "extra" equalization of the middle and upper bass without excessive overdrive of the deep bass. \$575.00 in metal cabinet.

**DESCRIPTION:** An integrated stereo amplifier FTC rated for 8 ohms at 90 watts RMS per channel, 20 to 20,000 Hz at no more than 0.015% THD.

Features include dual range bass turnover frequencies (150, 300 Hz), dual range treble turnover frequencies (3kHz, 6kHz), a subsonic filter, automatic copy (dubbing) from/to either of two recorders or direct dub from the tuner while listening to another sound source, and an output signal hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for two magnetic phono, tuner, aux, and two tape. Outputs for two speaker systems, two tape and phones.

Controls are provided for volume, balance, ganged bass, ganged treble, input selection, speaker selection, and copy (dub) selection. There are switches for power, bass turnover frequency, treble turnover frequency, tone control defeat, subsonic filter, loudness compensation, 20 dB audio muting, tape monitor 1, tape monitor 2, and source monitor.

One switched and two unswitched AC outlets are provided.

Overall dimensions measured 16<sup>15</sup>/<sub>16</sub>-in. wide x 6<sup>5</sup>/<sub>8</sub>-in. high x 15<sup>1</sup>/<sub>8</sub>-in. deep. Weight is 35.3 lbs.

**PERFORMANCE:** The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 103 watts RMS. The frequency response at 103 watts/8 ohms measured +0/-0.5 dB from 20 to 20,000 Hz at a distortion no higher than 0.15% THD at any frequency.

The tone control range depended on the selected turnover frequencies. At 50 Hz the range with a 150 Hz turnover measured  $\pm 10$  dB;  $\pm 11$  dB with the 300 Hz turnover. At 10,000 Hz the range was +8/-10 dB with a 3 kHz turnover; +6/-8 dB with a 6 kHz turnover.

The subsonic filter resulted in an attenuation of 2 dB at 20 Hz.

The magnetic input hum and noise measured -66 dB; stereo separation was into the noise level.

The listening panel reported a notably excellent sound quality, particularly in the deep bass, which was singled out for special attention, as was the shelving action of the bass tone controls which permitted the middle and upper bass to be boosted without excessive equalization of the deep bass. ▲

## RECORD PLAYERS



Circle No. 27 On Reader Service Card

### DUAL CS 650 RC-55

An award-winner. There is no way measurements, or mere words, can describe the acoustic-presence of this record player. \$509.95 includes integral base, dust cover, and specially designed tonearm pickup.

**DESCRIPTION:** A two speed (33, 45 rpm) electronic-controlled automatic record player with integral base and dust cover, and an Ortofon pickup specifically designed for the turntable. The pickup is supplied factory wired and adjusted.

Full-time illuminated 33 and 45 rpm strobes are embossed around the rim of the platter; a single pitch control is provided for both speeds. Power is controlled by a separate switch. After the end of automatic play the tonearm recycles to the rest and the motor stops, though standby power remains on. (The motor also starts when the tonearm is removed from its rest during manual play. A selector provides single or continuous automatic play). The power, auto start and stop, and lift touch switches are mounted on the front of the base. The front panel lift is in addition to the usual cueing lever. It is used to raise the tonearm during play, or lower the tonearm after lift. Since the lift switch is on the base, the tonearm can't be disturbed when operating the cueing lever on the motorboard. Jacks on the rear permit plug-in connection of a wireless infra-red remote control.

In addition to the front-of-the-base switches, there are controls on the motorboard for speed select, pitch, tonearm lift, and single/continuous play.

The tonearm has a combination sliding a micro-adjust counterweight, and a separate 0-3 gram VTF adjustment calibrated in increments of 0.1 gram to 1.5 grams, and 0.25 gram to 3 grams. There is a calibrated anti-skate. Though the turntable is supplied with a pickup, the mounting hardware and a stylus overhang gauge is provided for those who might want to exchange for a "standard" pickup. (Note: the headshell does not plug in as on other Dual turntables; there are no press-fit connections at the back of the pickup.) The finger lift, which is generally the Dual headshell locking device, on this player also functions as the stylus lock for the specially designed Ortofon pickup. The stylus cannot be removed by anyone who does not know the finger lift must be released first.

The output cable capacity was nominally 200 pF. (Make certain to read the note on this under the pickup's performance.)

**PERFORMANCE: TURNTABLE:** Speeds remained constant with essentially total immunity to transient line voltage variations over an applied test range of 100 to 140 volts. The pitch control range measured  $\pm 5/-6.6\%$  at 33 rpm;  $\pm 5\%$  at 45 rpm. Wow and flutter measured 0.04% with peaks to 0.12%.

The tonearm's stylus force adjustment was within 0.1 gram accuracy at all settings. Resistance to external shock and vibration was more sensitive than

average, caused by the extremely low-mass pickup/tonearm assembly.

**PERFORMANCE: PICKUP:** Magnificent! Actually, even better than that. (Comments apply only to the turntable, tonearm and pickup combination. We have no idea how well the pickup might work in any other turntable, or if it could be installed in another turntable.)

The worse-case frequency response is essentially ruler flat from 20 to 20,000 Hz when the pickup works into a 400 pF load. There is a 5 dB rise at 20 kHz if the loading is the more nominal value of 200 pF. (Since the turntable's output cable capacity is only 200 pF, allowing for 50 pF input impedance for the amplifier, the user must provide about 200 pF additional capacity for proper operation of the pickup. This can be attained by using 60-inch patch cord extensions, which are generally about 180-200 pF. The 1-meter ("three foot") cables do not provide sufficient capacity. If all you can get are 1-meter cables use two in series—the slight "extra" capacity won't make much of a difference. If your amplifier has a phono capacity input switch, set it for 150-250 pF.)

The channel balance was exact. The worse-case stereo separation measured 18 dB at 1 kHz; 17 dB at 15 kHz.

The sound quality cannot be described adequately. Highs are crystalline, with a purity we haven't heard before. The bass is so clean that one can hear new sounds from records, such as the harmonic vibration of unplayed strings of the double-bass—the natural sound (Many listeners might think the sound is too soft because of the lack of high frequency distortion, which is often confused with "brilliant" highs). Similarly, the knife-edge-sharp deep lows will lack the boom or drone caused by low frequency distortions.

Overall definition and transient response was outstanding. If not remarkable. (Neither definition nor musical transient response can be measured; it can only be heard.)

Our listening panel gave the overall sound quality of the CS 650 RC-55 a total "rave" review.

Note. Because of the low mass stylus/tonearm assembly the player is unusually sensitive to vibration. It's meant for listening, not dancing. If you are willing to sit for no-compromise sound, it's unlikely you'll find better for the price.. ▲

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**Worst case:** The test results that we report within these pages are always the *worst* case measurement for the piece of equipment being evaluated. For example, if the frequency response of an amplifier's left channel is 20 to 20,000 Hz,  $\pm 2$  dB, while the response of the right channel is  $\pm 3$  dB from 20 to 20,000 Hz, the test report will show the worst case measurement, that is,  $\pm 3$  dB. Similarly, if an FM tuner's stereo separation measurement is 40 dB left-to-right and 32 dB right-to-left, the test report will show a separation figure of 32 dB. This method of reporting allows you to be certain that performance in all other cases was equal to *or better than* the published results.

## TEST REPORTS / RECORD PLAYERS



Circle No. 85 On Reader Service Card

### PIONEER PL-400 RECORD PLAYER

Noteworthy performance for a budget priced record player. Has much higher than average resistance to external shock and vibration. \$199, includes integral base and dust cover.

**DESCRIPTION:** A two speed (33, 45 rpm) electronically controlled fully automatic record player. Speeds are "quartz locked" with no pitch control, so a full-time strobe serves only as a power indicator (it is always on-the-mark except when the platter slows slightly during the reject cycle). The player can be manually started by moving the tonearm off its rest. Using either an automatic or manual start, at the end of play the tonearm returns to its rest and the unit shuts off unless programmed for continuous repeat

play. The tonearm can be programmed to index at 12, 10, or 7 inches in the automatic start mode.

There are controls for speed select, start cut (reject), record size (tonearm indexing), and repeat/single play. A standard tonearm list is provided.

The tonearm has a micro-adjust counterweight that also serves as an 0-3 gram VTF (vertical tracking force) adjustment calibrated in 0.25 gram increments. There is a calibrated anti-skate. The pickup mounts in a plug-in *universal* shell for which no overhang gauge is provided. The user must measure the 49 mm. overhang with a ruler. The output cable capacity is 150 pF. **PERFORMANCE:** Both speeds held constant with total immunity to transient line voltage variations over an applied test range of 100 to 140 volts.

Wow and flutter measured 0.03% with peaks to 0.09%.

The tone control calibrations were essentially on-the-mark. In-between calibration values (such as 1.8 grams) can be estimated to approximately 0.2 gram accuracy.

Sensitivity to external shock and vibration was considerably lower than average for almost all price ranges, and this unit should be considered where its mounting will be "shaky." Control layout and handling is somewhat child resistant, something to consider if the player will be used by younger children. ▲



Circle No. 32 On Reader Service Card

### REALISTIC LAB-500 AUTOMATIC RECORD PLAYER

A nice package for the money, with just about the lowest wow and flutter we have yet to measure. \$260 includes integral base, dust cover, and pickup.

**DESCRIPTION:** A two speed (33, 45 rpm) electronic controlled manual/automatic record player built into a wood base. Supplied with dust cover and a Shure magnetic pickup factory installed and adjusted in a

universal shell. The tonearm always recycles to off after the end of play regardless of the starting mode unless the user selects continuous repeat play.

The tonearm indexing is not locked to the motor speed selector: the indexing can be set for 7-, 10- and 12-inch records.

Except for the single/repeat play selector, all operating controls are on the front of the base; they are: *speed*, *tonearm lift* (cue), *record size* (tonearm indexing), and automatic *start/stop*. In the manual mode the motor starts when the tonearm is moved off its rest; it stops when the arm is returned to the rest (automatically or manually).

The tonearm has a micro-adjust counterweight that also serves as an 0-3 gram vertical stylus force adjustment (VTF) calibrated in 0.1 gram increments. There is a calibrated anti-skate. Since the pickup is supplied factory installed and adjusted in a universal shell, no overhang gauge is provided (as there are no user adjustments that can be made between the pickup and shell). The tonearm rest has a positive lock.

**PERFORMANCE: TURNTABLE:** Both speeds were precisely "on the mark" with total immunity to transient line voltage variations over an applied test

range of 100 to 140 volts. Wow and flutter measured a notably low 0.03%.

The tonearm's VTF calibrations were precisely "on the mark."

**PERFORMANCE: PICKUP:** The special Shure R-9000ELWS pickup/shell assembly is rated for less than 1.5 grams stylus force (VTF). Realistic suggests 1 gram. The stylus is a special bi-radial design.

At the recommended 1 gram VTF the frequency response measured within  $\pm 2$  dB from 20 to 12,000 Hz, rising to +5 dB in the 14,000 to 20,000 Hz range. The rise, which is heard as "brightness," can be sharply tamed by using a 60-inch shielded patch cord as an extension for the output cable, whose unusually

short length results in a total circuit capacity that appears substantially less than required by the pickup.

Channel balance was within 1 dB. The worse-case stereo separation measured 23 dB at 1000 Hz; 19 dB at 15,000 Hz.

Overall, this pickup sounds a lot better than it measures. As supplied, the highs are somewhat "hot." With the 60 inch extension cable the overall sound quality is best described as "smooth and pleasant."

Because of the somewhat low tracking force the system has higher than average sensitivity to external shock and vibration, and it is recommended for use on a firm surface, with no shaky floors. ▲



Circle No. 128 On Reader Service Card

**ZENITH MC9050  
SEMI-AUTOMATIC RECORD PLAYER**

Features all operating controls on the front of the base. Convenient when there isn't much space available above the turntable. \$249.95 includes integral base, dust cover, and a Shure M75EJZ pickup.

**DESCRIPTION:** A two speed (33, 45 rpm) electronically-controlled semi-automatic record player with integral base, dust cover, and a factory installed and adjusted Shure M75EJZ pickup. The motor starts when the tonearm is moved off the rest; it stops when the tonearm is returned to the rest. At the end of play the tonearm lifts and automatically returns to the rest (turning off the motor). Full-time illuminated 33 and 45 rpm strobes are embossed around the rim of the platter.

All operating controls are built into the front of the base: the speed selector; 33/45 speed adjust (pitch control); cut (reject); and tonearm lift.

The tonearm has a micro-adjust counterweight that

also serves as an 0-3 gram vertical tracking force (VTF) adjustment calibrated in 0.1 gram increments. There is a calibrated anti-skate. The pickup comes factory installed in a universal plug-in shell; recommended VTF for the supplied pickup is 2 grams. The output cable capacity is nominally 90 pF. The tonearm's rest has a friction (push in) lock.

**PERFORMANCE: TURNTABLE:** Both speeds were constant with essentially total immunity to transient line voltage variations over an applied test range of 100 to 140 volts. The pitch control range at 33 rpm measured +3.7/-2.5%; +4.7/-3.7% at 45 rpm. Wow and flutter measured an unusually low 0.04%.

The tonearm's VTF calibrations were within 0.1 gram accuracy.

The turntable is somewhat more sensitive than average to external shock and vibration, and its use on shaky floors is not recommended.

**PERFORMANCE: PICKUP:** As factory installed the pickup is factory specified for 2 grams VTF.

At the recommended 2 grams VTF the frequency response measured within 2 dB from approximately 20 to 14,000 Hz, with a sharp peak of 3 dB at about 16,000 Hz. The rise, which is heard as "brightness," can be sharply tamed by using two 60-inch shielded patch cord extensions for the output cables. The standard cable's short length results in a total circuit capacity that appears substantially less than required by the pickup.

Channel balance measured within 1 dB. The worse-case stereo separation measured 21 db at 1000 Hz; 25 dB at 15,000 Hz.

Overall, the sound quality is a lot better than it measures if the "hot" highs are reduced with the patch cord extensions. With the extensions the sound is pleasant. ▲

# TEST REPORTS / CASSETTE DECKS



Circle No. 62 On Reader Service Card

## AKAI GX-F80 STEREO CASSETTE DECK

This cassette deck has metal tape capability and delivers outstanding performance from budget-priced cassette tape. Combination average/peak-indicating bar-graph metering keeps distortion at a minimum. \$495, in wood grain metal cabinet.

**DESCRIPTION:** A front loading three head system (simultaneous record/playback) Dolby cassette deck featuring: selector for low-noise normal, high-output normal, chrome-bias and metal tapes; left and right bar-graph level indicators that respond relatively slowly to 0-VU, while indicating the +3 dB and +8 dB peak signal level; automatic end-of-tape stop/disengage; continuous repeat play starting with automatic rewind in both play and record modes; microphone/line input signal mixing; a record mute that disables the input signal while the tape continues to drive (the record interlock flashes at 1-second intervals while the muting is *on*); a memory reset counter; play and record timer controlled start through an optional accessory timer; a prewired socket for an optional remote control unit; and automatic monophonic microphone recording if the microphone plug is connected to the left input.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for concentric-clutched left and right microphone level, concentric-clutched left and right line level, and ganged output level. There are switches for power, tape type, tape/source monitor, Dolby/Dolby with mpx filter, timer control selector, repeat play, counter memory *on-off*, and record mute.

The tape mechanism has touch-buttons for the record interlock, rewind, play, fast forward, stop, and

pause. A pushbutton is provided for reject.

Overall dimensions are 17.3-in. wide x 5.3-in. high x 13.4-in. deep. Weight is 19.6 lbs.

**PERFORMANCE:** The playback frequency response from a standard test tape with a 40 to 12.5 kHz range measured +1.5/-3.5 dB from 40 to 6.3 kHz, down 4.5 dB at 12.5 kHz.

The chart shows the test results for one tape of each type that gave optimum performance for its type, price and class.

### Record/Playback Tape Performance

BRAND AND MODEL NUMBER	Tape Type		Frequency Response			Percent THD*	Headroom to 3% THD	Signal-to-Noise Ratio	
	Dolby on/off	Signal Level in dB	Optimum Range in Hz.	Wideband	Narrowband				
								Max.	Min.
TDK-D	F	off	+1.0	-0.6	20-15K	1.1%	5 dB	46 dB	
TDK-D	F	on	+0.8	-2.0	20-14K	1.1%	5 dB	50 dB	57 dB
TDK-SA	C	on	+0.5	-3.0	30-15K	1.4%	6 dB	53 dB	59 dB
Fuji Metal/OVU	M	on	+0	-3.0	20-13K				
Fuji Metal/STL	M	on	+1.0	-1.5	30-15K	1.1%	8 dB	49 dB	57 dB

Standard test level

Key: F = ferric C = chrome R = ferrichrome M = metal

\*Total Harmonic Distortion at meter-indicated 0 VU level or 0 dB record level

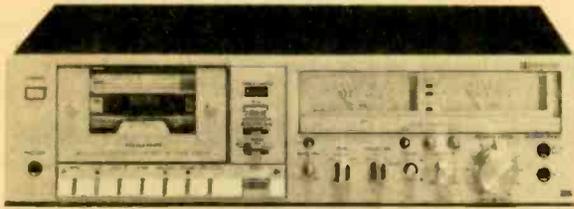
The maximum output level corresponding to a 0-VU meter indicated record level was 0.4 volts.

Wow and flutter measured 0.07% steady.

The record level indicators, though bar-graph, have approximately the characteristics of a VU meter. The segments at +3 dB and +8 dB are peak-indicating, and will "flash" when necessary regardless of the indication of the rest of the display. The frequency response of the indicators is "flat" within the value represented by any given dot of light.

When using the meters, minimum distortion and best signal to noise ratio is attained if the record level drives the bar-graph as high as is possible while getting only occasional illumination of the +3 dB peak indicator. ▲

Readers often ask what we mean when we say that the performance of a piece of equipment is average. We have established high critical standards for all pieces of equipment that are reviewed on these pages. After all, we are concerned with high fidelity components—not just any gear that produces sound. An *average* rating means that the component meets our rigid performance standard and is a good buy in its price range. For example, if a \$1000 receiver is rated *average*, this means that it is the equal of other average \$1000 receivers, superior to an average \$600 receiver, and far superior to an average \$200 receiver.



Circle No. 32 On Reader Service Card

## REALISTIC SCT-3000 CASSETTE DECK

This machine can be fine-tuned for notably excellent performance from any type of tape, even the budget variety, though superb results are attained from "better" tapes. \$579.95, metal cabinet.

**DESCRIPTION:** A front loading, dual capstan, three-head system (simultaneous record/playback) Dolby stereo cassette deck featuring: left and right record level meters; +3 dB and +6 dB peak record level indicators; a tape type selector for "normal," ferrichrome and chrome-bias tapes; a test oscillator with left and right adjustments for calibration of the Dolby system; a test oscillator system for optimization of bias for any type of tape; a position marker concentric with the record level control; automatic end-of-tape stop/disengage; a reset counter; automatic rewind at the end of the tape with auto-stop after rewind or auto-play; a timer control system for automatic play or record controlled by an optional accessory timer; and a record mute that disables the input signal while the tape is driving.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for concentric-clutched left and right record level, ganged output level, left Dolby calibrate, right Dolby calibrate, bias adjust, tape type selection, and Dolby/FM Dolby/mpx filter. There are switches for power, bias test system on-off, Dolby calibration system on-off, tape/source monitor, automatic rewind mode, timer control mode, and record muting.

The tape mechanism has touch switches for the record interlock, rewind, play, fast forward, stop, and pause. There is a pushbutton for eject.

Overall dimensions are 17½-in. wide x 4¾-in. high x 10½-in. deep. Weight is 15.4 lbs.

**PERFORMANCE:** The frequency response from a standard test tape with a 40 to 12,500 Hz range meas-

ured ±2.6 dB.

Because there is only one set of bias and Dolby adjustments we suggest you standardize on a particular tape and optimize performance for that tape. We show the test results for one tape of each type that resulted in superior recordings. The bias and Dolby adjustments are sufficiently broad to properly adjust for budget tapes such as TDK-D.

## Record/Playback Tape Performance

BRAND AND MODEL NUMBER	Tape Type	Dolby on/off	Frequency Response				Percent THD*	Headroom to 3% THD	Signal-to-Noise Ratio	
			Signal Level in dB		Optimum Range in-Hz.	Wideband			Narrowband	
			Max.	Min.						
Maxell UD/XL-I	F	off	+2.0	-0.5	30-15K	1.1%	6 dB	47 dB	N/A	
Maxell UD/XL-I	F	on	+1.5	-0	30-15K	1.0%	6 dB	53 dB	57 dB	
Sony DUAD	R	on	+0	-1.5	30-15K	1.4%	7 dB	52 dB	59 dB	
TDK-SA	C	on	+0	-1.2	30-15K	0.8%	9 dB	52 dB	58 dB	

Key: F = ferric C = chrome R = ferrichrome M = metal

\*Total Harmonic Distortion at meter-indicated 0 VU level or 0 dB record level

The maximum output level corresponding to a 0-VU record level was nominally 0.55 volts.

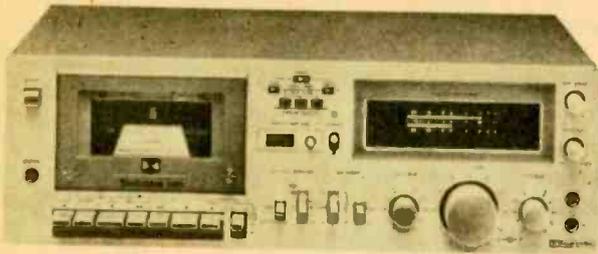
Wow and flutter measured a notably steady 0.06%.

One peak record level indicator lamp was not precisely calibrated. While the +3 dB indicator was precisely "on the mark," the +6 dB indicator did not turn on until the program peaks were +8.5 dB. This should create no problems if you simply adjust the record level so the +3 dB indicator flashes on peaks while the +6 dB indicator remains off, or flashes infrequently. (Normally, we wouldn't bother to mention this type of error, but the machine is capable of such excellent recordings we believe you should know how to attain the maximum performance.)

Both the bias and Dolby calibration systems were easy to adjust and unusually accurate. The bias system is the two-tone type: a mid frequency is fed to the left channel at approximately 0-VU, while a high frequency is fed to the right channel. The bias adjustment is rotated until the right output has the same meter reading as the left output. ▲

**Please note:** All prices listed in the test reports section, as well as prices listed elsewhere in this issue, are approximate and subject to change. Use them only as a ballpark guide to what you can expect to pay for a piece of equipment. It is assumed that prices vary at the discretion of individual dealers and that advertised prices may change without notice.

## TEST REPORTS / CASSETTE DECKS



Circle No. 98 On Reader Service Card

### TECHNICS RS-M63 STEREO CASSETTE DECK

A high-performance three-head cassette deck with many useful features and metal tape compatibility. Its memory auto-play system is worth checking out. Price: \$450 in a metal cabinet.

**DESCRIPTION:** A front-loading 3-head system (simultaneous record/play) Dolby cassette deck with selectors for Normal, ferrichrome, chrome-bias, and metal tapes. Other features include: peak signal fluorescent bar-graph record level indicators, microphone/line input mixing, a fine bias adjustment, automatic end of tape stop/disengage, rewind with automatic replay, rewind with auto replay from counter zero, a memory reset counter, record or play control through an accessory time, dimming of the bar-graph meters.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for concentric-clutched left and right microphone level, concentric-clutched left and right line level, ganged output level, bias level, bar-graph dimming. There are switches for power, tape/source monitor, metal tape, NOR/ferrichrome/chrome-bias tape, Dolby/Dolby mpx filter, counter memory on-off, and timer standby.

The tape mechanism has lever controls for the record interlock, forward, REW/review, FF/cue, stop, pause, and eject.

Overall dimensions are 16 $\frac{1}{8}$  in. wide x 5 $\frac{3}{8}$  in. high x 10 $\frac{5}{8}$  in. deep. Weight is approximately 14 lbs.

**PERFORMANCE:** The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured +1/-1.2 dB (Note: Maxell UD/XL I, Sony Duad, TDK-SA and Scotch Metafine tapes are speci-

fically recommended by the manufacturer so all tests were conducted using these tapes.)

### Record/Playback Tape Performance

BRAND AND MODEL NUMBER	Tape Type	Dolby on/off	Frequency Response				Headroom to 3% THD	Signal-to-Noise Ratio	
			Signal Level in dB		Optimum Range in Hz.	Percent THD*		Wideband	Narrowband
			Max.	Min.					
Maxell UD/XL I	F	off	+1.0	-1.2	40-15K	1.3%	6 dB	46 dB	N/A
Maxell UD/XL I	F	on	+0.0	-3.0	34-15K	1.3%	6 dB	52 dB	56 dB
Sony Ferrichrome	R	on	+0.5	-1.0	40-15K	1.0%	7 dB	54 dB	60 dB
TDK-SA	C	on	+1.0	-2.0	40-15K	0.8%	8.5 dB	54 dB	59 dB
Scotch Metafine	M	on	+0.5	-2.0	14-15K	1.5%	5 dB	54 dB	59.5 dB

Key: F = ferric C = chrome R = ferrichrome M = metal

\*Total Harmonic Distortion at meter-indicated 0 VU level or 0 dB record level

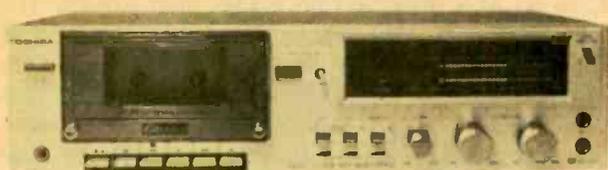
The maximum output level was nominally 820 mV. Wow and flutter measured 0.08%.

The peak reading meters have a moderate flow speed; they are no more difficult to track visually than a moderately fast-action VU meter. Their calibration is precise and Technics suggests recording at specific levels above 0-dB to attain maximum signal-to-noise ratios. The illustrations supplied in the manual were good; you need not be afraid to exceed the 0-dB record level.

The manual has a pictorial showing the approximate recommended setting of the bias control for several popular tapes. Best results in our laboratory tests were attained for the suggested tapes with the bias control set for its detented "normal" adjustment. The manual also suggests using FM interstation noise as a test signal, adjusting the bias so that the source and playback noise sound the same. It's a somewhat time-consuming method (about 10 minutes) but it works well if you're careful. We attained good results with a broad range of tape types using the interstation noise adjustment procedure. ▲

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## TEST REPORTS / CASSETTE DECKS



Circle No. 99 On Reader Service Card

### TOSHIBA PC-X20 STEREO CASSETTE DECK

A low cost machine with metal tape capability. Features peak indicating bar-graph record level indicators. \$300, in metal cabinet.

**DESCRIPTION:** A front loading Dolby stereo cassette deck featuring left and right peak indicating bar-graph or dot record level indicators, bias and equalization selectors for normal, chrome-bias and metal tapes, end of tape strip/disengage, automatic replay after rewind, and a reset counter.

There are inputs for microphones and line. Outputs for line and phones.

Controls are provided for left record level, right record level, and ganged output level. There are switches for power, bias, equalization, Dolby/Dolby with mpX filter, and bar/dot record indicator mode.

The tape mechanism has lever controls for the record interlock, rewind/review, play, fast forward/cue, pause and stop eject. The tape will replay after rewind if both the play and rewind levers are depressed.

Overall dimensions are 16.5-in. wide x 4.6-in. high x 10.9-in. deep. Weight is 11.2 lbs.

**PERFORMANCE:** The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured +1.5/1.8 dB.

The chart shows the test results for one tape of each

type that gave representative performance for its type, price and class.

### Record/Playback Tape Performance

BRAND AND MODEL NUMBER	Tape Type Dolby on/off	Signal Level in dB		Optimum Range in Hz.	Percent THD*	Headroom to 3% THD	Signal-to-Noise Ratio	
		Max.	Min.				Wideband	Narrowband
TDK-D	F off	+1	-3	20-13K	0.8%	10 dB	46 dB	
TDK-D	F on	+1	-3.5	20-8K	0.8%	10 dB	50 dB	57 dB
TDK-SA	C on	+0.5	-3	20-10K	0.8%	12 dB	47 dB	54 dB
Fuji Metal/0-dB	M on	+0.5	-2	20-14K				
Fuji Metal/STL	M on	+0.5	-3	20-15K	0.09%	11 dB	50 dB	57 dB

Standard test level

Key: F = ferric C = chrome R = ferrichrome M = metal

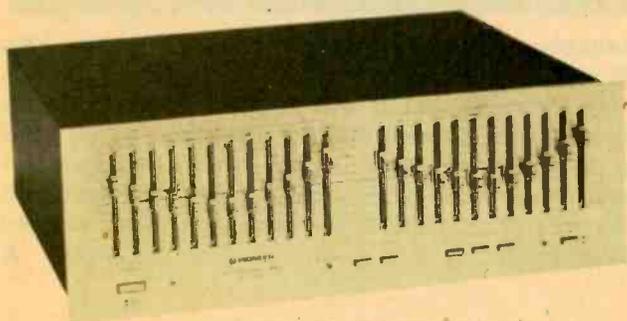
\*Total Harmonic Distortion at meter-indicated 0 VU level or 0 dB record level

The maximum output level corresponding to a 0-dB meter indicated record level was 0.25 volts.

Wow and flutter measured 0.08% with peaks to 0.12%.

The record level indicators are true peak indicating. In the bar-graph mode the display is a continuously moving light bar that follows the signal level. In the dot mode, the indicators are bar-graph to -10 dB, then the peak signal level is indicated by a dot that follows the signal level. If the level falls to -10 dB or less, the level is indicated by the light bar. The frequency response of the indicators is "flat" within the value represented by any given dot of light. ▲

## EQUALIZERS



Circle No. 85 On Reader Service Card

### PIONEER SG-9800 GRAPHIC EQUALIZER

Very impressive performance. What first appears to be unnecessary "dress up" equalization at the extreme frequency limits turns out to be quite useful. Completely free from overload even at maximum equalization. \$395, metal cabinet.

## TEST REPORTS / EQUALIZERS

**DESCRIPTION:** A stereo, graphic equalizer with twelve  $\pm 10$  dB equalizers spaced one octave apart on center frequencies of 16, 32, 64, 125, 250, 500, 1k, 2k, 4k, 8k, 16k and 32k Hz. The unit connects between a pre-amplifier and power amplifier; or in place of the recorder, with the recorder's connections moved to the equalizer. The equalized signal can be fed to the line output, to the associated recorder, or both. The equalizer is rated for a maximum input of 7.5 volts; an overload indicator illuminates if the input exceeds the maximum level. 3 dB and 6 dB input attenuators are provided to prevent overload (if it occurs). With the equalizer controls in their off (flat) position there is unity gain—the output level is the same as the input level.

There are input and output connections for line and tape.

Twelve equalizer controls are provided for each channel. There are switches for power, 3 dB input attenuator, 6 dB input attenuator, equalizer to line, equalizer to tape, equalizer off, and tape monitor. One switched AC outlet is provided.

Overall dimensions are 16½-in. wide x 5⅞-in. high x 14-in. deep. Weight is 15.5 lbs.

**PERFORMANCE:** Note. The rated output voltage is 1 volt unequalized, and all tests were conducted at this value.

With the equalizers in the center (off) position, the frequency response measured  $+0/-1$  dB from 20 to

20,000 Hz at a distortion no higher than 0.015% THD at any frequency. With the maximum boost of  $+10$  dB applied the distortion at the center frequencies actually fell to 0.005% THD, with a maximum distortion of 0.02% THD at 20 Hz. (Outstanding graphic equalizer distortion characteristics). It was impossible to overload this unit, even with full boost, at the normal signal levels associated with high fidelity equipment.

Each equalizer control provided nominally  $\pm 10$  dB equalization, and the extreme end frequency controls did not "shelve" to approximate standard tone controls. A standard tone control characteristic is attained by using two or more controls to attain the shelving characteristic. The 16 Hz and 32 kHz appear to have no value at first glance. The 16 Hz control can be used as an effective subsonic filter (as suggested), or can be used to tip up or tip down the 20 Hz end without affecting the remaining deep bass around 50 Hz. Same effect for the 32 kHz filter; it too can be used to tip the extreme high end up or down without affecting the upper highs (not too valuable, but someone probably can use it to reduce high frequency distortion from worn records).

The signal to noise ratio referenced to a 1-volt output measured 85 dB.

The remarkable feature of this equalizer is its freedom from overload even with full boost applied, and its notably low distortion even at maximum equalization. ▲

## PHONO PICKUPS



Circle No. 61 On Reader Service Card

**DESCRIPTION:** A magnetic pickup with a special elliptical stylus and an integral stylus guard. Rated for a 1-gram  $\pm 0.25$  gram VTF. Recommended output capacity load is 275 pF.

**PERFORMANCE:** With a 250 pF capacity loading the

### ADC ZLM PHONO CARTRIDGE

Magnificent. Exceptionally well balanced with a deep rolling bass that brings out the "feeling" associated with listening to live music. Superb definition. \$135.

frequency response measured almost ruler flat from 20 to 10,000 Hz, rising to  $+5$  dB at 20,000 Hz. Worst-case stereo separation was 22 dB at 1000 Hz; 25 dB at 15,000 Hz. Channel balance measured within 2 dB at all frequencies, even for the weak separation signals. (A indication of the overall quality of this pickup.) The frequency response measurement in no way reflects the outstanding performance of this pickup. ▲



Circle No. 120 On Reader Service Card

**DESCRIPTION:** A magnetic pickup that has a special stylus and a integrated stylus guard. Rated for  $\frac{3}{4}$  to 1 $\frac{1}{4}$  grams VTF. Recommended output capacity load is 100 pF. (Note. Capacity of 100 pF or less is generally only possible with the newer Far East record players having output cables of 1-meter or less.)

Increasing the capacity loading to 200-250 pF does not appear to have more than a minimal affect on sound quality, and we would therefore recommend its use with just about any modern record player (with output cables up to 1-meter long).

**EMPIRE EDR.9  
PHONO CARTRIDGE**

Excellent. At this level of performance you must listen for your own nuances in quality. \$200.

**PERFORMANCE:** With a capacity loading of 125 pF (we could not get lower on the test equipment) the frequency response with a VTF of 1 to 1 $\frac{1}{4}$  grams measured an unusually smooth  $\pm 1$  dB from 20 to 20,000 Hz. Worst-case stereo separation was 25 dB at 1000 Hz; 22 dB at 15,000 Hz. Channel balance measured within 1 dB at all frequencies, and the separation channel balance was also within 1 dB (an indication of the overall quality).

Note. The entire pickup assembly was off-center on its holder. Make certain the stylus is centered on an imaginary line through the center of the record player's pickup shell, or positioned directly under the "notch" of a stylus overhang gauge. ▲



Circle No. 82 On Reader Service Card

**DESCRIPTION:** A magnetic pickup with a special stylus. Rated for a 400 pF capacity load. Recommended VTF is 1-gram (exact).

**PERFORMANCE:** With a 450 pF capacity loading the frequency response measured nominally  $\pm 2$  dB from

**ORTOFON LM30  
PHONO CARTRIDGE**

Using a special stylus, this pickup provided an excellent, slightly "hot" sound quality. At this level of performance you must look for your own nuances in sound quality. \$150.

20 to 20,000 Hz with a moderately wide peak of +4 dB at 16,000 Hz (producing the extra "hot" sound quality). Channel balance was exact The worst-case stereo separation measured 22 dB at 1000 Hz; 21 dB at 15,000 Hz. ▲



Circle No. 93 On Reader Service Card

**SHURE SC39ED  
PHONO CARTRIDGE**

A surprisingly excellent sound for the price. Very close in overall quality to Shure's best pickups with an "extra" of a deep rolling bass that does not muddy the definition. \$100 with user replaceable stylus.

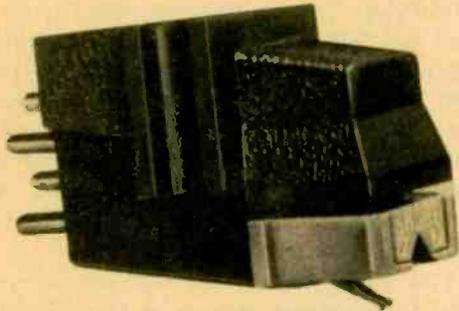
**DESCRIPTION:** A magnetic pickup with a 0.2 x 0.7 biradial stylus with a built in swing-down stylus guard.

## TEST REPORTS / PHONO PICKUPS

Rated for a 200-400 pF capacity load (tested with 400 pF). Recommended VTF is ¾ to 1½ grams, with best results attained at 1½ grams.

**PERFORMANCE:** The frequency response measured approximately  $\pm 1.5$  dB from 20 to 20,000 Hz. Channel

balance was within 1.5 dB from 20 to 15,000 Hz, increasing to 4 dB at 20,000 Hz. The worst-case stereo separation measured 24 dB at 1,000 Hz; 25 dB at 15,000 Hz. (The measurements simply do not show the relatively excellent sound quality from this pickup.) ▲



Circle No. 93 On Reader Service Card

**DESCRIPTION:** A magnetic pickup with a 0.4 x 0.7 elliptical stylus. Pickup is intended for the less expensive record players, and has a recommended VTF of 1.5 to 3 grams. Best results were attained with VTF of 2 to 3 grams. Rated for an output capacity load of 400-500 pF.

**PERFORMANCE:** With 450 pF capacity loading the

### SHURE M72EJ PHONO CARTRIDGE

This budget priced pickup, intended for less expensive record players, delivers an overall sound quality comparable to many of the finest pickups. It's not the highest of *fi*, but a well balanced, extremely pleasant sound with big rolling bass. \$51.

frequency response measured nominally  $\pm 2$  dB from 20 to 20,000 Hz with a +2 dB moderate width peak at 15,000 Hz. Channel balance measured  $\pm 1$  dB throughout the range. Worst-case stereo separation measured 15 dB at 1000 Hz; 17 dB at 15,000 Hz. (Note. Rolling bass, which contributes to a generally pleasant sound, is not shown by the measurements.) ▲



Circle No. 101 On Reader Service Card

### YAMAHA MC-1S PHONO CARTRIDGE

A moving coil cartridge with a super light cantilever. Both lows and highs are slightly muted. \$200. Stylus is not user replaceable.

### YAMAHA MC-1X PHONO CARTRIDGE

Appears to be the MC-1S premounted in a universal shell and factory adjusted for a 50 mm overhang. No user adjustment. Performance is almost identical to that of the MC-1S. \$250.

**DESCRIPTION:** A moving coil pickup with a special, non-user-replaceable, stylus. The recommended VTF is 1.8 grams.

**PERFORMANCE:** The frequency response measured within  $\pm 1.5$  dB from 20 to 15,000 Hz, rising to 3 dB at 20,000 Hz. The worst-case stereo separation measured 21 dB at 1000 and 15,000 Hz. Channel balance was better than 1 dB through most of the range, rising to 2 dB at 20,000 Hz. Output level is typical of moving coil pickups and a head amplifier of MC phono input is required. ▲

**Worst case:** The test results that we report within these pages are always the *worst case* measurement for the piece of equipment being evaluated. For example, if the frequency response of an amplifier's left channel is 20 to 20,000 Hz,  $\pm 2$  dB, while the response of the right channel is  $\pm 3$  dB from 20 to 20,000 Hz, the test report will show the worst case measurement, that is,  $\pm 3$  dB. Similarly, if an FM tuner's stereo separation measurement is 40 dB left-to-right and 32 dB right-to-left, the test report will show a separation figure of 32 dB. This method of reporting allows you to be certain that performance in all other cases was equal to or *better than* the published results.

## SOUND PROBE: ACOUSTIC RESEARCH AR92

(Continued from page 22)

resistors, and open-air chokes made of heavy wire.

Both the midrange and tweeter units are planted in the midst of an acoustically absorbent pad of thick, soft felt. The purpose of this "acoustic blanket" is to squelch sound waves traveling alongside the front surface of the enclosure, because such sound propagation can blur the stereo image (due to phase interference between sound issuing directly from the speaker diaphragm and sounds reflected from the cabinet). The "acoustic blanket" eliminates this type of interference and thus aids precise stereo localization.

The woofer is deliberately set close to the floor so that the floor reflection stays in phase over most of the lower range, reinforcing the bass. Out-of-phase floor reflections occur only in the higher regions of the woofer range, where any loss due to phase cancellation is made up by the output of the midrange driver. Crossover frequencies are located at 700 and 7500 Hz, respectively, and both midrange and tweeter output are controlled by switches at the rear. Each has three

positions: flat, -3db, and -6db. In our room, the -3db positions on both sounded best.

The cabinet measures 31 $\frac{1}{8}$  inches high, 14 inches wide, and 11 $\frac{1}{16}$  inches deep. It is made of high-density particle board with an attractive walnut-grain vinyl finish, which is easy to clean and hard to scratch. The sealed enclosure results in rather modest speaker efficiency -87 db sound-pressure level at 1 watt input measured at a distance of 1 meter. In consequence, the AR92 requires a minimum of 15 watts per channel, but it will handle anything up to 200 watts. The nominal impedance is 4 ohms and the price \$300.

### Performance:

The best thing you can say about any speaker is that you don't notice it much. That's certainly true of the AR92. It calls no attention to itself and lets you concentrate on the music. If you have to find words for describing the sound, the ones that most readily come to mind are: open, clear, natural. There's no trace of boom in the bass. It may lack ultimate depth (below 40

Hz or thereabouts), but it's adequate and solid. With a bit of boost from the tone controls, the AR92 pumped out convincing pedal notes from a big pipe organ and it packed the necessary wallop for hard rock.

As usual, we played mostly symphonic music because orchestral sound textures furnish the greatest sonic variety and make the most demands on a speaker. We were particularly pleased by the glossy smoothness of the strings, the clear definition of woodwinds, and the fact that the brass had plenty of brilliance without any nasty, sharp edges. With piano music, the AR92 reflected every nuance of touch, attesting to its splendid transient response, and for the same reason, it was equally outstanding on percussion, guitar, and banjo.

The stereo imaging lived up to its theoretical billing—directional definition was excellent. In choral music, we could pick out every strand in the sonic texture, and the singers seemed "out in the open" rather than "in the box." That is always the mark of a truly fine speaker. ▲

## SOUND PROBE: KLH-3

(Continued from page 22)

peak limiter is far greater than is normally feasible in small speakers, the net effect is one of extraordinary sonic force emerging from this small box.

Yet the computer cannot take sole credit for the remarkable bass of the KLH-3. Much of it stems from the mechanical properties of the woofer cone itself, which is made of polypropylene. This material is highly resistant to so-called cone break-up; that is, the random flexing of the cone between center and rim when strongly pushed by the thrusting signal. The flexing generates false harmonics that blur the sound. Thanks to the use of polypropylene, the cone—firmly cradled in a cast basket—can accept powerful thrusts without buckling. This, in turn, lets the computer apply far stronger bass thrusts than could otherwise be tolerated by a small cone.

Even with a vented enclosure, the

KLH-3 is fairly inefficient—efficiency having to be sacrificed for the sake of attaining massive bass in a small unit. It produces a sound pressure level of only 85 db/1 watt at 1 kHz at a distance of 1 m. Hence the recommended minimum power for these speakers is 40 watts per channel. The tweeter is a conventional cone type, 2.5 cm in diameter. The speaker enclosure measures 12 $\frac{1}{2}$  by 8 $\frac{1}{2}$  by 6 inches.

### Performance:

No higher praise can be given to this little bantam than to say that it sounds like a good, full-size bookshelf speaker. We were frankly skeptical and tried to detect audible evidence of all the tricks the computer plays with the signal. We found none—everything sounded utterly natural. Even heavy orchestral bass came through with all its proper weight and ponderosity. We listened particularly for bass transients to find out if

they were objectionably softened by the low-frequency limiting action of the computer. But kettledrums and electrical guitar bass came through at ample volume without any sign of special signal processing. Obviously, KLH engineers had taken good care to hide their artifice.

Our only reservation was the rather bright and hard treble—not objectionable in jazz and pop, but sometimes giving a rather metallic sonic flavor to orchestral sound. However, this could be largely rectified with a downward nudge of the tone control, and the highs were broadly dispersed throughout the listening space.

In all, this unconventional speaker makes a splendid complement for the new mini-components (providing they furnish the required wattage), and it is a welcome boon for listeners in cramped quarters. ▲

## POP DISCS

(Continued from page 23)

**Bishop & Gwinn: "This Is Our Night." Infinity. \$7.98.**

Exploring the various sides of romance in ten self-composed light pop songs, this duo has a casual, seemingly effortless way of singing together. Their auspicious debut boasts the appearance of many of California's best

session musicians. Production is especially good.

**Rob Grill: "Uprooted." Mercury. \$7.98.**

This is a very good blues-rock debut by the former lead singer of the 1960's group, the Grassroots. Churning, swirling lead and rhythm guitars, sensuous

female harmonies and energetic vocals set the motif. One tune features most of Fleetwood Mac as guests.

**Richard Lloyd: "Alchemy." Elektra. \$7.98.**

Built around Richard Lloyd's immensely agreeable guitar riffs, this al-

bum marks the second solo from a former member of the now-disbanded Television. Leader Tom Verlaine took the initial plunge last year. Lloyd eschews the pyrotechnic flash of other New Wavers and so succeeds in projecting a genuine competency.

**The Police: "Reggatta de Blanc." A&M. \$7.98.**

Offering a surprisingly full sound for a trio, with little or no overdubbing, the Police combine reggae vocal phrasing with guitar-based rock instrumentation backed by solid drum and bass lines. "It's Alright For You" features some early Dylanesque singing, while "Walking on the Moon" has jazz-oriented guitar, bass and drum riffs. The hot cymbals here will strain the limits of your cartridge's tracking ability.

**Angela Bofill: "Angel of the Night." Arista/GRP. \$8.98.**

You begin to consider the human voice a dynamic musical instrument, not a constant among different-sounding instruments, as you listen to the second album by last year's "new female jazz sensation." Bofill moves easily from blues to ballads to funk, her voice changing with each stylistic shift. But in every case, the basic richness, strength and flexibility of this wonderful singer are evident.

**U.K.: "Night After Night." Polydor. \$7.98.**

With all the disco, new wave and heavy metal dominating the airwaves lately, who's playing the highly musical progressive rock, most typified by Yes, King Crimson and other mostly British aggregations? U.K. is. This trio, playing keyboards, electric violin, bass and percussion, has become quite popular advancing the seemingly sidelined genre. This album documents segments of two live Tokyo concerts.

**Linda Clifford: "Here's My Love." RSO. \$7.98.**

Bouncy dance numbers, full-blown production epics—complete with strings and horns—and some nice blues wailing propelled by hypnotic percussion lines, are all to be heard on the fourth album release by this award-winning R&B vocalist. Her voice is expressive, obviously well-trained and equally suited to the diverse musical styles offered on the album.

**The Motels: "The Motels." Capitol. \$7.98.**

Better than average rock instrumentation, excellent mixing and the vocals of Martha Davis make this debut a stand-out among the sudden rush of post-New Wave no-frills pop-rock.

## HFSBC UPDATE

Readers of the article "Speaker Design Concepts" in the November/December 1979 issue may have been confused by the segment on page 50 that described the Bose 901's active equalizer and various receivers. The Bose 901 is designed to operate with an outboard active equalizer that is normally sold as a part of the speaker package. Bose also produces two receivers that have that active equalizer circuitry built in, so that all you need to buy are the speakers and the receiver. The receivers, model 901 (100 watts per channel \$860) and model 550 (40 watts per channel \$380) can also be used with regular speakers.

Another small error slipped into our November/December issue. In the test report of the JVC KD-A8 cassette deck we reported that the record/playback frequency response with Scotch Metafine tape was +0/-9 dB from 30 to 13,000 Hz. It should have read: +0/-3 dB from 30 to 13,000 Hz.

## CARTRIDGE CATALOG

(Continued from page 28)

coil type. This despite their inherent disadvantages. . . . A major disadvantage is that the vast majority of moving coil cartridges—in 18 of 21 brands—require stylus replacement to be done by and at the factory. This means a wait of two or more weeks for the cartridge/stylus roundtrip between your home and the factory. Unless you have a standby cartridge, there goes your disc listening for the period involved.

The second key disadvantage of the moving coil design is that it generates a low-output signal. Which means you need some form of boosting—via either a separate, somewhat costly pre-amp (also called head amp) or a setup transformer, or a special MC input on the preamp, integrated amp, or receiver to be used. Such an input adds to the basic cost; it is currently confined to higher priced equipment.

However, moving coil technology is advancing, and some new models coming into audio shops need no special amplification. Sonic Research, for example, recently introduced the Dimension 5, a moving coil unit with high enough output to drive conventional preamps, precluding the need for sep-

arate head amp or stepup transformer. It features a new "Lambda-shaped" stylus and single transmission path cantilever for claimed better phase coherence than regular stylus assemblies.

Adcom, a newcomer to the cartridge field, offers three brand new moving coil cartridges, priced from \$190 to \$250, depending on stylus type, in two versions—high output, and low output (with the latter priced from \$160 to \$200). The high output design, a spokesman explained, was meant to eliminate a head amp or stepup transformer. The low output versions are being offered "for die-hards, who believe only in low outputs, and who already have a head amp or stepup unit." The firm is "pushing" the high output models over the low output units in the belief that "a high output eliminates one piece of equipment that can only hurt the signal."

**Fine Wire.** Dynavector, specializing in moving coil cartridges and offering a line of 10 models, has also come up with high-output models, to eliminate traditional voltage stepping-up. They are the 20A Mark 2 and 20B Mark Two, respectively priced at \$230 and \$290. The company achieved the high

output of 3.6 mV by providing up to 20 times the coil turns of conventional cartridges by using sophisticated coil winders and wire hair half as thick as human hair—11.5 microns.

Dynavector also added two deluxe low-output (0.2 mV) models, the 100 Ruby at \$275, and the 100 Karat with diamond stylus at \$1,000.

The four new models feature a short cantilever, thus eliminating rubber damping. The firm says this means that the cartridges will not be affected by temperature changes or the non-linearity of rubber dampers found in many moving coil cartridges.

Four moving coil cartridges were introduced under the Satin brand name by Osawa, a major force in the pioneering of moving coil cartridges. The four models range from \$100 to \$250, and have output voltages ranging from 2.5 to 3 mV, thus obviating need for voltage stepup devices. They track in a range from three-fourths of a gram to two grams. The three higher priced models have a frequency response of 15 Hz to 25 or 30 kHz, plus/minus 2 dB. They are also among the few moving coil cartridges that have user-replaceable styli. Incidentally, the \$100

model-117Z, with a response of 20 to 20,000 Hz, plus/minus 2 dB, is the lowest priced moving coil cartridge available, to the best of our knowledge.

Among other news on the moving coil cartridge front is that it has three "newcomer" entrants—Sony, Onkyo and Yamaha.

Sony, long noted as a turntable "specialist," has entered the U.S. cartridge field with a deluxe model at \$300. It is integrated with the headshell. Here is Sony's explanation for that move: "Resonance and echo that normally occur at the headshell are completely suppressed as the die-cast magnesium headshell is attached to the pole piece of the cartridge while the cartridge interior is extremely well damped." Designated Model XL-55, it generates voltage (0.2 mV) by push-pull action, via a figure-8 coil—a Sony innovation. This results in low distortion and high efficiency, Sony claims.

Onkyo, a long-established component manufacturer, has entered the cartridge

field with the MC-100, at \$170. It features a three-layer cantilever—two aluminum layers with a carbon fiber middle section, for improved high-range reproduction. Its output of 0.4 mV means it requires external amplification for optimum operation or special MC equipment input. This cartridge is, literally, hand-made. Only three a day are produced by the company in Japan under current production schedules, making ownership of an MC-100 somewhat of an "exclusive" proposition.

Yamaha's moving coil cartridge entry—as MC-1S in unmounted form at \$200, and as MC-1X mounted in a proprietary headshell at \$250, is said to be the first of its type to feature a tapered hollow cantilever formed of high purity beryllium, a metal known for its light weight and rigidity. The tube's thickness is only 35 microns. Another feature is pure gold coil leads, and goldplated connectors and output terminals. Its output is 0.2 mV, requiring additional amplification. It can

operate in a stylus pressure range of 0.2 to 1.8 grams.

The moving coil contingent has also increased by virtue of the entry of old-timer Audio Technica, heretofore a champion of moving magnet types, with two models. Initial entries are the AT-30E at \$125 with an output of 0.28 mV and channel separation at 1 kHz of 25 dB, and the AT-32 at \$300 with an output of 0.4 mV and channel separation at 1 kHz of 30 dB. Both models track at two grams or less.

Audio Technica also offers a new stepup transformer, the AT-650, at \$250, that is adjustable to work with any moving coil cartridge in Audio-land. It is also ideal for those who mix moving coil with moving magnet cartridges; they can use any one without physically removing the transformer, in that its adjustment dial includes a "Pass" setting which allows the transformer to be bypassed without being removed from the audio chain. ▲

## UNDERSTANDING PHONO PICKUPS

(Continued from page 29)

magnet. The sensitivity and load requirements are much the same as those of a moving-magnet or moving-iron cartridge.

Is one of the three types inherently superior to the others? In this author's opinion, no, although a *particular implementation* of one or another of them may be better than the competition. To a large extent, the differences in design come about to avoid patent infringement not because there is some inherent theoretical reason why it is better.

**Moving Coil.** All three of the types mentioned so far mate with "conventional" magnetic phono inputs and almost invariably have user-replaceable stylus assemblies. *Moving-coil* cartridges frequently require a pre-preamp (head amp) or matching transformer to mate with conventional preamps. (Some preamps have a moving-coil pre-preamp built in.) And, usually, moving-coil stylus assemblies cannot be replaced at home.

As the name implies, in a moving-coil cartridge, the coil moves and the magnet is fixed. In order to minimize the mass of the moving system and keep the "trackability" high, only a few turns of wire can be used. Hence, the sensitivity and impedance is low, and a pre-preamp or transformer is needed. And, since the coil frequently is electrically wired to the system but mechanically is part of the stylus assembly, the latter is not replaced easily. This is not always the case however. There are some user-replaceable moving-coil stylus assemblies, and there are some "high-output" moving-coil designs that can be used with a conventional pre-

amp. Their sensitivity seldom is as high as a fixed-coil design, however.

Moving-coil cartridges are generally expensive although some are competitively priced with the better fixed-coil types. Usually they require more tracking force too—in the order of 1½ to 2 grams. But, they have a characteristically bright sound that appeals to many users who are willing to shell out the bucks and put up with the inconvenience of a non-replaceable stylus.

Although magnetic cartridges are by far the most common, there are other esoteric designs that make use of strain gauges and electrets as the generating element. Piezoelectric or crystal cartridges are still used on some cheap systems, but they are not hi-fi.

### The Stylus Assembly

The cantilever must be light but rigid in order to couple the rapid vibrations to the moving element in an accurate fashion. The most common cantilever material is aluminum formed into a thin-walled hollow tube. Sometimes, the cantilever is tapered to increase its rigidity and to reduce its mass. This is better but usually costs more since it's harder to fabricate. Beryllium is a metal whose strength-to-mass ratio is even better than that of aluminum. Theoretically, it is a preferable cantilever material, but it is difficult to work with and hence expensive. Some expensive cartridges have even used solid sapphire or diamond rods as a cantilever.

At the end of the cantilever is the stylus itself, the part that rides within and contacts the groove walls. In all quality styli, the tip is a diamond, but various shapes are used. The simplest

and least expensive stylus geometry is the *spherical* or *conical* type. In cross-section, the diamond is circular with a diameter of about 0.0005 to 0.0007 inch; mighty small but still rather large to follow high-frequency information at the inner grooves of the disc.

*Elliptical* styli are able to trace this high-frequency information with lower distortion and are, probably, the most popular mid-priced shape. As the name implies, the cross-section of this type of stylus has the shape of an ellipse. The "tracing radius," that which scans the groove, may be as small as 0.0002 inch, but the "supporting radius" is larger, perhaps 0.0007 inch, so that the stylus doesn't ride at the bottom of the groove and respond to dirt particles.

**Shibata.** The best stylus shape is one of the "Shibata" types. Although each manufacturer has his own name for it—Stereohedron, Hyperelliptical, L.A.C., Pramanik, etc.—these styli are characterized by a more complex geometry that provides a very narrow scanning radius and a large area of contact with the groove wall. The latter distributes the tracking force and so reduces record wear.

Some styli are said to be *nude mounted*. This means that the diamond is affixed directly to the cantilever without the use of a cup to hold it. The idea behind nude mounting is to reduce the tip mass as far as possible and improve high-frequency track-ability.

There you have it. Whether you buy a cartridge for \$10 or pay as much as \$1,000, somewhere in between there is likely to be one to suit your taste and pocketbook. ▲

requires you to lift the tonearm and place the cartridge/stylus in the lead-in groove of the record, and requires you to lift the tonearm from the record at the end of play. The semi-automatic type requires manual placement of the cartridge/stylus only; at the end of play it will return the tonearm to rest and off position. On an automatic turntable, you press one or more buttons and the machine does the rest.

Turntables use two basic drive types—direct drive and belt drive. In the former, the motor and record platter are integrated. In the latter the platter is connected to the drive motor by a belt. One system *can* be as good as the other, but direct drive units are generally superior.

Some turntables have a Speed Adjustment for increasing or decreasing the unit's speed by up to 6 percent. It's a valuable feature for those who want to play an instrument or sing along with records whose pitch may be off somewhat. A Cue Lever or Cue Control is featured in many turntables; it helps line up the cartridge/stylus with the lead-in groove of a record and to lower it gently into the groove.

Cartridges are usually an option with the purchase of a turntable. They are available in a wide range of prices—up to \$1,000. But only those with "golden ears" can really appreciate the difference between a \$50 cartridge and those selling above \$100. (See the article "Cartridge Catalog" elsewhere in this issue.)

Space precludes our going into the basic details of tape equipment—worth an article by itself. Check upcoming issues of HFSBG for such an article.

**Selection.** Too many first-time audio buyers get bogged down in the matter of equipment specifications. We'd suggest you forget about specs, and concentrate instead on how the equipment sounds—to your ears. They, not spec sheets, have the ultimate say. If this advice sounds heretical, consider the reality of the marketplace. The reality is that heavy competition keeps most component products at a given price point at virtually the same quality/performance/features level. Thus a \$350 receiver in Brand Y will essentially be as satisfactory in terms of quality, performance, features, power, etc., as a \$350 receiver in Brands P, S, or T. The same goes for other audio products, except speakers, where dollars don't equate to sound quality so closely, primarily because sound is perceived individually and subjectively, and one person's great sound is another's mediocre sound, etc. In addition

to good sound, also seek out equipment whose controls feel good to you, and whose appearance pleases you; these are important factors.

**Speakers First.** Start your total system selection by choosing the speakers first. The ones you pick will determine what else you will buy. Let's say your budget of \$1,000 apportions \$350/\$400 for speakers. That can buy an excellent pair—for most ears. You check your listening room layout and see that you have two cubic feet of space in each spot where you'd place the speakers. This gives you a lot of leeway.

In the store, you check the price tags of several models whose looks appeal to you. Six fit your budget range. The process of selection should go something like this: Ask the salesman for a "quickie listen" of about two minutes per speaker pair, using a record you brought as your listening reference. This will eliminate, say, two models that are not to your aural taste—bass-heavy, or with shrill high frequency sounds, or voice reproduction with nasal or "tubby" characteristics, etc. Next, ask the salesman to "A/B" (compare models at the flick of a switch) two of the remaining pairs of speakers. One will sound better than the other in some way, with perhaps smoother high frequencies, more realistic "punchy" bass, more natural voice reproduction, better definition of individual musical instruments, and so forth. Then ask the salesman to A/B the final pair of speakers. Again, one is likely to please you more than the other. Now ask the salesman for an A/B of the "finalist" with the winners of the two previous A/B checks.

This checkout will take a bit longer, in that the contenders will each likely sound quite good. But with the aid of your reference records, you'll settle on one pair that pleases your ears more than the others. In this case you pick a three-way unit with a 10-inch woofer, priced at \$360 a pair.

At this point, you ask the salesman how much power will be needed to operate the speakers you've chosen. The spec sheets says "Minimum amplifier power 15 watts RMS." That means a receiver with 15 watts per channel output. But your salesman wisely suggests a receiver with more power—on the order of 30 or 40 watts per channel. He explains that the power would be reserve power, to accommodate the extra demands of certain types of music. As for example, music with lots of bass sounds, or loud orchestral climaxes that are part of so many types of music. Further, your listening room

size and the large areas of sound-damping elements indicated on your listening room sketch also suggest you'd be wise to have output power to spare. He notes that the store has several receivers at that power level well within the framework of the \$350/\$400 allotted in your budget.

The one you like the best from visual, sound reproduction, and operating control standpoints actually has 55 watts per channel output. While its list price is \$430, the store's price is \$380.

Your turntable/cartridge budget reads "\$200 to \$250." After looking over the store's selection, listening to the salesman describing the features and benefits of a half dozen models in your price range, you spot a unit nearby that sets your visual taste buds tingling. It's priced at \$300, less cartridge. In addition to appealing to your eyes, it appeals to your touch—with its controls mounted up front for easy access. Its major attribute, the salesman explains, is quartz-control, for absolute accuracy of speed, a benefit well worth the extra cost. The salesman suggests a major-brand cartridge with elliptical stylus, list-price at \$100 that is on special sale for \$55. You listen to it, plus four others, but like the one he suggested best because of its balanced reproduction, its clarity of sound.

You realize at this point that the turntable/cartridge runs to \$355—way beyond your budget. Won't this throw the price/quality ratio out of balance? No, explains the salesman. "Despite its higher cost, the turntable with cartridge is essentially in the same league as the speakers and receiver." He adds that this situation is typical of a *real buying situation*, rather than an unreal ivory-tower proposition. (Which relates to our comment earlier that budget apportionment should be regarded only as a general rule of thumb.)

So here you are, \$95 over budget for the total system. What to do? You could pick the runner-up in the receiver category and reduce the differential by \$75, and the power factor by 10 watts per channel. You could pick the runner-up direct-drive turntable at \$260 to come out exactly on budget, minus quartz speed control. You explain your thinking to the salesman. Says he, "I'd say spend the \$95 extra. Your choices are excellent, make sense, and obviously please you. If you left here with your budget intact by buying the other turntable you would always be somewhat unhappy with it. And the same goes for the

receiver, but maybe to a lesser extent. Here's a thought to consider...

"A good quality audio system—like the one you've picked, will have a *minimum* operating life of 12 years. The difference of \$95 spread over 12 years amounts to around \$8 a year. Are you going to let a matter of \$8 a year stand in the way of being completely satisfied and happy with what

you've bought?"

Your answer comes in a flash. "No." Followed by, "OK, wrap it all up."

Note: The foregoing is but one of countless buying situations that could be depicted. It is typical of what you might experience. On the other hand, you might end up with choices at substantially *under* your budget figure. That would also be typical of what you

might experience. Our bottom line advice is this: Regard your budget as but one element in selecting an audio system. As such it should be *flexible*. Regard your *satisfaction* with what you buy as another element in buying—of far more consequence than keeping within budget parameters. Remember, buying a hi-fi system is a long-term proposition. For long-term pleasure. ▲

## PHONO PICKUP TUNE-UP

(Continued from page 42)

is tilted towards the cartridge and tonearm, it digs into the record as the grooves spin under the pickup. You must eliminate the *lead* because it not only degrades sound reproduction quality, but it rapidly accelerates record wear as the stylus accumulates wear.

Stylus lead is corrected in one of several ways, ranging from easy to damnable. On the highest quality tonearms the arm itself can be raised up and down on an elevator spindle mechanism. Simply loosen the lock-screw and move the tonearm assembly downwards until the stylus is perpendicular to the record. Then secure the lock-screw. If the stylus has *lag* move the tonearm upwards. On many record players, such as the Duals, some Garrards, and others, if you have mounted the pickup so the stylus is centered in the overhang gauge's V-notch no adjustment is necessary; the gauge insures a perfect stylus angle. On most other turntables, you're going to have to place spacers or shims between the pickup and the shell, and go through the whole overhang adjustment several times. There's no other way out if you want optimum performance from the pickup. Sometimes, it takes three or four tries—assuming you have sufficient spacers—before you get it right.

When you're certain the cartridge is installed with the best possible accuracy, doublecheck the VTF adjustment, set the anti-skate control as recommended in the instruction manual

(don't guess, all turntables aren't set up the same way even though their adjustments appear similar), and get ready to connect to the amplifier.

**Loading Capacitance.** There is absolutely nothing standard about the optimum capacity loading of a phono pickup, or the capacity of the cables supplied with turntables. If you have a pickup requiring a high capacity, and you use a modern turntable, it's an odds-on bet the load capacity is so low the pickup's frequency response will have a sharp peak in the neighborhood of 15 kHz and will literally scream the highs at you, along with record scratch and snaps, pops and crackles.

Older record players, those that predate four-channel sound, have cable capacitances in the area of 250-400 pf (including tonearm wiring). This results in an almost perfect match for most American and European pickups. New record players, particularly those with the short (less than 1-meter) output cables have a total capacity in the area of 80 to 150 pf. If used with the better quality U.S. and European pickups you must add capacity to eliminate high frequency peaks. A 60-inch (not 1-meter) shielded patch cord connected between the record player's output cable and the amplifier will add 250-300 pF to the pickup loading—resulting in an almost optimum load for the pickup. Alternately, some of the super-deluxe amplifiers have a phono input capacity loading switch.

Far East pickups usually require nominally 175 pF for optimum loading. This almost exactly matches record players with 1-meter cables, but the new record players with less than 1-meter cables provide less than 100 pF loading. Add the extra capacity with a 1-meter patch cord.

While it's easy for us to say "Add a patch cord," the truth of the matter is that both the patch cord and the record player's output cable have male connectors and they won't go together. You will also need a phono plug to phono jack adaptor, a device about 1-inch long with phono jacks at each end. They are available for a dollar or so per pair from Radio Shack stores and parts distributors handling the *Calectro* electronic hardware lines. If the salesman is confused and doesn't know what you're talking about, tell him you want to connect two audio patch cords together.

In today's hi-fi marketplace almost all pickups will deliver good sound, some will deliver excellent sound, a small handful will deliver superb reproduction. As a general rule of thumb, sound quality starts out at the level best described as "good." It's the extra care taken during pickup installation and set-up, and the capacitive loading, that extracts any extra performance inherent in a particular pickup. Final sound quality is directly proportional to the efforts you expend in the pickup installation. ▲

## CAR STEREO SPECS

(Continued from page 39)

distortion—the so-called "*Usable Sensitivity* rating"—and at 50-dB quieting. The latter is the more important measurement in this author's opinion. Furthermore, the signal input required for 30 dB S/N+D and for 50-dB quieting will be specified in dBf—a power measurement that eliminates confusion in comparing specs.

The old way, specifying the number of *microvolts* ( $\mu V$ ) required across the input terminals, is only comparable if the antenna impedance is stated, and, often, it isn't. For example, it takes only half the voltage across a 75-ohm

antenna to develop the same power as across a 300-ohm input; a 50-ohm input requires even less. But, the receiver doesn't care about voltage; it cares about power. Thus, three receivers with the same sensitivity could carry three different input-voltage-sensitivity ratings—1%  $\mu V$  if a 50-ohm input is used, 1%  $\mu V$  for a 75-ohm input, and 2%  $\mu V$  for a 300-ohm input. Since the true sensitivity is the same on all three, isn't it less confusing to state it as 14 dBf in each case?

One relatively serious lack in the Ad Hoc Committee standard is the specifi-

cation of *stereo* sensitivity. Only mono is covered, and stereo takes a lot more signal for equivalent signal-to-noise ratio. While 50-dB quieting in mono may require only 14 dBf to 17 dBf, the stereo figures are likely to range between 36 dBf and 45 dBf. In all cases, the lower the number the better.

*FM frequency response* will be expressed as a tolerance over the full FM audio bandwidth, 30 to 15,000 hertz and will appear as " $\pm$  \_\_\_ dB, 30 to 15,000 Hz." It will be measured only in mono, but, if auto-sound equipment is like home gear, the stereo response

will be pretty much the same. Obviously, you want the tolerance to be as tight as possible (a minimum number of dB).

*Capture ratio* has the same meaning in an automobile receiver as in home equipment, and you want the smallest number of dB you can find. A good low capture ratio is especially important while on the road since your car antenna isn't directional and will be picking up a lot of multipath signals which will change continuously as you drive along.

The *alternate-channel-selectivity* measurement also parallels that on home gear and is equally important in rejecting an unwanted station close in frequency to the one you wish to hear. Look for the *greatest* number of dB here.

For car sound, *stereo separation* is specified *only* at 1 kHz; it probably will be less at the higher and lower frequencies so the more midband separation the better. But, in the reverberant innards of your chariot, true stereo imagery is wishful thinking anyway. Neither you nor the speakers are located in the optimum fashion, and the acoustics are rotten. So we'd not get too concerned with separation; 20 dB is probably fine.

The *image-response ratio* and *IF-response ratio* will be specified too. These tell you how well the tuner rejects out-of-band signals like those from

an overflying aircraft. Since you get little help from your non-directional car antenna, look for the highest number of dB possible. The *output voltage*, along with a recommended load impedance will be specified on separate tuners as an aid in matching them to other equipment. The format will be "—V, —Hz to —Hz, —ohms load."

**Tape Players.** In this area, the Ad Hoc Committee was on its own. The Committee seems to have covered the most important points well. *Frequency response* will be measured *with* a tolerance against standard test tapes. The standard recommends that the tolerance be  $\pm 3$  dB rather than the  $\pm 10$  dB that frequently is the tolerance "implied" by "wide open" ratings. They do allow averaging to smooth out the head-contour effect at low frequencies but this is relatively unimportant. If the deck has selectable equalization (for ferric and chrome, for example), it is recommended that the response be reported for each. The format will be "— to —Hz,  $\pm$  —dB." Obviously, you want the widest response and tightest tolerance possible, but test tapes themselves have limited response. The DIN test cassettes go only from 31.5 Hz to 10 kHz. Some others make it to 12.5 kHz.

For the present, *wow and flutter* will be measured on a "weighted rms" (WRMS) basis. The Ad Hoc Committee expects to revise its standard to

conform with the IHF standard when the latter is published. The IHF will probably adopt the more stringent DIN peak measurement. Either way, the lower the flutter percentage, the better.

*Stereo separation* will be specified at 1 kHz, and the same comments we made on FM channel separation apply here as well. *Signal-to-noise ratio* will be based on an A-weighted measurement to indicate the audibility of the noise. The signal reference is 250 nWb/m, the DIN-0 recording level. Since car decks are mainly playback devices, the noise will be measured using a blank tape. The S/N is to be specified separately for each equalization setting, and, if noise-reduction circuits such as Dolby are used, the status of the system should be stated along with the S/N in dB. Obviously, the greater the S/N ratio, the better, so shoot for a big number here. Finally, just as with separate tuners, the *output voltage* and recommended *load impedance* is to be specified (on separate tape players) to aid in establishing component compatibility.

Hats off to the Ad Hoc Committee. They've done a fine job of bringing order out of chaos *without* big government breathing down their necks. Those manufacturers who adhere to the standards deserve your serious consideration. *Their* specifications at least are comparable to each other and to home-component specs. ▲

## OPERA: SHERRILL MILNES

(Continued from page 43)

Carlo to *Otello's* Iago—but he has expanded his repertory with operas by other composers. The French roles he has sung include the standard Escamillo in *Carmen* and the Valentin of his *Faust* debut, as well as Athanaël in Massenet's *Thais*. His portrayal of Eugene Onegin represents the Russian roles he has performed, and in German he has sung the Herald in *Lohengrin* and recorded the role of Jokanaan in *Salome*.

His vocal texture is full and rich, its volume enormous and its shadings quite multifarious. Milnes' glory has always been his high register which is equal to many tenors, although he keeps a baritone color throughout. In the middle area he has gone through a lot of changes, but at the moment it seems in quite good shape. There was a time when it sounded muddy and fuzzy, characteristics that might have come from his habit of singing so often for great volume. But he has worked on this and cleared it up. Still a problem is his variance from pitch, which rarely happens on top but can occur in the middle of his voice. He has a full range, with low notes displaying a

sonorous and impressive sound.

Prime roles, such as Figaro in *The Barber of Seville*, tend to make him push for the top gallery—never necessary with his voice size—and the result is less than graceful or attractive. If the conductor is weak, Milnes tends to do what comes naturally, which is work for a big sound. Dramatically, he is not instinctive, becoming stiff in difficult to act parts such as Onegin, but he is infinitely more stage-worthy than most of his famous predecessors who could do nothing but stand.

Much of Milnes' appeal has not come over on records. He is one of those artists who is difficult to record because of the size of his voice, and he does not light up before a microphone as he does in the theater. Indeed, only in the occasional recording does he really come alive.

He has a penchant for records of Americana, made almost totally for RCA, which have not been too successful either commercially or critically. He sings the music all fairly well, but the texts or his feelings about them make him sound pompous. One notable exception shows him in strong form

in lighter music—a duet record of Broadway show tunes made last season with Beverly Sills, with Julius Rudel conducting. The Angel recording, called "Up in Central Park" (S-37323), is a delight, and although Milnes may not be totally at home in the style, he illustrates how attractive it is to hear good American music sung so easily.

Style and grasp of vocal possibilities abound in many of his Verdi recordings. His *Luisa Miller* (London 13114) is, oddly enough, not up to the calibre that he does the role onstage, but *Rigoletto* is much better. In either the old recording from about a decade ago (London 13105) or the Angel pressing (SZCX-3872), his voice rolls out strong and secure, with much time taken to project the complex personality. In his most recent recording of the role on Angel, his denunciation of the courtiers has rage, warmth and passion coupled to a voice healthy and in perfect control. Also strong are his recordings of *I Vespri Siciliani* (RCA ARL 4-0370), made about six months before he sang the role at the Met, and Di Luna in *Il Trovatore* (RCA

LSC-6194), which features the Leonora of Leontyne Price.

Milnes has had enormous success on records with verismo, and though his voice is not all that it has been in the theater, he seems to convey the emotions of verismo better than other operatic styles on record. A recent recording of Puccini's *La Fanciulla del West* (DG 2709078) finds Milnes as a gun-toting sheriff, angry but basically honest. He has no famous aria here, but builds the character carefully, much as he does with the same composer's Michele in *Il Tabarro* (RCA LSC-3220),

one of the one-act operas that make up *Il Tritico*. In *Tabarro*, however, he is subject to the charge of being dull, one that comes from a loss of electricity in vocal interpretation.

Two other verismo records, particularly stimulating, involve the baritone with James Levine, Renata Scotto and Placido Domingo, a combination on record and onstage that makes for the most exciting possible evenings of our time. The operas include Cilea's *Adriana Lecouvreur* (Columbia M3-34588), in which he plays an impossibly good Michonnet, a masochist with a heart

of pure gold, and Gerard in *Andrea Chenier* (RCA ARL 3-2046), a villain who does everything possible to over- come the effects of his own villainy. In both, Milnes sings with fervor and great appeal. He does not force his large voice and lets the high notes come out easily with expression.

His is a talent that will be very available for future generations to hear. With few exceptions however, his performance on record will offer a little bit less than the strong, sensual and exciting personality the tall American baritone gives his audiences. ▲

## JAZZ: HANK JONES

(Continued from page 16)

CBS staff. In the four years since that staff disbanded, Jones continued to free-lance in commercial work, but has devoted most of his time to jazz, and to a long stretch as the onstage pianist for the Broadway hit *Ain't Misbehavin'*.

Until the mid-1950s, Jones nearly always recorded as a sideman, but in this period he worked on one or more sessions with many of the finest musicians alive. *The Be Bop Boys* recording (Savoy) found him with Dizzy Gillespie and a small group from Gillespie's then newly formed big band. Two different 1947 sessions with Coleman Hawkins are heard on *Bean and the Boys* (Prestige) and *Body and Soul* (Quintessence). Fats Navarro, J. J. Johnson and Max Roach appear on both discs. (*Bean and the Boys* is also available with a second disc of Hawkins-Jones material on *The Hawk Flies High*.) Jones supports a very young Stan Getz in 1946 recordings on *Opus De Bop* (Savoy), and an almost equally youthful J. J. Johnson the following year in selections on *Mad Bebop* (Savoy). Lester Young and Jones produced some of the great saxophonist's liveliest late work on *Lester Swings* (Verve); and another great saxophonist, Charlie Parker, played with Jones for one of his best late sessions now on *The Verve Years: 1952-1954* (Verve).

In the mid-1950s, Jones was a member of two informal but frequently recorded rhythm sections—the so-called "New York Rhythm Section" with guitarist Barry Galbraith, bassist Milt Hinton and drummer Osie Johnson, and a trio with bassist Wendell Marshall and drummer Kenny Clarke. The Hinton group's best records are not in

print, but the Marshall-Clarke combination can be heard supporting Milt Jackson on part of *Second Nature* (Savoy). Jones and Clarke appear on Donald Byrd's *Long Green* (Savoy), recorded long before Byrd's pop phase, and Milt Jackson's *Opus De Funk* (Savoy). *The High and Mighty Hawk* (Master Jazz) reunited Jones with Coleman Hawkins in an outstanding 1958 session with trumpeter Buck Clayton; the previous year had also seen a Hawkins-Jones date, now part of *The Hawk Flies High* (Milestone). It would be impossible to list all of Jones's many sideman assignments in this period, but mention should be made of his work with Art Farmer on the album *Portrait of Art* (Contemporary). *Solo* (Savoy) is probably the outstanding record from the first half of Jones's career, an unaccompanied recital that demonstrates his mastery.

In the 1970s Jones recorded frequently as a leader. *Just for Fun* (Galaxy) is among his best albums, with a challenging repertoire ranging from "A Very Hip Rock and Roll Tune," an affectionate parody in Erroll Garner's style, to "Little Rascal on a Rock," an easy-listening but hard-playing piece by composer-brother Thad. *Jones Brown Smith* (Concord Jazz), with bassist Ray Brown and drummer Jimmy Smith, finds Jones in excellent form at the piano, and "Oh, What a Beautiful Morning," from *The Trio* (Chiaroscuro) may be the masterpiece of Jones's entire career. A lovely combination of Art Tatum's delicate articulation with Bill Evans's modal harmonies, it features him as a soloist surrounded by good small-group work with Milt Hinton and drummer Bobby Rosengar-

ten. *Tiptoe Tapdance* (Galaxy) is all solo, and equally moving in Jones's renditions of popular songs and traditional spirituals.

*The Bop Redux* disc (Muse) is a Jones retrospective of the early modern era; all compositions on this tight trio date are by Charlie Parker or Thelonious Monk, and Jones solos appropriately. *Groovin' High* (Muse), a quintet date with Thad Jones, inclines even more toward Monk—in fact, with Monk's longtime saxophonist Charlie Rouse present, it seems almost an imitation Monk date.

*Our Delights* (Galaxy) presents Jones with fellow pianist Tommy Flanagan, providing contributions to the rarely-recorded two-piano genre.

With Tony Williams on drums, and Ron Carter (or Buster Williams) on bass, Jones has recorded with "The Great Jazz Trio." This group backs saxophonist Jackie McLean on *New Wine, Old Bottles* (Inner City) with an intensity that helped make this McLean's most praised album of the 1970s. *Love for Sale* (Inner City) represents the trio on its own better than *At The Village Vanguard* (Inner City), a "live" album with subpar recorded sound. *Ain't Misbehavin'* (Galaxy) which is not an original cast album, but Jones's own interpretation of songs from the hit show has its moments, but is lightweight on the whole. The most recent Jones output includes *Arigato* (Progressive); monotonously programmed with an excess of bass and drum solos, and with too little cooperation between Jones and busy bassist Richard Davis. This facile offering is the exception to the rule of Jones's otherwise involved and intelligent improvising. ▲

## SPOTLIGHT ON: DUAL 650 RC

(Continued from page 44)

650RC designation—price: \$120) system that plugs into a jack on the back of the record player. This is why there's a separate standby power

switch: power must be turned on for the remote control even when the turntable is off.

One of Dual's highlight features on

the CS 650 RC is an adjustable anti-resonance filter, which is part of the tonearm counterweight. The self-resonant frequency of any tonearm also in-

cludes the pickup. As a general rule, an average value of damping is selected which is adequate for the pickups in common use. Dual, on the other hand, provides an adjustable damping that is optimized to individual pickup/tonarm combinations. The correct value, selected from a supplied chart for many popular pickups, or determined from a supplied anti-resonator calculator, is simply dialed up on the counterweight, where an anti-resonator filter control replaces the usual vertical tracking force adjustment which is now located on the side of the tonearm mounting assembly.

**Ortofon Pickup.** Finally, we come to the specially designed pickup. It is about the size of a pencil eraser, lightweight, having extremely low mass. The stylus assembly, which has an integral swing-down guard, is user replaceable. The pickup comes "factory installed and adjusted"; all the user does is dial in the tracking force, anti-skate, and anti-resonance values. Aside from its minute size, the pickup has a very unusual feature. You are probably familiar with the tonearm finger lift Dual has previously used as the pickup carrier lock: move the lift backwards and the carrier, with the pickup attached, drops out of the pickup shell. On the CS 650RC-55E the finger lift acts as a stylus lock to prevent theft or removal of the stylus assembly.

First, there's no more plug-in pickup carrier. The output wires run all the

way through the tonearm directly to clips which are pushed on the pickup's terminals—this eliminates the total mass of the carrier/tonarm docking hardware, and press-fit electrical contacts that tend to get dirty and intermittent. Second, the pickup mounts on a small carrier block that gets secured to the tonearm by a screw. This leaves the finger lift free for something else. The something else is a stylus lock. In its normal forward position the lift physically locks the stylus assembly into the pickup. Push the lift back and the stylus assembly can be pulled out of the pickup. If this isn't sufficient protection against the stylus growing feet and walking off, you can install a small screw which unobtrusively locks the finger lift, and no one is getting that stylus out until you say so.

(Between the stylus lock, and the platter protection against dropping the tonearm without a record in place, this player is ideal for a school that needs high performance equipment but isn't willing to risk frequent stylus damage or loss.)

The ULM 55E pickup has a 6 x 18  $\mu$ M biradial stylus and a variable tracking force (VTF) range of 1.25 to 1.75 grams. It is designed to work into a 400 pF capacitance load. The pickup/record player system results in a 5 dB rise at 20kHz if the loading is the more nominal 200 pF. Almost the precise loading is attained if 60-inch shielded patch cords—not 1-meter

patch cords—are connected between the turntable's output cables and the amplifier. (60-inch patch cords are nominally 180-200 pF). Using the patch cords, the frequency response measured essentially "ruler flat" from 20 to 20,000 Hz, with some of the most spectacularly natural sound quality ever heard by our listening panel.

As for the effect of the anti-resonance filter on sound quality: we could neither measure nor discern any difference as long as it was on. Fully locked out, some members of the listening panel reported the bass lost some of its acoustic-presence, and the ULM55E sounded just like any other high performance pickup as far as the low end was concerned. (Other members of the listening panel reported no difference in sound quality.)

The only problem—if it can be called a problem—is that the tonearm has higher than average sensitivity to external shock and vibration caused by the extremely low mass of the tonearm/pickup combination. The stylus will jump out of the record groove if you're doing a John Travolta to Saturday Night Fever. The tonearm can barely withstand tepid toe tapping; let alone high-fever foot stompin'.

The CS 650RC-EE is meant for people who want to listen, who want to hear real music and not just a beat.

For more information see the test report in this issue and circle No. 27 on the reader service coupon. ▲

## SPOTLIGHT ON: SCOTT 830Z AUDIO ANALYZER

(Continued from page 35)

and moving the speakers until the analyzer indicates it is receiving more bass. (You can see the screen from across a room.)

Let's take another example: Your new pickup has screaming highs. Well, maybe the amp's phono input capacity is too low. As you play the supplied test record and watch the amplifier output on the analyzer's screen you change capacity loading. When the response is "flat," or the sound the way you like it, you have the correct capacity. The analyzer will show you a *real-time* picture of the pickup's output as you change capacity (generally by adding lengths of shielded patch cord extensions to the turntable's output cables).

The Scott analyzer's display is a grid that's calibrated horizontally from 30 to 20,000 Hz in 10 bands, and vertically in 10 steps of 2, 3, or 4 dB as determined by a range switch. The location of each crossing in the grid is indicated by an LED (light emitting diode). If all the LEDs in a horizontal band light the overall signal fed into the analyzer is "flat." The analyzer has a sweep oscillator with a front panel

output control that can be fed to any amplifier or recorder input (usually a high level input).

Switching and connectors allow the analyzer to be connected to an amplifier or recorder's preamplifier (line level) output, or an amp's speaker output. There is also a front panel connection for a supplied microphone.

Calibrated attenuators are provided both for the line and microphone inputs. In fact, the mike input is calibrated in SPL (sound pressure level), and both A and C *weighting* is provided for the mike input, as well as "flat" response.

The connections are so arranged that the analyzer can be left permanently connected to a hi-fi system, and not affect the normal operation of the hi-fi equipment.

The LEDs are very fast-acting, there is no delay such as found on professional instruments, but this is part of a cost/feature trade-off. For this reason you must use the supplied sweep oscillator and sweep record rather than a pink-noise sound source, which will have LEDs flashing all over the "screen." Even with the sweep test

signal you will often have two vertically adjacent LEDs light; this simply means the value is between the two; for example, if the -3 and -6 LEDs are lit the "true value" is probably -4 or -5 dB. You can narrow the range if a more exact value is necessary. If this results in the -4 and -6 dB LEDs lighting the value is obviously -5 dB.

While the one octave filter spacing has nowhere near the precision of the  $\frac{1}{2}$ -octave spacing used on professional equipment, it's adequate for hi-fi use. The choice of filter frequencies—30, 63, 125, 250, 500, 1k, 2k, 4k, 8k and 15k—is good from the viewpoint of the average stereophile. Unfortunately, the same cannot be said of the manual. It's a bit light for someone who knows nothing or next-to-nothing about real-time analysis; and without the knowledge the analyzer is nothing more than a set of bouncing lights. If the salesman can't give you a good understanding of how to use the device you had better find someone who can.

For more information on the Scott 830Z Audio Analyzer circle No. 90 on the reader service coupon. ▲

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**SAVE 50% BUILD YOUR OWN SPEAKER SYSTEM.** Write McGee Radio Electronics, 1901 McGee Street, Kansas City, MO 64108.

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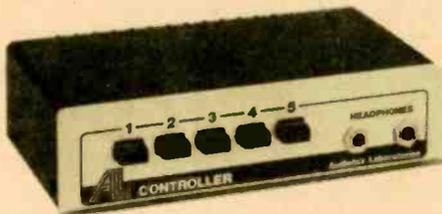
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# AUDIO SHOWCASE

(Continued from page 15)

## Speaker Control Box

The Controller™ is a new stereo select-or switch, designed by Audiotex Laboratories Division of GC Electronics, that permits hookup and independent control of as many as five pairs of stereo speakers. Any one pair or up to five pairs of speakers may be played at one time. The Controller includes two



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stereo headphone jacks for private listening, and features built-in circuitry for amplifier protection, regardless of the number of speakers employed. The lightweight and compact unit is compatible with all high fidelity amplifiers or receivers and headphones designed to operate into no less than 4 ohms impedance. The internal protection load may be switched out of circuit if desired when the speaker load is no less than 4 ohms. Barrier type terminals are provided for all amplifier and speaker connections to minimize the possibility of short circuits. Rated at 50 watts continuous per channel, the unit's power is, for all practical purposes, unlimited with the load switch in the "off" position. Suggested retail price: \$49.50.

## Turntable Isolator

Discwasher's new DiscFoot Isolation System is claimed to be the only isolation system designed to act in series with existing turntable feet to achieve optimal turntable isolation from airborne speaker feedback and surface-borne vibrations. The system consists of four isolation feet, four furniture-



protective sheets, four platform caps for attachment to turntable feet, and four special damping foam pads to adapt DiscFoot units to certain turntables. The structural member and damping foam sections are said to have "totally engineered" complexes with chemical inclusions that make the polymers radically different from other plastic, rubber or spring systems. DiscFoot is claimed to minimize airborne feedback in the 30 to 200 Hz frequency range by as much as 25 dB representing an 18 dB improvement over competitive products. Up to 20 dB improvement of surface-borne vibrations, typically in the 2 to 20 Hz range, can be attained according to the company. DiscFoot is packed to retail for \$22.

## Direct Drive Turntable

Technics' Model SL-Q3 quartz-phase locked, direct drive turntable offers the convenience of automatic operation with the precision claimed for the company's drive system. There's additional convenience by virtue of front panel controls, and automatic single disc operation with memo-repeat. Just place the record on the platter, push a button, and the tonearm automatically sets down on the record, and returns it to



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rest. Repeated plays of a record can be programmed—as many as six times, or you can opt for indefinite repeat if you want to wear out the record as soon as possible. Play can be interrupted in the middle of a record by pressing the stop switch. The SL-Q3 can also be operated manually to play any particular cut on the record. Price: \$240. ▲

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# Introducing the Bose 550 Receiver.

The new, moderately priced Bose® Model 550 AM/FM Stereo Receiver brings you Bose® technology and research wrapped up in an affordable, innovative package. It includes a direct-coupled amplifier that delivers a solid 40 watts of RMS power per channel—enough to drive almost any loudspeaker. It has an excellent AM/FM tuner section for clear, clean reception. And exclusive Bose® Source and Room Compensation Controls let you adjust for recording characteristics and for room acoustics. These controls make it easy for you to remove mid-range boominess *without* losing your deep bass. Try that with a conventional receiver!

The Bose® 550 Receiver is designed to drive any speakers that suit your taste and budget. And it contains a unique feature you'll really

appreciate when you upgrade your system. More and more customers tell us their first loudspeakers are interim units and that one day they hope to invest in a Bose® 901® Series IV Direct/Reflecting® Loudspeaker System. Ownership of the 550 Receiver brings that day much closer, because the receiver has a built-in 901® Active Equalizer that gives you a significant savings when you purchase 901® speakers.

With or without Bose® speakers, we believe you won't find a receiver that gives you better engineering, better design and better sound for the money. For more information about this fine new Bose® Model 550 AM/FM Stereo Receiver, see your nearest authorized Bose dealer. Or write: Bose Corporation, Dept. BG, 100 The Mountain Road, Framingham, MA 01701.



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With all the receivers to choose from, how do you make the right choice? By comparing power, performance and price. It's the only meaningful way to tell how much receiver you're getting for your money. So compare.

# Technics

Specifications	SA-101	SA-201	SA-303	SA-404	SA-505
Suggested Retail Price*	\$180	\$220	\$280	\$350	\$420
RMS Power Per Channel (rated bandwidth)	18 watts (40 to 20,000 Hz)	30 watts (30 to 20,000 Hz)	40 watts (20 to 20,000 Hz)	50 watts (20 to 20,000 Hz)	63 watts (20 to 20,000 Hz)
Rated THD	0.04%	0.04%	0.04%	0.04%	0.04%
FM Sensitivity (50 dB, stereo)	38.3 dBf	38.3 dBf	37.2 dBf	37.2 dBf	37.2 dBf
FM Selectivity	65 dB	68 dB	70 dB	70 dB	70 dB

\* Technics recommended prices, but actual price will be set by dealers.

As you can see, Technics gives you a lot. A lot of power and a lot of performance at a very good price. That's because our receivers have the technology you need. Like hefty transformers and big power capacitors to punch out deep bass notes with authority. Like a dynamic headroom of 1.4 dB which means 38% extra power (above RMS) on sudden musical transients.

Our phono sections are just as impressive. All have a very high S/N ratio, which means that even quiet musical passages come through clearly. Yet each can handle the high voltages generated by today's best records.

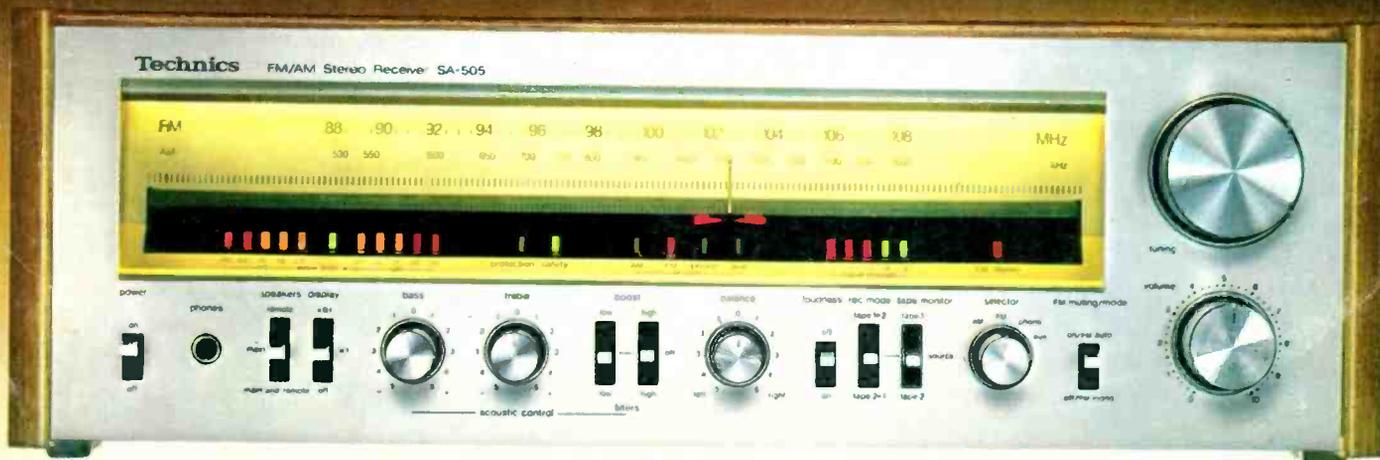
And when it comes to FM, all Technics receivers include MOS FET's for high sensitivity and low noise. "Flat Group Delay" IF stages for clean signal processing. And phase-locked-loop circuitry for accurate stereo imaging.

With the SA-303, 404 and 505, you also get 10 LED peak-power indicators. And the 404 and 505 have Acoustic Control that gives you more control over both the bass and treble frequencies than is possible with conventional tone controls.

How do you make the right choice? It's simple. Just compare.

Cabinetry is simulated woodgrain.

## Don't buy any receiver until you compare its power, performance and price to Technics.



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