

SIGNAL PROCESSORS

02367

JANUARY-FEBRUARY 1979 \$1.35

hi-fi stereo

BUYERS' GUIDE

BALANCE YOUR SYSTEM

EQUALIZERS

TAKE THE QUIRKS OUT OF YOUR LISTENING AREA AND TAILOR THE SOUND TO YOUR OWN TASTE

NOISE REDUCTION

GOODBYE TO HISS, POPS, CLICKS, SCRATCHES AND OTHER AUDIO DEMONS

AMBIENCE SIMULATORS

ADD AND SPACE FOR AREA CH

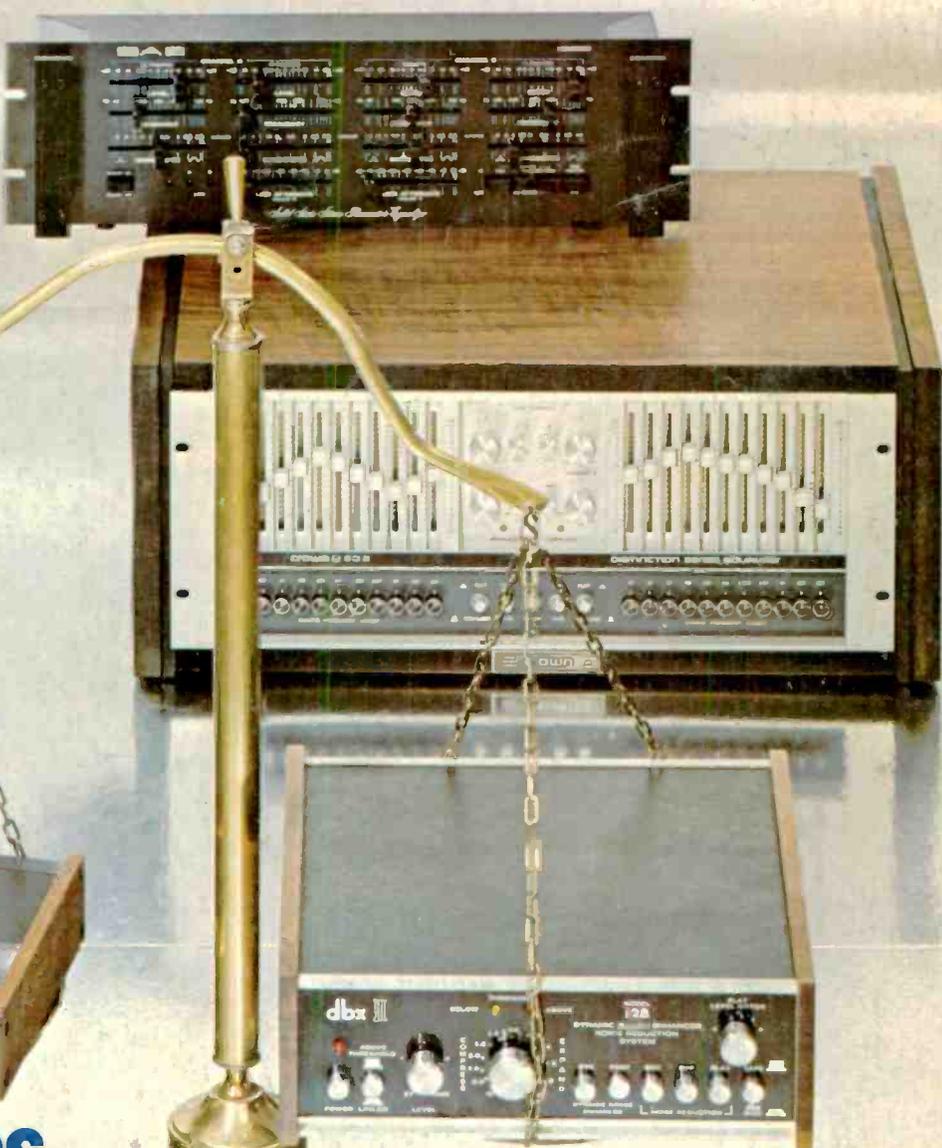
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AU BURN

INDICATORS

W...RE USED AND WHY

TEST REPORTS

FROM OUR INDEPENDENT LABORATORY





Record Ecology

—for the person who needs everything

DiscKit is a milled walnut tray and dust cover that includes Discwasher brand products in the kit at a savings (\$50 versus \$55 separately).

DiscKit includes: 1) The Discwasher System Record Cleaner with D3 Fluid, 2) the Zerostat anti-static pistol and test light, and 3) the SC-1 Stylus Cleaner.

But you'll save more than money. You'll save your rec-

ords from imbedded micro-dust, your cartridge stylus from abrasion and your ears from a lot of static.

Record Ecology from Discwasher—a substantial bargain.

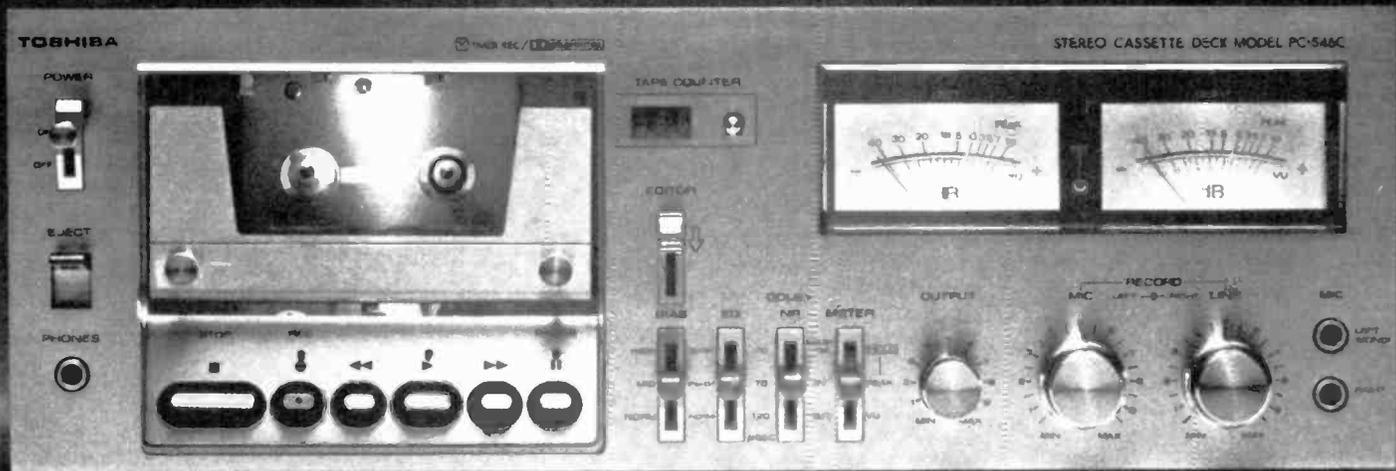
(Walnut tray and dust cover are available separately as

the Discorganizer, \$12.50.)

All from Discwasher, Inc., 1407 N. Providence Rd., Columbia, Missouri 65201.



WHEN TOSHIBA BUILDS A CASSETTE DECK, SUPERIOR SPECS ARE NOT ENOUGH.



The Toshiba 5460 cassette deck. With an All-Sendust recording head, Dolby* FM and Direct Access feather-touch controls.

When you buy any of Toshiba's cassette decks, you can take excellent sound for granted.

Our 5460, for example, has inaudible wow and flutter: just 0.05% wrms. A high signal-to-noise ratio: 69 dB (± 3 dB, Dolby on, CrO₂). And wide frequency response: 20-18,000 Hz (FeCr).

But Toshiba goes beyond specs, to professional features for continued superior performance.

Consider the 5460's All-Sendust recording head. It stands up to wear much better than hardened permalloy. And it's not susceptible to the "chipping" that can occur with ferrite heads.

Then, get your hands on

our Direct Access feather-touch controls. The merest touch allows you to switch from one function to another. Without pressing the stop button or jamming the tape.

And the Toshiba 5460's front-loading cassette compartment has an oil-damped soft-eject mechanism, for smooth and convenient operation.

Of course, almost every cassette deck has Dolby these days. But few have Dolby FM as well. Toshiba does, with a switchable MPX filter circuit. So you can feed Dolby FM broadcasts through the 5460 to get cleaner sound. Whether or not you're recording.

The 5460 tape transport is DC servomotor-controlled.

And you'll appreciate

the three-function meter plus LED peak indicator. And our new edit/fade control.

Naturally, the 5460 has all the standards as well. Like three-position bias and equalization switches. Mike/line mixing. And circuitry to accommodate an accessory timer.

Look at and listen to the Toshiba 5460 and the full line of Toshiba cassette decks at better audio dealers.

As you'd expect from Toshiba, their sound and features are very impressive. And even their prices will be music to your ears.

TOSHIBA

Again, the first.

Toshiba America, Inc., 280 Park Ave., New York, NY 10017

hi-fi/STEREO

BUYERS' GUIDE®

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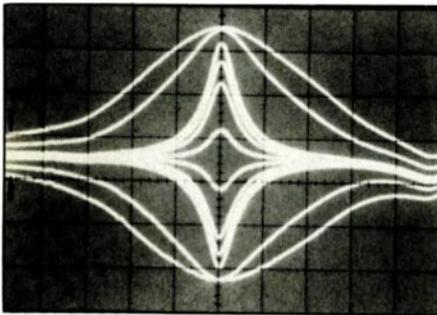
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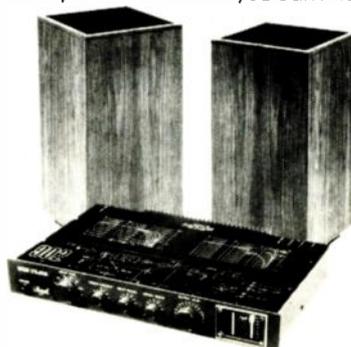
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dbx 128 dynamic range expander/
noise reduction device
MXR Stereo Ten-Band equalizer
SAE Model 1800 parametric equalizer

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Ohm's Law 4:

It is possible to make a loudspeaker that doesn't sound like a loudspeaker.

According to the traditional laws of loudspeaker design, a small driver can't reproduce bass notes, and a large driver can't reproduce high notes.

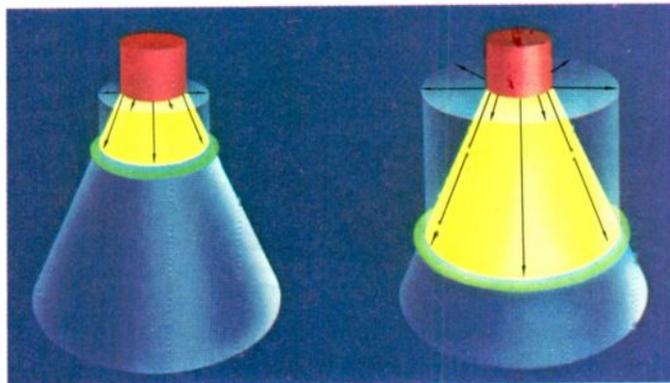
So most loudspeakers use two or more piston-like drivers of varying sizes (woofers, midranges, and tweeters), to achieve wide frequency response.

Unfortunately, large drivers respond more slowly to the audio signal than small drivers. So "time delay" distortion is added to the music.

And time delay distortion is what makes a loudspeaker sound like a loudspeaker.

But Ohm F loudspeakers boldly defy the traditional laws of loudspeaker design. They employ a *single* patented Walsh Transmission Line Driver that not only reproduces all audible frequencies, from the lowest lows to the highest highs, but it does it without adding time delay distortion to the music.

That's why, when you listen to music with Ohm F



Since all frequencies radiate in a 360° pattern from a single driver in the Ohm F, there is perfect horizontal dispersion with no time delay distortion.

loudspeakers, you hear the music, not the loudspeakers.

When audio critics listened to music with Ohm F loudspeakers, here's what



they wrote about the experience:

Hifi Stereophonie (Germany):

"The most important aspect of the Ohm F's performance is its freedom from phase and time errors, i.e., its coherent sound. The Ohm F's are in a class by themselves."

Stereo Review:

"With one of the larger

power amplifiers...the sound began to warrant the use of such words as awesome. The low bass, too, was extraordinarily clean and powerful...It should be apparent from the foregoing that we include the Ohm F among those few speakers we have tested that achieves state-of-the-art performance." (Copyright 1973 by the Ziff-Davis Publishing Company. Reprinted from *Stereo Review*, October, 1973, by permission. All rights reserved.)

The FM Guide (Canada):

"They have one great quality, a quality that puts them right in the front line of desirable speakers. *Their sound musical.* A pair of Ohm F's can recreate a live musical performance free of the usual spatial limitations imposed by conventional speakers."

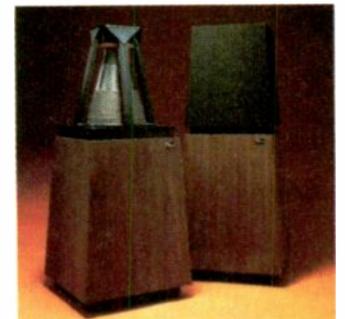
Stereo Buyer's Guide:

"Judging loudspeakers,

no matter on what principle it has been designed, should always be on its sound quality, and we are happy to report that the Ohm F system is amongst the very best we have heard."

Complete Buyer's Guide to Stereo/Hifi:

"The Ohm F is an extraordinary loudspeaker. The 'coherent' sound produced by this speaker is clear, full, and undistorted. It may well be the finest speaker on the market, and is certainly without a doubt among the top few. Given the proper associated electronics, the Ohm F is capable of providing almost absolute realism in the listening room."



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



We make loudspeakers correctly.



hi-fi/stereo BUYERS' GUIDE

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

Micro Cassette Deck

Mitsubishi's M-T01 micro cassette deck measures only 10½ inches by 5½ inches by 9½ inches and weighs 17 lbs. 10 ounces. It features Dolby noise reduc-



Circle No. 78 On Reader Service Card

tion, windowless, vertical front-load format, and a closed-loop dual-capstan drive. Feather-touch solenoid-controlled microswitches are logically interlocked to prevent misoperation. An automatic spacing pause system (ASPS) automatically provides three seconds of silent tape between recorded selections at the touch of a switch. A dual capstan mechanism, mounted on a precision die-cast base, prevents tape slippage and reduces wow and flutter to 0.045% according to the manufacturer. Peak level meters provide fast response to help obtain recordings with minimum distortion and maximum signal-to-noise ratio (put at 64 dB with Dolby). Frequency response, using normal tape, is 30 to 15,000 Hz, and with ferrous or chrome tapes 30 to 17,000 Hz. Other features include: full access to tape heads, multiplex filter for FM recording, separate three-way bias and EQ settings for tape selection, timer-controlled recording and playback, memory play and stop functions, mixing recording of line and microphone inputs, output level control, and line-mono microphone jack. Suggested retail price: \$560.00.

Budget-Priced Integrated Stereo Amplifier

JVC's new JA-S11G integrated stereo amplifier is budget-priced at \$159.95. It delivers 30 watts per channel mini-

mum of continuous power into 8-ohm loads from 20 to 20,000 Hz, with no more than 0.1% total harmonic distor-



Circle No. 74 On Reader Service Card

tion. Highlights include: full complementary, direct-coupled output circuitry; class A two-stage direct coupled phono equalizer section; constant-voltage dual power supply; low distortion, direct-coupled tone control circuit with negative feedback; two tape monitor circuits plus tape-to-tape dubbing; convenient front panel tape 2 input/output terminals; protection circuit for speakers and power transistors; three-position speaker selector (A, B, A+B); loudness switch, switchable source selector for tuner-phono-aux; front panel headphone jack. Specifications: IM distortion, 0.1% at rated power output; damping factor, 30 at 8 ohms; phono signal-to-noise ratio, 75 dB; phono overload capacity, 150 mV; phono equalization, RIAA within ± 0.5 dB (25 to 15,000 Hz); overall frequency response, 25 to 40,000 Hz, +0/-1 dB; phono input sensitivity, 2.5 mV (47k ohms); bass and treble control range, ± 8 dB at 100 Hz and 10 kHz.

Three-Way Acoustic Suspension Speaker

Avid's Model 230 3-way acoustic suspension speaker system employs newly-developed Avid drivers consisting of a 12-inch woofer, 4½-inch cone mid-range and 1-inch dome tweeter. The cabinet enclosure and grille assembly



Circle No. 102 On Reader Service Card

are said to be engineered in a unique way to create a truly integrated acoustic system that significantly reduces unwanted cabinet diffraction effects that produce "boxy" sounds in other speaker systems. Special features include: modular, zero-distortion divid-

THE JVC CASSETTE DECK.

It gives you more of what the others wish they could.

Cassette recording takes a giant step forward with the new series of JVC cassette decks. Each is designed to give you everything you need to get the most out of any tape. And there are totally new features to help you make better-sounding cassettes.

Exclusive Spectro Peak Indicator System.

With almost recording studio vigilance, 25 instant-responding LED indicators offer fail-safe protection against distortion produced by tape over-saturation.

For the first time, you can constantly visually monitor the levels of five low-to-high musical frequency ranges. Then, on playback, the Spectro Peak Indicator actually lets you see how accurately the deck has performed.

Expanded Dynamic Range and Better Noise Reduction.

Our Super ANRS circuitry applied compression in recording and expansion in playback to improve dynamic range at higher frequencies. So distortion is eliminated in sudden high peaks of any musical

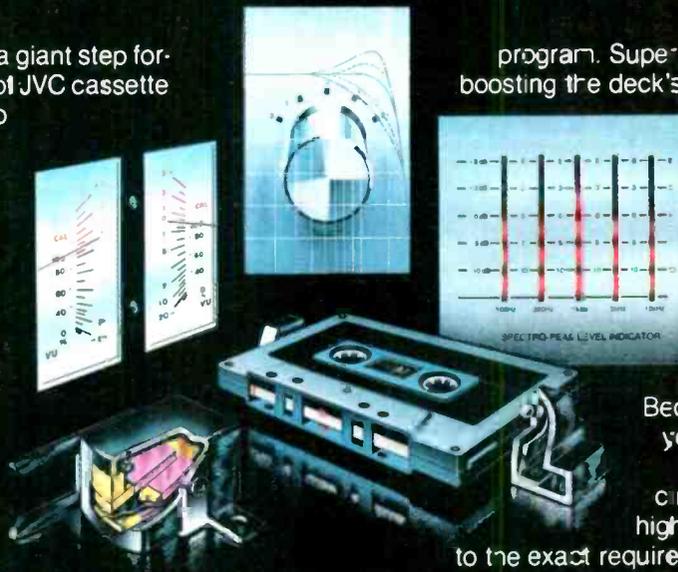
program. Super ANRS also reduces tape hiss by boosting the deck's signal-to-noise ratio by as much as 10dB over 5000Hz.

New Head Design.

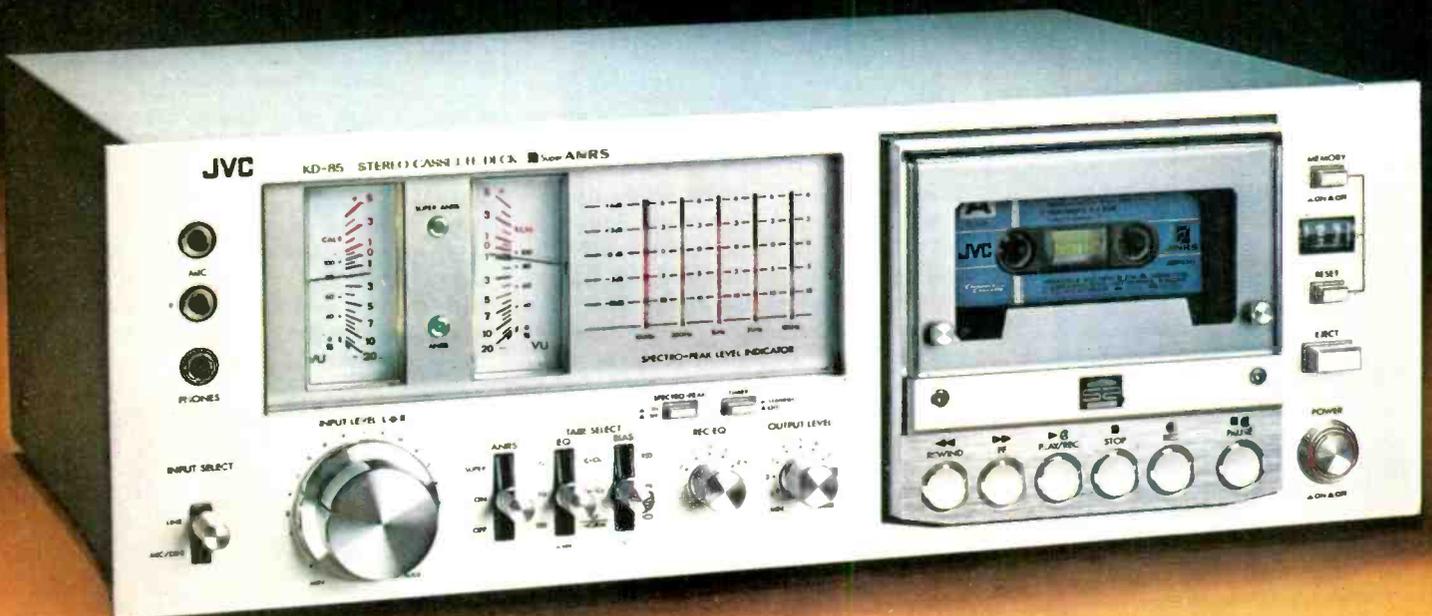
Our refined Sen-Alloy heads give you the sensitive performance of permalloy head construction, combined with the extreme longevity of ferrite, for bright, full-sounding recordings.

Get the most out of any tape

Because whichever type you select, you'll extract the most from it with our special recording equalizer circuit that lets you "fine tune" the high frequency response of the deck to the exact requirements of the tape. These innovations alone set JVC cassette decks apart from all the others. Then, when you consider our other refinements, like precision-ground capstans, gear/oil-damped cassette doors, multi-peak LED indicators, independent drive mechanisms, plus top performance specifications, you can understand why we say that JVC gives you more of what other decks wish they could. Visit your JVC dealer and you'll hear why.

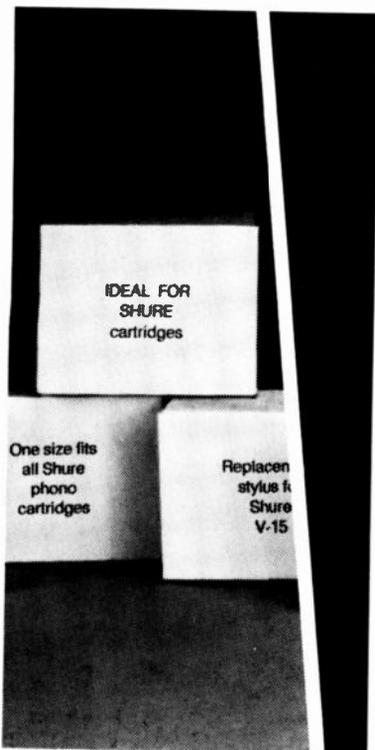


JVC
We build in what the others leave out.



JVC America Co. Div. of U.S. JVC Corp. 58-75 Queens Midtown Expwy. Masspeth, N.Y. 11378 / Canada: JVC Electronics of Canada, Ltd., Scarborough, Ont.

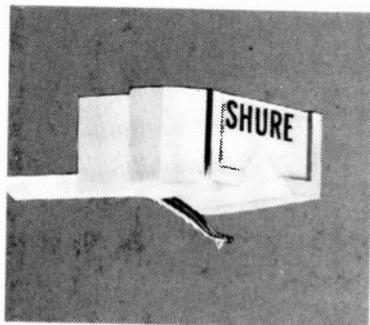
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Needle in the hi-fi haystack

Even we were astounded at how difficult it is to find an adequate other-brand replacement stylus for a Shure cartridge. We recently purchased 241 random styli that were not manufactured by Shure, but were being sold as replacements for our cartridges. Only ONE of these 241 styli could pass the same basic production line performance tests that ALL genuine Shure styli must pass. But don't simply accept what we say here. Send for the documented test results we've compiled for you in data booklet # AL548. Insist on a genuine Shure stylus so that your cartridge will retain its original performance capability—and at the same time protect your records.

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



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

Circle No. 41 On Reader Service Card

AUDIO SHOWCASE

ing network assembly; speaker fuse overload protection; magnetic fluid technology with the Avid tweeter for improved power handling; "forward aligned" shallow-cone 10-inch woofer for reduced cone breakup; Optimum Dispersion Couplers™ for mid and high frequency drivers; "solid front" grille panels with rolled edges to significantly reduce cabinet edge diffraction. An optional floor stand (II/200) is available to properly time-align driver units. Prices per speaker: about \$215.00.

Direct Drive Automatic Turntable

Sansui Electronics' Model SR-5090 two-speed direct drive automatic turntable has a single knob control, including power turn-off at the end of play, with the tonearm returned to its rest position. The unit is equipped with a repeat control with one to five repeat plays possible, and also an option for endless play. Automatic play can be interrupted at any time and the turntable can be manually operated. An electronically controlled drive system uses an advanced high-torque 20-pole, 30-slot brushless DC servo motor with speed drift "practically eliminated" by



Circle No. 89 On Reader Service Card

an exclusive rotor position sensor mechanism. Wow and flutter are down to 0.038%, rumble is better than 67 dB and the signal-to-noise ratio is better than 57 dB. The edge of the 12-9/16-inch aluminum alloy die cast platter has four rows of strobe patterns, two each for both speeds. A built-in strobe light permits visual check of rotational speed, and the speed can be adjusted through a $\pm 3.5\%$ range. The statically balanced S-shaped tonearm utilizes a two-point pivot support. A direct reading tracking force dial has calibrated markings every 0.25 grams, from zero to three grams. Minimum tracking force can be as low as 0.9

grams. The anti-skating control is adjustable during record play. Suggested retail price, including dust cover and base, is \$280.00.

Top-of-the-Line Receiver

Zenith's top stereo receiver, model MC7050, is a tuner/amplifier unit offering 40 watts of RMS power per channel minimum into 8 ohms, over a bandwidth of 20 to 20,000 Hz. The total harmonic distortion is put at 0.2 percent or less. A loudness compensation switch automatically increases low and high frequencies for richer sound



Circle No. 103
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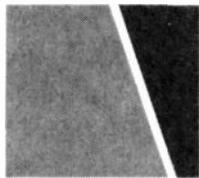
at low volume levels, while high and low filters eliminate frequency noise at both ends of the sound spectrum. The tuner section has tuned RF on FM, a ceramic filter to eliminate noise and alternate station interference, a MOS FET integrated circuit to "lock in" FM stations and a phase-locked loop MPX integrated circuit to maintain precise phasing of pilot and sub-carrier signals on FM for low distortion and good stereo separation. Other features include: tape monitor; tape dubbing; 41-position detent volume control; 11-position detent bass and treble controls; center detent balance control; speaker overload protection circuit; A/B/A+B speaker selector; FM mute; headphone and microphone jacks; flywheel tuning; separate tuning and signal strength meters. \$329.95.

Auto Stereo System

Clarion's high performance auto stereo system is built around a new PE-751A Hi-Way Fidelity Series in-dash AM/FM/MPX pushbutton receiver with cassette player priced at \$339.95. The unit includes five-pushbutton tuning, auto reverse, Dolby noise reduction on both cassette and FM, locking fast forward and rewind, separate bass and treble controls, 15 watts per channel,



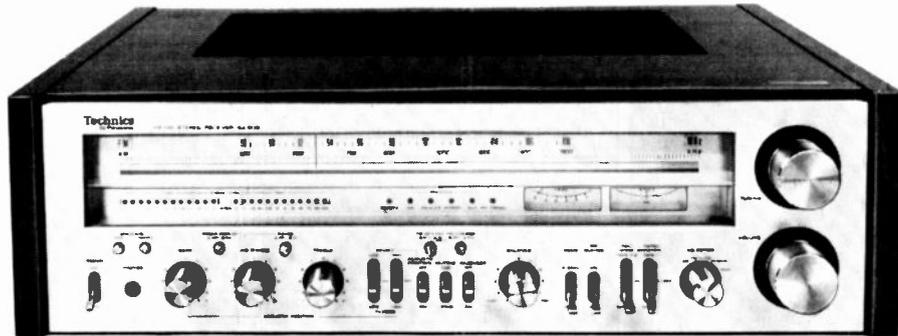
Circle No. 104
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**fact:
calling this a "brush"**



is like calling this a "radio"



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

True, the device on the front of a V15 Type IV cartridge bears a superficial resemblance to a cleaning brush.

In reality, it is a complex, exquisitely engineered subassembly which performs several complex functions that measurably enhance the quality of record reproduction!

Each one of its 10,000 conductive carbon fibers is positively grounded to discharge ever-present static electricity from the surface of your records. This eliminates static clicks and pops, as well as the tracking distortion produced by the varying electrostatic attraction between the record surface and the tone arm.

What's more, the Dynamic Stabilizer incorporates Shure-developed viscous damping that results in a uniquely efficient suspension system which maintains precise cartridge-to-record distance and uniform tracking

force—even on severely warped records. The stabilizer also acts as a shock absorber to cushion the stylus in case you accidentally drop the tone arm onto the record.

Finally, the tiny carbon fibers are so fine that 10 of them can fit *inside* a single groove to sweep free minute dust particles.

This integrated approach to pure sound reproduction extends throughout the design of the V15 Type IV. It sets a new standard of high trackability at ultra-low tracking forces—even on records that are warped, dusty, and charged with static.

If faithful reproduction of *all* your recordings is of paramount importance to you, we invite you to audition the V15 Type IV with the Dynamic Stabilizer. Or, write for the complete story (ask for AL569).



V15 Type IV...the stabilized cartridge



Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204, In Canada: A. C. Simmonds & Sons Limited
Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

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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.

Send us your name and address and we'll send you the complete product reviews and data on all McIntosh products, copies of the international awards, and a North American FM directory. You will understand why McIntosh product research and development always has the appearance and technological look to the future.

Keep up to date.
Send now - - -

McIntosh Laboratory Inc.
Box 96 East Side Station
Binghamton, NY 13904

Name _____

Address _____

City _____ State _____ Zip _____

If you are in a hurry for your catalog please send the coupon to McIntosh. For non-rush service send the Reader Service Card to the magazine.

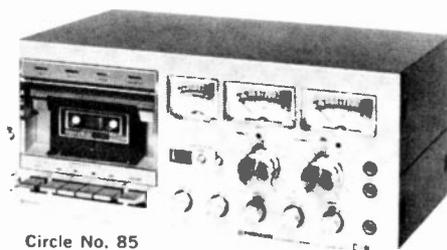
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AUDIO SHOWCASE

front-to-rear fader, left-to-right balance control, FET front end, cassette eject button, stereo indicator light and cassette program change button. Cassette wow and flutter is put at 0.13%. Fits most U.S. and foreign cars. The Clarion SK-103 speaker (\$159.95) is a three-way unit that fits into standard 6 inches by 9 inches mounting points and features an independently mounted 6 inches by 9 inches woofer with 20-oz. magnet, and separate dome mid-range and tweeter speaker elements. The 300-EQB combination power booster/graphic equalizer (\$179.95) provides 30 watts RMS per channel and features LEDs to display the power output of each channel. Also featured are a front-to-rear fader and power switch. The equalizer controls allow an increase or decrease in each of five frequency ranges to custom tailor sound to the car acoustics and listener preferences.

Flexible Mid-Priced Cassette Deck

Pioneer's new CT-F700 stereo cassette deck has, in addition to the normal two level meters, a third dual-function meter for aiding in the adjustment of



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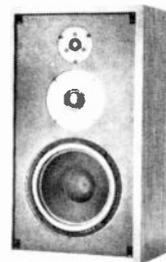
bias level and for indicating the dynamic level of program material. The dynamic level meter can monitor the amount of low and high frequency material being recorded—a desirable feature because excessive low frequency material causes an increase in distortion while excessive high frequency material causes tape saturation. In playback the meter functions as a peak indicator. The bias scale on this third meter, and the variable bias adjustment of the bias level. The front-loading machine has the following specifications: frequency response using standard LH tapes, 25 to 15,000 Hz (30 to 14,000 Hz \pm 3 dB); signal-to-noise ratio more than 54 dB with Dolby off and more than 64 dB with Dolby on; harmonic distortion, no

more than 1.5% (0 dB). Notable features include: DC servo-control motor with large flywheel; soft-touch mode buttons; automatic tape select for CrO₂ tape; memory stop; EQ select; and left/right input and output controls. Price: \$375.00.

Soft Dome Speaker System

RTR's model 75D three-way speaker system has a frequency response of 32 to 25,000 Hz, and from 40 to 20,000 Hz \pm 3 dB. The speaker complement includes a 10-inch woofer with a 1½-

Circle No. 105 On
Reader Service Card



inch high temperature voice coil, cured and outgassed; a 1½-inch soft dome midrange with single layer high-temp voice coil; lengthened magnetic micro-gap; 3.16-lb. magnet structure; 1-inch soft - dome wide - dispersion super-tweeter. Crossover frequencies are 1250 and 10,000 Hz, and the nominal impedance is 6 ohms. Recommended amplifier power is from 20 to 100 watts RMS, unclipped. Controls consist of variable midrange and tweeter controls, push-button reset circuit breaker, and five-way binding post terminals. The speaker system measures 14¼ by 25½ by 11½ inches and comes with a black high-porosity double-knit grill. Price: \$225.

Tangential Tracking Turntable

ReVox offers a "radically new" Tangential Tracking Turntable, model B790, that features a unique opto-elec-



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Reader Service Card

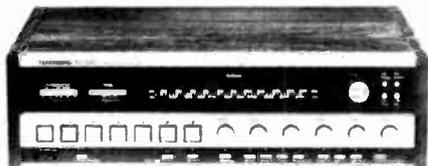
tronic servo drive mechanism that replaces the conventional turntable tonearm. The cartridge, which has no tonearm in the usual sense, is lifted and lowered electronically, and advanced laterally by a beam of light on an over-

HI-FI/STEREO BUYERS' GUIDE

head trolley. This system eliminates two major problems: angular tracking error; and non-compliance due to the effective moving mass of a typical 9-inch beam or tubular arm. At start of play, the cartridge carrier locks into place on detent, so there is no guesswork. Stylus position is indicated by a beam of light that shines on the outer periphery of the record, or follows the stylus if you choose to play one of the inner cuts on the disc. The cartridge is electronically muted except when the stylus is in contact with the record. Play may be interrupted at any point. The ReVox B790 is supplied with an Ortofon M20E cartridge as standard factory-installed equipment, but any high quality cartridge of standard mounting dimensions may be used. A direct-drive motor operating off a quartz crystal provides precise speeds of 33 $\frac{1}{3}$ and 45 rpm. The speed may be manually adjusted over a range of $\pm 7\%$. Speed is shown on a four-digit seven-segment LED display. A polystyrene dust cover is sloped in the rear to permit use of the turntable while placed flat against a wall. Suggested retail price: \$799.00.

"Flagship" AM/FM Receiver

Tandberg's TR 2080 AM/FM receiver heads the fleet of hi-fi receivers made by the company, and integrates three "superior" audio components together in a single cabinet. The unit includes



Circle No. 97 On Reader Service Card

Tandberg's Electronic FM Tuner 4, and an AM section having two MOS-FETS in the RF and mixer stages, plus AVC (automatic volume control). There are connections for two tape recorders and for two record players. All signal sources are controlled by electronic rather than mechanical switching, and all source inputs have separate preamplifiers with adjustable sensitivity controls. Also featured are two front panel output jacks for stereo headphones, and outputs for three pairs of speakers. Tape copy facilities permit copying both ways between two tape recorders, while you listen to a third program. Special features make the TR 2080 a "mini-recording studio" according to the manufacturer. These include independent volume, balance and tone controls, mono/stereo switch, filters, and loudness control, and other features. The TR 2080 has an output

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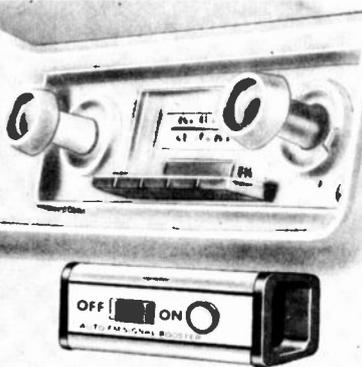
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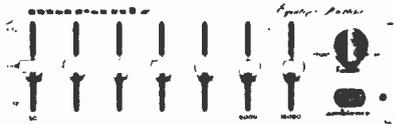
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AUDIO SHOWCASE

of 80 W per channel (RMS) into 8 ohms with less than 0.05% total harmonic and intermodulation distortion from 20 to 20,000 Hz, at full rated output. The amplifier specs include: dynamic intermodulation (DIM) of only 0.02% rise time of less than 1 sec., and "excellent" slew rate. Thus the receiver has an "extraordinary" ability to react quickly and correctly to sudden signal changes, according to Tandberg. Suggested retail price: \$1,200.

Seven-Band Equalizer Car Amplifier

This seven-band equalizer stereo amplifier with ambience and automatic



Circle No. 77 On Reader Service Card

turn-on, by Marantz, delivers 60 watts total RMS power with 0.5% total harmonic distortion at 15 watts per channel into 4 ohms. The graphic equalizer section allows the contouring of more than eight full octaves of music with "unprecedented precision." Other features of this under-dash unit include: fader control; detented equalizer controls; heat sinks to maintain cool operating temperatures for low distortion and dependable service. Suggested retail price: \$169.95.

Automatic Direct Drive Turntable

Kenwood's KD-5070 turntable, priced at \$260, offers direct-drive precision along with the convenience of fully automatic operation. The unit features



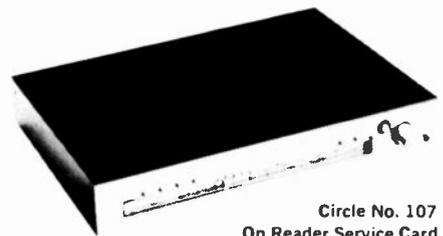
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the company's exclusive molded limestone/resin concrete base, claimed to be probably the most effective anti-

resonance material in use today because it damps all vibrations and holds resonances to subaudible levels. Wow and flutter is thereby held to 0.025% WRMS and rumble is better than -73 dB (DIN weighted). These specs also derive from use of an exceptionally heavy platter weighing 3.3 lbs., and a powerful new servo-controlled 20-pole, 30-slot DC motor with a starting torque of 900 gr-cm. The center shaft is of hardened stainless steel encased in a brass sleeve and balanced on a tempered copper ball-bearing resting on a brass plate. The S-shaped tonearm minimizes tracking error to ± 1.5 degrees. An independent 12-pole synchronous motor controls the automatic functions of the tonearm, thus taking unnecessary strain off the DC motor. Automatic lead-in, cut, return and repeat-play are all said to perform silently and smoothly. A safety device protects the mechanism should the arm be touched during automatic operation. However, manual operation is also possible. Other features: anti-skating control; tracking force adjustments; fine speed adjustment; strobe markings; anti-resonance dust cover; capacitance phono cables.

Quartz Locked FM Tuner

Luxman's model T-12 Accutouch quartz-locked FM tuner is priced at \$645. For this investment you get an "accutouch" system which is said to



Circle No. 107 On Reader Service Card

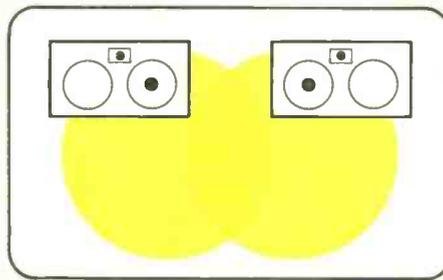
seize the exact tuning point including that of the RF amplifier stage. The accurate center tuning point is detected by means of a control voltage at the quartz circuit, which activates a mechanical lock function as the tuning knob is turned. The accutouch system is said to go beyond the performance of a typical quartz-locked FM tuner system because it controls RF as well as the local oscillator. Specifications: frequency response, 20 to 17,000 Hz (within -0.5 dB, mono and stereo); total harmonic distortion, 0.05 to 0.5%; signal-to-noise ratio, 80 dB; 50 dB quieting sensitivity, 50 μS, 16.0 dBf (3.3 μV); capture ratio, 0.8 dB (wide), 2 dB (narrow); adjacent channel selectivity, 12 dB (narrow ±200 kHz); alternate channel selectivity, 60 dB (narrow, ±300 kHz); spurious response ratio, 100 dB; image response ratio,



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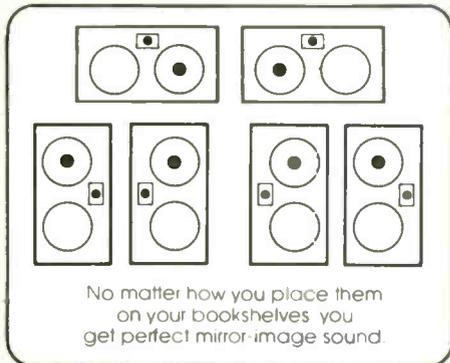
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an exceptionally flat energy output and unusually low distortion that provides for a transparency and liveliness not found in other competitive speakers.

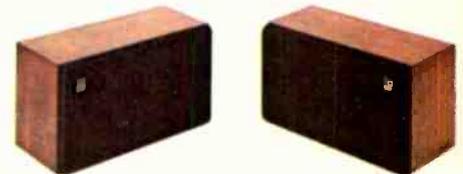
Ask your Audio Dealer to give you a live demonstration of a matched pair of bookshelf speakers. You'll be amazed at their perfect mirror-image sound. And while you're at it, try the perfect answer to private listening: Koss stereophones. But by all means, write, c/o Virginia Lamm, for our full color speaker and stereophone catalogs. The Sound of Koss will do great things for your records or tapes . . . and your image.

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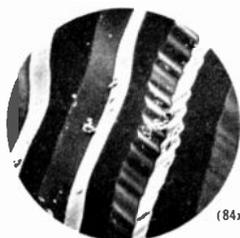
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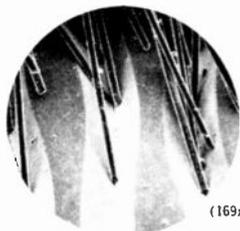
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Audio-Technica AT6002



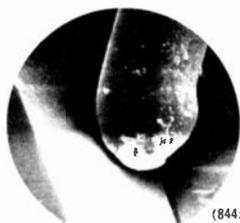
(84x enlargement)

This is an A-T scanning electron microscope photo of the dirt that must be removed if your records are to sound clean. It's dirt that is falling on your records even as you listen.



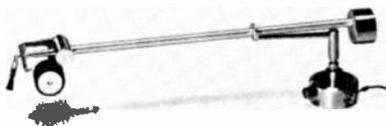
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Our unique carbon fiber brush sweeps each groove literally hundreds of times as the record plays, just *before* the stylus touches the groove. The carbon fiber brush helps conduct static charges away, making groove cleaning easier. And the incredibly small 6 micron diameter reaches deep into the groove for the smallest particles.



(844x enlargement)

Immediately behind the brush, our velvet pad captures and holds dust particles as you play. And moisture released from an inner reservoir helps to dissolve stubborn deposits to prevent static build-up.



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12

AUDIO SHOWCASE

100 dB; AM suppression, 62 dB; stereo separation, 30 dB to 50 dB. Additional features include: tuning lock system; IF bandwidth selector; multipath check switch; record test tone circuit; center indicator; signal strength indicator; FM muting switch; FM muting level control; time delay muting circuit; output level control.

Deluxe Cassette Deck

Sanyo model RD5350 deluxe audio cassette deck features a special Permalloy recording head and PLL DC servo motor with 34 stator and 34

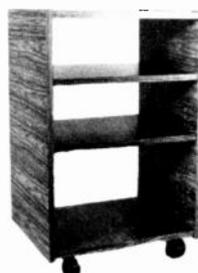


Circle No. 108
On Reader Service Card

rotor poles (Tachogenerator system). Other features include: separate calibrated input/output level controls; jumbo lighted VU meters; record mute; standby timer; back-lit cassette light. There's also a full automatic stop, locking pause, separate bias equalization switching, LED indicators, separate left and right microphone jacks, headphone jack, digital tape counter. Frequency response measures up to 17,000 Hz with CrO₂ or FeCr tape, and signal-to-noise ratio is put at 64 dB with Dolby on. The unit, in a simulated walnut covered metal cabinet, has a suggested list price of \$219.95.

Audio Rack

Star Case Mfg. offers this RS30 four-shelf audio rack for \$199.95. It's finished in rosewood formica throughout and has the following inner dimensions: 23 3/4 inches wide by 18 inches deep by 28 inches high. Included in the price are four steel barrel casters. Use the unit to house a turntable, re-



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Reader Service Card

ceiver, effects units, records, books or what have you. The rack is shipped unassembled, and assembly is said to take about 15 minutes using shelf-support screws that engage plastic sockets in the vertical end pieces.

Akai Turntable Line

Top-of-the-line in a new five-turntable line-up offered by Akai is Model AP-307, a fully automatic, quartz lock,

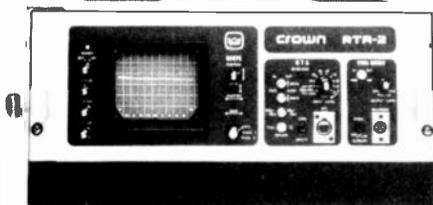


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direct drive unit that carries a suggested retail price of \$299.95. The turntable is equipped with static balance tonearm and is powered by a DC servo motor. There's also an anti-skating adjustment, set by a dial, plus a twist-type counterbalance on the tonearm. Other features include: low-profile look; vibration-absorbing insulated legs; hinged, removable dust cover; pitch control for speed variations to as much as $\pm 2\frac{1}{2}\%$; lighted strobe prism for instant indication of turntable speed. Speed accuracy of the AP-307 is $\pm 0.08\%$ at 1,000 Hz.

Real Time Audio Analyzer

Crown's RTA-2 Real-Time Audio Spectrum Analyzer has all the subsystems needed to perform quick, accurate on-site equalization of sound-reinforcement systems. The self-contained unit features a 5-inch CRT display scope, a lighted graticule for photography of waveforms and easier



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viewing in dim light, and a pink noise generator. All you need to add is a balanced low-impedance microphone. The RTA-2 has a 60 dB dynamic range and provides frequency curve readouts for a live performance that will accurately report the full sound range to be heard in the audience. There's a

Again we turn the world around.

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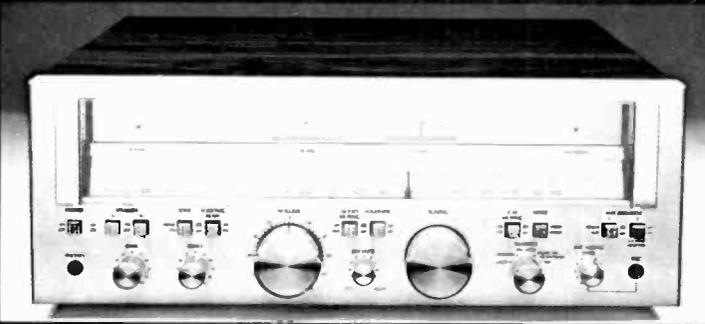
The **G-7500** delivers 90 watts per channel, min. RMS, both channels into 8 ohms from 20 to 20,000Hz with no more than 0.025% total harmonic distortion, at a suggested retail price of only \$620.

The **G-5500**, at a suggested retail price of only \$465, offers 60 watts per channel with no more than 0.03% THD under the same conditions.

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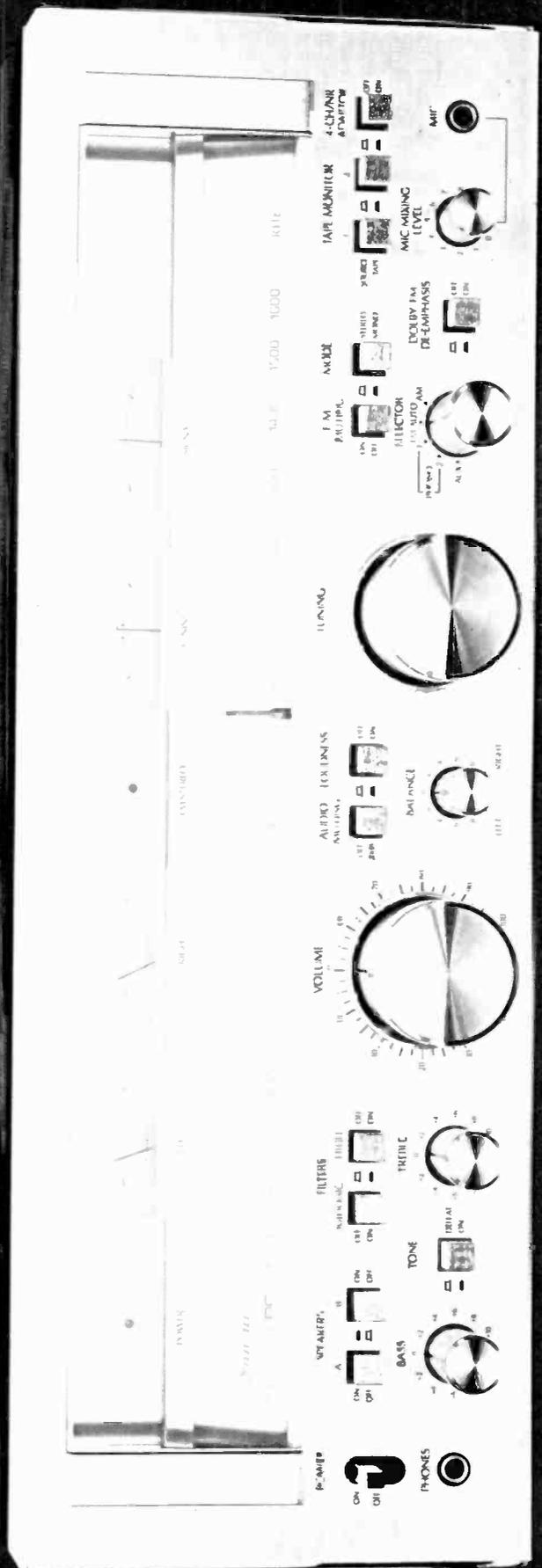
Now look carefully at the graceful styling, with elegant rosewood veneer cabinet. It is setting the trend for all other receivers.

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switch-selectable $\frac{1}{2}$ or 1 octave display. Controls are grouped by function. A slow integration time of the display is switch selectable for averaging of the spectrum when needed in measuring system response. A full 16 to 20,000 Hz audio bandwidth (compatible with full bandwidth equalizers) is displayed. "Hi-Low" calibrate positions on the input level attenuator provide a display of pink-noise at two levels with a 20 dB difference. Price: \$2,595.00.

High Performance Receiver

NAD (New Acoustic Dimension) suggests that this model 7080 AM/FM unit may be the "ultimate receiver," and yours for \$590.00. An "Infrasonic" circuit which can be switched



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off, is claimed to eliminate almost completely signals below 20 Hz—attributable to room vibrations, turntable rumble, record warp and the like. Actual phono cartridges, instead of conventional test equipment, are used to develop circuits having exceptionally low distortion. Similarly, receiver outputs are tested with actual loudspeakers rather than with resistive loads that only simulate loudspeakers. The resulting specifications include: power output, 90 watts, RMS, from 20 to 20,000 Hz, into 8 ohms; total harmonic distortion, less than 0.008%; intermodulation distortion, less than 0.008%; transient intermodulation distortion, less than 0.008%; damping factor, 20 to 20,000 Hz, 60. Features include: two stereo tape inputs and outputs; two stereo phono inputs; multiple-position tape copy control; two headphone jacks; high and low filters; Baxandall-type tone controls; bass and treble turnover switches; relay speaker output protection; switchable FM de-emphasis; main and remote speaker selector; provision for using remote speakers for ambience effects.

Full Range Speaker System

Electro-Voice's PI 15-3 speaker system was designed to give theater, club

and disco owners the opportunity to install full range speaker systems in their facilities without having to modify existing touring systems. It features extended low-frequency response, es-

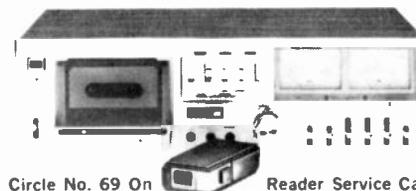


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entially flat to 50 Hz. Also "superb" high-frequency dispersion, a full 120 degrees to the high frequency upper limit of 16,000 Hz, only 6 dB down 60 degrees off axis. Additionally, the PI 15-3 uses the exclusive vented cone midrange driver "widely acclaimed" for its ability to reproduce midranges accurately at sound pressure levels equivalent to that of most horns. The system utilizes E-V's High Frequency Auto Limiting circuit which protects the tweeter from excessive power input without reducing the power output of the speaker itself. The speaker handles 100 watts continuous power in. The PI 15-3 uses EVM15L woofer, ST 350A tweeter plus the described vented midrange driver. Crossovers are at 600 Hz and 4,000 Hz. Suggested list price: \$563.00.

Deck With Wireless Remote Editing

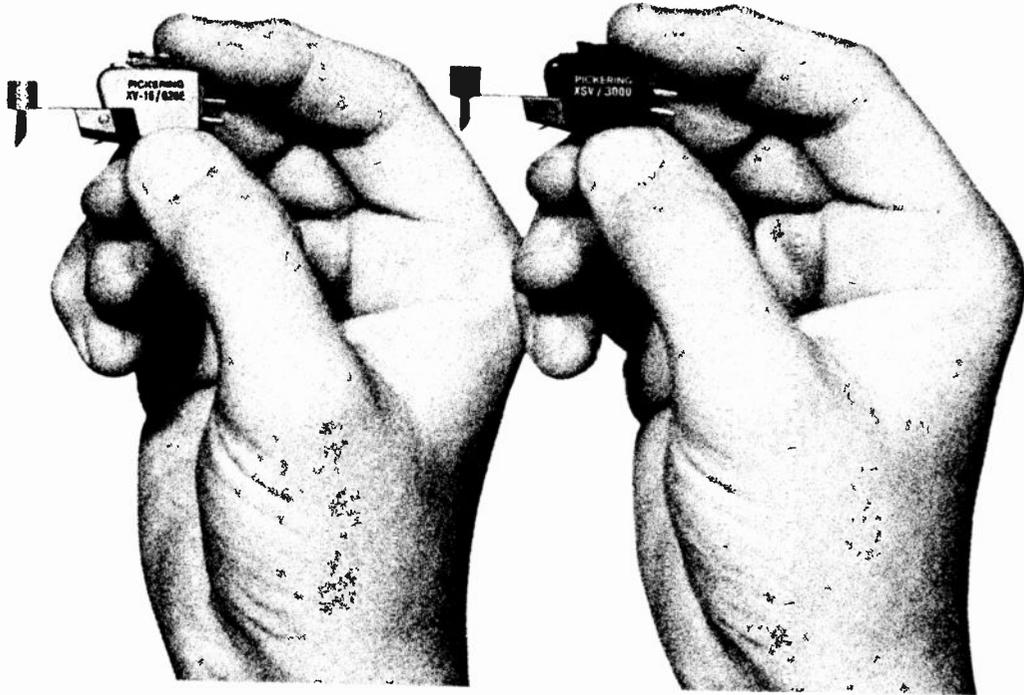
You can now record off the air or from discs and edit out undesired material, while recording, from anywhere in the room up to 20 feet from a Fisher model CR5125 "Studio Standard" 3-head cassette deck. A push of the pause button on a hand-held wireless remote unit activates a solenoid to instantly stop tape motion; another push resumes recording without hesi-



Circle No. 69 On Reader Service Card

tation or slurring. The deck also features dual process Dolby noise reduction, dual-capstan drive and direct cassette loading design. Specifications: frequency response, 30 to 15,000 Hz \pm 3 dB (normal tape), 30-18,000 Hz \pm 3 dB (CrO₂ tape); signal-to-noise ratio, 64 dB with Dolby; wow and flutter, 0.04% WRMS. Other features include: direct-loading tape transport design; defeatable FM subcarrier filter;

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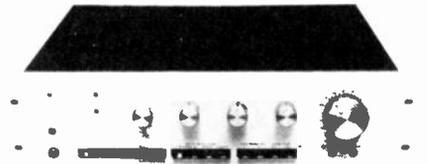
AUDIO SHOWCASE

FM Dolby circuitry; Ferrite heads.
Price of the CR5125: \$550.00.

Assembled Integrated Power Amp

Dynaco's model 2530 100-watt-per-channel integrated power amplifier delivers less than 0.05% total harmonic

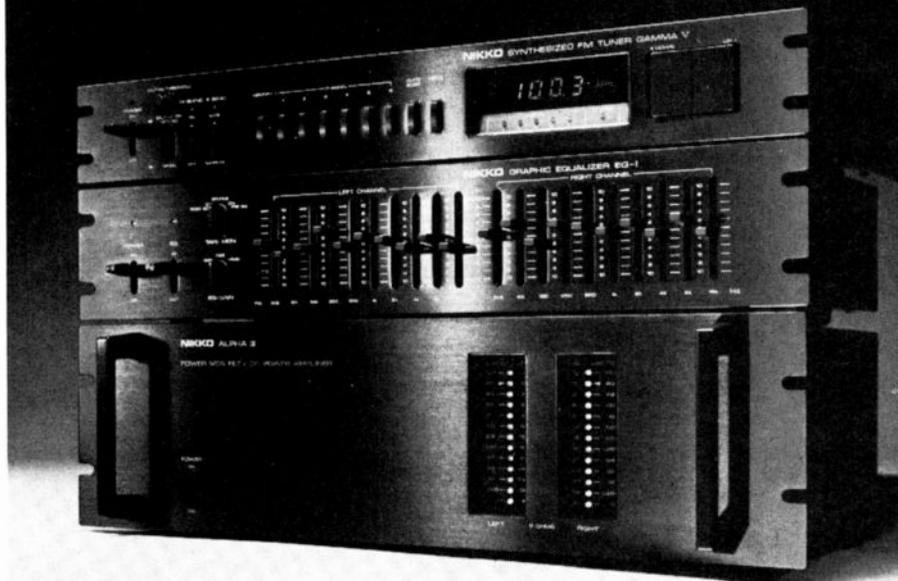
distortion at any power level up to 100 watts continuous average power per channel into 8 ohms at any frequency between 20 to 20,000 Hz with both channels driven. Distortion is even less at lower power levels. Electronic muting in the preamp section and a relay for the amplifier eliminate potential system noises and thumps. A yellow LED in the muting circuit indicates no audio signal and a green LED indicates audio signal can pass. Specifications: frequency response, 0 dB at 5 Hz and -1 dB at 40,000 Hz at 1 watt into 8 ohms; high power frequency response, +0/-0.4 dB from 20



Circle No. 37 On Reader Service Card

to 20,000 Hz at 100 watts into 8 ohms; hum and noise, greater than 95 dB below rated output, full spectrum; input sensitivity, 1.25 volts for 100 watts at 8 ohms; input impedance, 40k ohms; slewing rate, 10 volts per microsecond; damping factor, greater than 80 to 1 kHz into 8 ohms and greater than 30 to 10 kHz into 8 ohms; channel separation, greater than 60 dB by IIF standards. Notable features include: built-in thermal protection for each channel; 32-position detent-action volume control; speaker switching; tape monitoring and dubbing for two decks; huge power transformer. Price: \$749.00.

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Unlike any stereotype, Nikko Audio actually delivers the seed of sound in our professional series.

The Gamma V Synthesized FM Digital Tuner has a LED readout showing locked-in MHz numbers. Accuracy on the button.

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near the price range—0.008% (80 watts per channel, both channels driven into 8 ohms, 20 Hz to 20 kHz).

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Circle No. 19 On Reader Service Card

Audio Separates Speaker System

The entire Kriket Audio Separates™ car speaker system shown here features dome tweeters, mid-woofers, bi-amplified Domaxial™ speakers, sub-woofers and environmental equalizer and re-tails for \$319.75. Says the company:



Circle No. 112 On Reader Service Card

"Big car stereo sound is the biggest thing going in the entire consumer electronics field, and the hostile acoustic environment of most vehicles demands separation of high and low frequency drivers in order to maximize extraordinary sound reproduction.

Cassette Deck/Stereo Receiver

Sharp Electronics' SC-8000 stereo receiver, microprocessor cassette music center has five forms of memory and Dolby noise reduction. The receiver section has a listed power output of 15 watts per channel minimum RMS at 8 ohms, from 40 to 20,000 Hz, with no more than 0.8% total harmonic distortion. A major feature of the SC-8000 cassette deck section is that, through its Automatic Program Locate Device, it can play any song on the cassette by going either forward or in

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While the others were catching up, TDK was moving ahead.

Shortly after it was introduced in 1975, TDK SA, the world's first non-chrome high bias cassette, was accepted by most quality deck manufacturers as their high bias reference standard. This advanced, new cassette enabled their decks to perform to the limit of their capabilities. And because the decks are set in the factory to sound their best with SA, music-loving consumers made SA the number one selling high bias cassette.

The other tape makers set out in pursuit of SA, hoping someday to equal the performance of its Super Avilyn particle formulation and the reliability of its super precision mechanism.

But making the world's most advanced cassette was nothing new for TDK's engineers. They pioneered the high fidelity cassette back in 1968 and for more than a decade they've led the way in cassette tape technology. Over the last three years, they've refined SA and made

it clearly superior to the '75 version.*

That makes the music lovers happy; it means more music with less distortion. It makes the deck makers happy; they've been improving their decks and SA makes them sound better than ever. But for the competition, unhappily it means a whole new standard to catch up to.

So if you'd like to raise your own recording standards, step up to TDK SA, the high bias reference tape backed by high fidelity's original full lifetime warranty.**

TDK Electronics
Corporation
Garden City
New York 11530

 **TDK**
The machine for your machine.™



*Today's SA has a maximum output level (MOL) more than 3dB better than that of 1975 SA at the critical high frequencies, and improved sensitivity across the entire frequency range. **In the unlikely event that any TDK audio cassette ever fails to perform due to a defect in materials or workmanship, return it to your local dealer or to TDK for a free replacement. ©1978, TDK Electronics Corp.

Circle No. 29 On Reader Service Card

AUDIO SHOWCASE

reverse, skipping as many as 19 songs to reach the desired selection. It can be programmed to turn itself on or off, has zero rewind and tape counter memory, and can be programmed to play a certain segment of a tape. A



Circle No. 115
On Reader Service Card

liquid crystal display digital quartz clock and "command post" shows time in either 12-hour day mode with AM and PM displayed, or as a 24-hour day. It also tells what is taking place on the cassette by means of arrows that indicate when the deck is in fast forward, reverse, or play mode. Footage can be digitally displayed, and a symbol indicates when Dolby is on. A built-in time counter tells how long recording has been going on "right down to the last second." To assure accuracy of the clock and to preserve its memory function, the microprocessor automatically switches the clock to battery operation when power fails. Tuner controls include loudness, auxiliary, tape, phono, AM/FM stereo, FM selector. Price: \$549.95.

Two Cassette Tape Series

Two new cassette lines offered by Maxell are identified as Maxell LN (Ultra Low Noise) and Maxell UD (Ultra Dynamic) cassettes. Both feature a four-function leader tape offering the following advantages: a special polyester, surface-treated section that cleans all parts of the tape path,



Circle No. 114 On Reader Service Card

including heads, for 5 seconds without abrasion; translucent section to give visible indication of the direction the tape will travel by means of arrows; a printed letter A or B to indicate which side of the tape is about to be played; a cue bar on the leader that is exactly

at capstan position, when the tape is fully wound, to facilitate a 5-second count-off before the recording section appears. LN tapes are priced as follows: LN-46, \$2.30; LN-60, \$2.55; LN-90, \$3.90; LN-120, \$5.20. All are made of tensilized polyester, and are recommended as the best all-around cassettes for music and voice. UD tapes are priced as follows: UD-46, \$3.50; UD-60, \$3.80; UD-90, \$5.70; UD-120, \$7.50. This tape is used by audio professionals to test the performance of high quality cassette decks because the tape utilizes micro-fine particles of pure ferric gamma hematite magnetic oxide to achieve "consistency, uniformity and predictability."

Concert Cassette Deck

Eumig introduces a "new concept" in quality cassette decks for in-home and professional use with the Eumig Metropolitan Concert Cassette Deck. The unit uses a unique opto-electronic servo system for "ultra-precise" control of the capstan drive. Instead of belts and fly-wheels to turn the capstan, the Eumig makes use of a lightweight disc that is photo-etched with 2500 precisely spaced radii to create 15,000 pulses per second as the capstan rotates them past an optical sensor. By comparing the counted pulse-rate against a fixed



Circle No. 126 On Reader Service Card

reference, it's possible to apply continuous speed corrections to the capstan motor in a matter of mere microseconds. The result: wow and flutter is reduced to an extraordinarily low 0.05% WRMS, according to Eumig. The deck has three heads and a solenoid logic tape transport. Peak recording level is indicated by two parallel columns of LEDs; since these are inertia-less, they supply instant values, unlike the much slower ballistic type VU meters. There's a mixing panel to handle two inputs per channel with automatic or manual level control. The CCD also uses three LEDs to indicate the type of tape. Bias and equalization switching for chromium dioxide tape is automatic. Signal-to-noise ratio with Dolby is 66 dB for ferric oxide, 68 dB for CrO₂ and 72 dB for Ferrichrome tapes. Suggested retail price: \$1,300.00. ▲

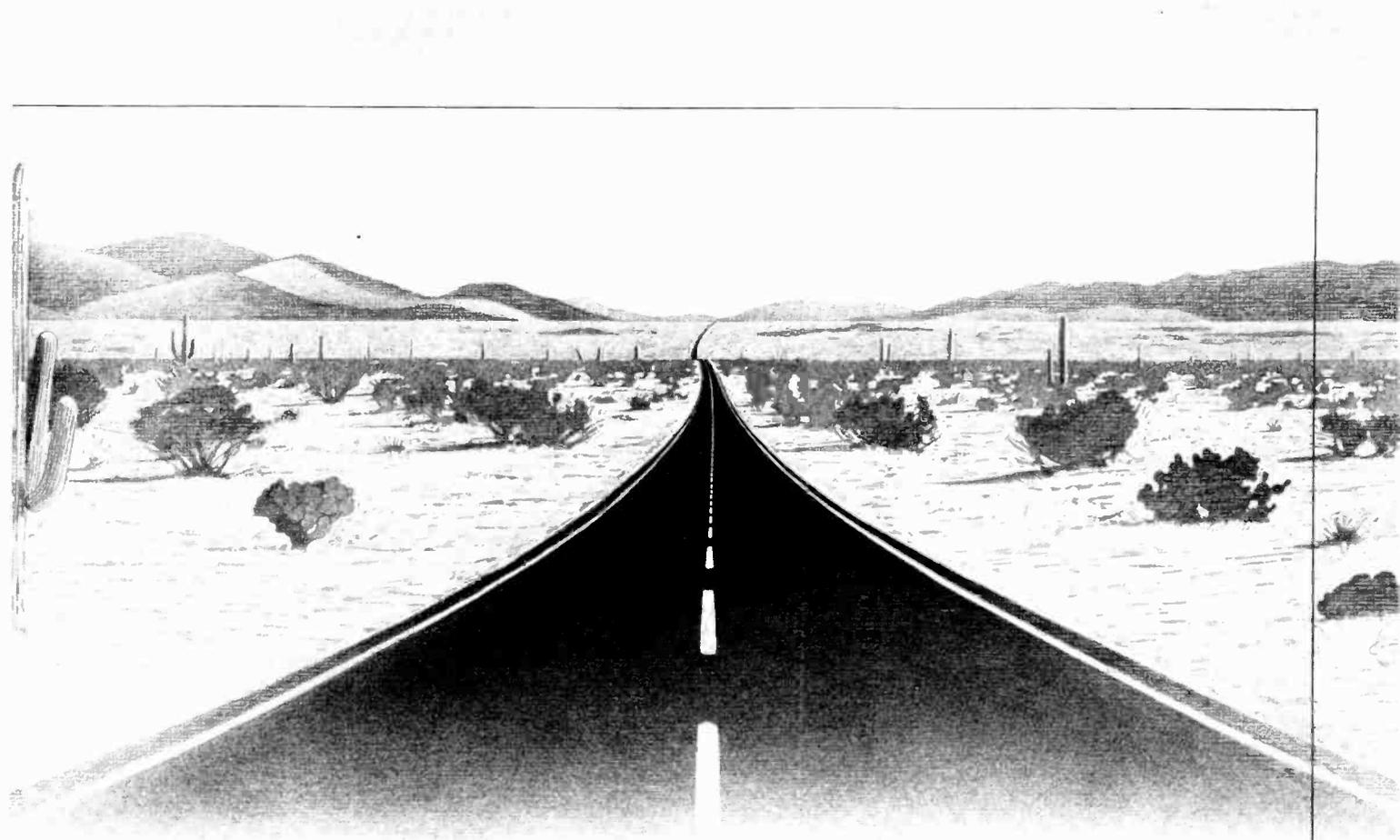
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Circle No. 117 On Reader Service Card

HI-FI/STEREO BUYERS' GUIDE



Miles Ahead in Car Audio Components

You're aware of Mitsubishi audio component systems for your home as well as the superior quality, performance and design that goes into them. Now Mitsubishi engineers have followed through with that same "separate components" premise, and we now want you to be fully aware of our new component systems for your car.

Start with the CV-21 Power Amplifier and the CJ-20 FM Tuner. Then choose the CX-21 Auto-Reverse Cassette Deck or the CX-20 Cassette Deck. Add up to six speakers including a pair of SX-30 two-way Alumi-Die Cast Enclosed

speakers for a total car audio system worthy of the name Mitsubishi.

Now a word about "specs"... we have always believed in rating our equipment's performance conservatively. Only you benefit from this caution. "Sound us out" before you buy any other car stereo system. You'll be miles ahead with Mitsubishi.



A complete line of components, in-dash/under-dash units and speakers await you at select audio and car audio dealers. Check the list adjacent to this ad for the Mitsubishi Car Audio dealer nearest you.

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Circle No. 42 On Reader Service Card

The best
speaker kit
isn't a kit
at all!



The best speaker kit is a system designed by Electro-Voice that allows you to choose your own level of performance; from a studio monitor to a modest bookshelf system, from a wide selection of woofers, tweeters, mid-range drivers and crossovers.

Then Electro-Voice provides detailed plans on how to construct the enclosures designed specifically for the drivers you chose.

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To get your component speaker catalog and construction plans package, just send \$1.00 to Electro-Voice Component Speaker Systems, 600 Cecil St., Buchanan, MI 49107.



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E-V component speaker packages.

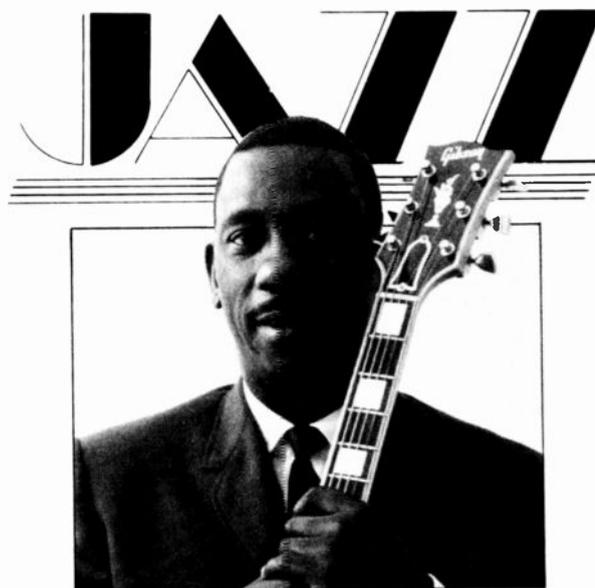
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WES MONTGOMERY/by J. R. TAYLOR

□ Wes Montgomery had one of the strangest careers in the annals of jazz. In a profession that reveres youth, he was still an unknown in his mid-thirties; yet by the age of 40, he was the best known of jazz guitarists, enjoying equally the applause of crowds and the respect of fellow musicians. Indeed, Montgomery was perhaps the most commercially successful jazz musician of the 1960s, though he had little time to enjoy his fame; within a decade of his "discovery," Montgomery was dead at forty-three.

In the fall of 1959, Montgomery was a principal member of Indianapolis's small but distinguished jazz community, working exhausting hours for little money to support a wife and seven children. Each day, after finishing a full-time non-musical job, he would report to the Turf Bar for a five-hour stint, then move on to the after-hours Missile Room to finish out the night with a couple of sets. His only significant national exposure—two years of limited solo opportunities with Lionel Hampton's big band—had ended in 1950. In the late 1950s, he had made a couple of records with his better-known brothers, Buddy (a pianist-vibraphonist) and Monk (one of the first electric bassists to be heard in any music, who led a fairly popular group called the

Mastersounds), but neither record attracted much attention to the guitarist.

On a visit to Indianapolis, composer Gunther Schuller heard Montgomery "live" at the Missile Room; later he wrote enthusiastically of what he had heard for the then-active *Jazz Review*. While Schuller's article was still in press, saxophonist Cannonball Adderley also visited Indianapolis; Adderley telephoned New York to sing Montgomery's praises to Orrin Keepnews of Riverside Records. Thus, by the beginning of 1960 Montgomery found himself with a recording contract, supported by a healthy burst of press coverage.

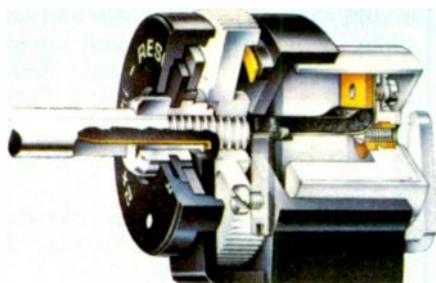
Through the early 1960s, however, the guitarist was unable to carry his "overnight success" beyond the narrow confines of the jazz audience. With brothers Monk and Buddy and a succession of drummers, The Montgomery Brothers made the rounds of clubs and festivals for over two years; but the group made no headway, and Wes returned to Indianapolis for over a year at the end of 1962. In 1964, Mont-

(Continued on page 76)

J. R. Taylor is the coordinator of the National Endowment for the Arts' Jazz Oral History Project at the Smithsonian Institution. He was formerly curator of the Institute of Jazz Studies at Rutgers University. His writing on jazz has appeared in the *Washington Post* and the *Village Voice*.

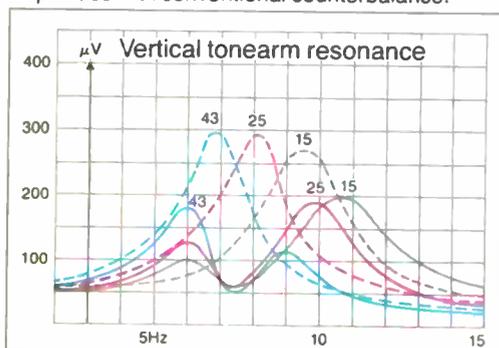
If the bass isn't as clean as you'd like...

The problem may be your tonearm. Not your amplifier or speakers.



Cutaway view of anti-resonance counterbalance.
(A feature of Dual models 604, 621, 721 and 1246)

Solid lines show effectiveness of anti-resonance filters in damping resonant amplitudes of three different cartridges (compliance 15, 25 and 43 $\times 10^{-6}$ cm/dyne). Broken lines show higher resonant amplitudes with conventional counterbalance.



These are specially tuned to damp resonant energy in the tonearm/cartridge system and chassis.

The startling effectiveness of these filters in lowering the resonant amplitude of three cartridges having different compliances can be seen in the graph. Whether the improvement in the bass is subtle or obvious to you depends on the other components and your listening environment.

We've prepared a technical paper on this subject which we'll send to you if you write us directly. You may discover that you don't have to replace your amplifier or speakers after all.

If you've been wondering why your high-powered amplifier and great speaker system don't deliver deep bass as cleanly as you'd like—especially at high listening levels—the problem may well be the effects of resonance on the stylus.

Ideally, the stylus should move only in response to the contours of the record groove. But in reality, the stylus tip also responds to various resonances: its own (with the stylus shank) and the combined resonance of the tonearm/cartridge system.

These subsonic frequencies, though inaudible in themselves, can have very audible effects. Especially with warped records. They can drain amplifier power and cause excessive movements of the low frequency driver. They can cause the tonearm to vibrate and even to momentarily leave the groove. All of which results in audible distortion.

Competent tonearm designers know all this and do their best with materials, masses and compliances to establish the inevitable resonances at the least harmful frequencies (usually between 8 and 10 Hz) and with the lowest possible amplitudes.

Dual's tonearm designers have taken a significant step beyond this.

The unique counterbalances of our direct-drive models (604, 621 and 721) and our top belt-drive multiple-play model (1246) contain two mechanical anti-resonance filters.



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United Audio, 120 So. Columbus Ave., Mt. Vernon, NY 10553

Circle No. 27 On Reader Service Card

pop discs

A review of the latest popular music releases

by KEN IRSAY

Frankie Valli: "Frankie Valli Is The Word" Warner Bros. BSK-3233 \$7.98.

With the hit single, "Grease," launching the beat, Valli and producer Bob Gaudio return to the rhythm that, in a more primitive form, made them much moolah many years ago with The Four Seasons, which Valli fronted and Gaudio produced. Valli retains his romantic repertoire, but the beat is more



prominent. In addition to "Grease," Bee Gee Barry Gibb contributed another winner in "Save Me, Save Me." Smooth orchestrations and background singers round out a polished package

Boston: "Don't Look Back" Epic FE-35050 \$7.98.

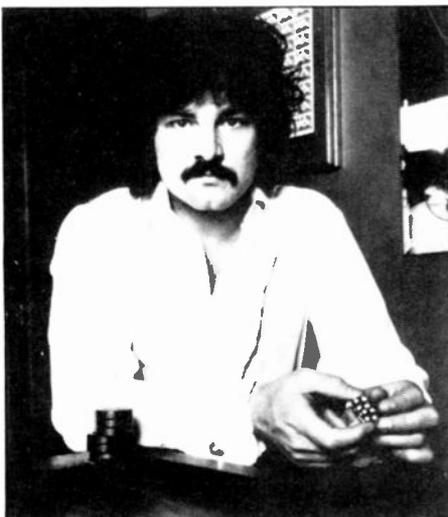
The more than two years Boston took to ponder, write, produce, record, mix, re-ponder, change and finally deliver their second album was unquestionably time well-spent. The skills that catapulted the group to instant stardom in 1976—solid, well-played hard rock tempered by pleasing melodic structures—have, if anything, been honed to perfection. The man whose name appears all over the album is Tom Scholz, the former Polaroid product designer who sacrificed solid employment after succumbing to the "rockin' pneumonia and boogie woogie flu." Scholz produced, engineered (in his cramped basement studio), arranged and wrote (with help from vocalist



Brad Delp on two cuts) the album. He also plays lead, acoustic, electric rhythm and 12-string guitars, not to mention bass, piano and organ. In addition to Scholz and Delp, the group features Barry Goudreau on guitars and percussion, Sib Hashian on drums and bassist Fran Sheehan. And a rockin' good time will be had by all.

Burton Cummings: "Dream of a Child" Portrait JR-35481 \$7.98.

Burton Cummings proves himself a sensitive composer and a fine interpreter of R'n'B classics in his third solo album since the demise of the Guess Who. And if one of your favorite Guess Who tunes was "American Woman," you'll recognize Cummings as the powerful lead singer on that song. This well-instrumented rock album spans many moods. "Break It To Them Gently" is a self-penned ballad



about a fugitive's concern for his family, while "Hold On, I'm Coming" is a spirited update of the Sam and Dave oldie with an appropriately punchy horn section led by Steve Madaio. Cummings' voice, as always, is distinctive and energetic throughout this self-produced collection.

Dan Fogelberg & Tim Weisberg: "Twin Sons of Different Mothers" Full Moon JE-35339 \$7.98.

This unusual album comprises seven instrumentals and three vocals, with Fogelberg as singer, guitarist and composer, and Weisberg on flute and other woodwinds. All tunes have a mellow rock combo backing, with lush strings on the opening "Twins Theme" and the bossa nova-style "Guitar Etude No.



3." Fogelberg shines here on classical acoustic guitar. The recording is clean and quiet, with a stable sound that belies the fact that six recording studios were used.

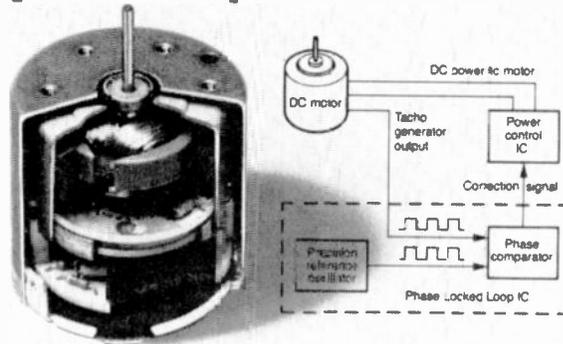
Leo Sayer: "Leo Sayer" Warner Bros. BSK-3200 \$7.98.

It's usually an artist's first album, not his sixth, that uses his name as the title. Maybe Sayer is signalling a new beginning with this Richard Perry-produced effort. It certainly is a change of pace from the blues, orchestral ballads and big beat of his previous albums. With a few notable exceptions (the Rolling Stones-flavored "Don't Look Away") the collection relies on subtle

(Continued on page 72)

1,247 times a second this motor checks itself for perfect speed...

How it works:
Built into the RD5350 motor is a 68 pole tacho generator that produces a series of pulses proportional to the motor speed. In the Phase Locked Loop integrated circuit, these pulses are compared with the signal from the precision reference oscillator (1246.7 Hz). If even a single pulse is found to be slightly out of phase, power to the motor is adjusted by a second integrated circuit to restore synchronization. This process takes place independent of fluctuations in load or AC line voltage.



so you'll never hear anything less than perfect sound from this Sanyo Tape Deck.

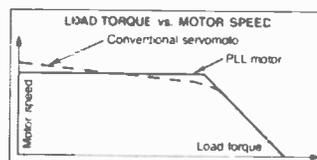


The new Sanyo RD5350 Dolby cassette deck has one of the most advanced drive motors ever put in a tape machine.

It's a new frequency generator DC motor with Phase Locked Loop speed control servo that actually checks and corrects for even the most infinitesimal speed variations *1,247 times every second!*

This hair-splitting accuracy helps give the RD5350 one of the lowest wow & flutter figures in the industry: 0.05% WRMS. And lets the drive system ignore line voltage fluctuations, and breeze right through even "sticky" cassettes without missing a beat.

Naturally, the RD5350 has one of the most rugged, precision tape transports available today and high performance electronics. As a result, you get superior specs like 30-17,000 Hz response ($\pm 3\text{dB}$, CrO₂ tape)



and 64dB S/N ratio with Dolby. Which is more Hz and less noise than you'll find on the discs and broadcasts you tape.

You also get advanced features like 3 peak-indicating LED's (0, +3, and +6 VU), separate input and output level controls, a Record Mute button for erasing short sections of tape, and a timer standby feature for taping programs when you're not around.

You'd probably expect to pay a bundle for a deck as sophisticated as the RD5350. But thanks to Sanyo's integrated manufacturing capability, you can have it for only \$240.*

Which may be the most perfect thing of all about the RD5350.

SANYO
That's life.

SOUND PROBE SOUND PROBE SOUND PROBE

The only way to size up a speaker is to live with it. Numerical specs alone never tell you the whole story, and showroom demonstrations—often hurried and in distracting surroundings—can be misleading. That's why the speakers we evaluate move in with us and stay a while. We spend days, sometimes weeks, listening to them—playing all kinds of music. And then we pass on our

impressions to you the same way we experience them—subjectively.

Of course, subjectivity alone is no standard of judgment. Our opinions are tempered and formed by years of hanging around the music world and hearing lots of "live" performances, not to mention all kinds of sound gear and dozens of speakers. That, we feel, gives us a valid basis for comparison, and we pass it on to you for whatever it's worth.

by CHRISTOPHER GREENLEAF and HANS FANTEL

Yamaha NS-10M



Circle No. 101 On Reader Service Card

On a recent junket to Japan we took the bullet train from Tokyo, whizzed at 140 mph past Mt. Fuji, floating above the plains like a snowy mirage, and headed for the Yamaha factory at Hamamatsu. On arrival, we saw an audio plant unlike any other. What makes Yamaha unique is the way its history is reflected in its present.

At the turn of the century, long before the age of electronics, Yamaha was already among the world's leading makers of musical instruments, and its pianos, guitars, and brass instruments have been prized among musicians ever since. When Yamaha later branched out into audio, the musical background of their staff was at least partly responsible for the quality of their sound gear. (Just where all those motorbikes fit into the picture we haven't figured out yet; but it is an odd and awesome sight to see engine

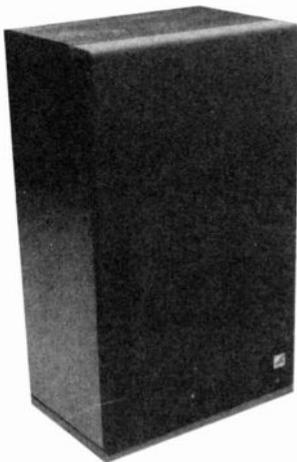
blocks, piano frames, and loudspeaker parts taking shape from red-hot metal in the same foundry.)

The rare combinations of musical and technical skills and talents at Yamaha clearly shows in their speakers. Expert listening, along with expert engineering goes into each design and is as evident in this bantam speaker as in Yamaha's justly famous studio monitor. Specifically, the upper range of the NS-10M has a sweetness and smoothness that delight keen-eared listeners of all tastes.

In the toughest of all listening tests—string instruments—the violins sounded like real fiddles, with no metallic traces. Many experts believe that this is the telltale mark of sonic truthfulness. And, sure enough, all other instruments—brass, winds, and percussion—also came through with the same

(Continued on page 26)

Electro-Voice Interface: B Series II



Circle No. 67 On Reader Service Card

Electro-Voice has been in the forefront of loudspeaker engineering since the early days of high fidelity. Their huge horn speakers of the 1950s were among the first to put out deep bass and ample volume from the meager wattage available at that time. So it is not surprising that E-V is again in the vanguard of speaker design. The speaker tested here is one of the finest achievements based on the principles of Thiele and Small, the two Australian engineers who revamped speaker theory a few years ago.

In case you haven't been keeping up with the technical journals, let's briefly recap the main points of the Thiele/Small approach. In conventional "acoustic suspension" enclosures, the drivers are mounted in a sealed box. All the sound energy radiating from the rear of the speaker cone—half the total energy produced by a speaker—

gets trapped in the box. This type of enclosure produces clean, accurate bass, but at a high cost in energy. After all, half the wattage never gets out of the speaker box and is converted into frictional heat.

By contrast, the Thiele/Small principle gets nearly all the sound out of the box. In this case, it's done by means of a "passive radiator"—sometimes called a drone cone. This is a regular woofer cone but without a magnet and voice coil to drive it. Instead the cone is activated by the back pressure created inside the box by the pumping motion of the main woofer. So, instead of being lost as frictional heat, the back pressure contributes to the audible output. Naturally, this increases efficiency, i.e., the amount of sound generated per watt of power.

In the case of the Electro-Voice
(Continued on page 26)

The most powerful argument for our new receiver is not just power.



True, it's tempting to be swept up by our power.

150 watts per channel minimum RMS at 8 ohms, from 20Hz to 20kHz, with no more than 0.07% Total Harmonic Distortion, is nothing to sneeze at.

But raw power means nothing. What's important is how that power is delivered. In the case of the STR-V7, it's brought to you by Sony in a very classy package.

You get a combination of features and controls that are impressive on their own—but almost unheard of in a single machine.

To start with, we've built in a Dolby system, for decoding Dolbyized FM broadcasts.

The advantages of our tuner,

though, need no decoding. They include a normal and narrow FM IF bandwidth selector. It makes life simple for people in areas where their signals are crowded together elbow to elbow.

In our preamp section, the V7 comes equipped with a special phono EQ circuitry. Thanks to Sony's high IQ, it allows for direct connection of a low-output, moving-coil cartridge phono source. Without calling for an external step-up transformer or pre-amp.

When you're gifted with as much power as the V7, you need a way to keep track of it. This receiver keeps tabs with two power-output meters, monitoring the power being fed to the speakers. So overload can't result from oversight.

And all that power comes from our direct coupled DC power amp. And our power is stable, thanks to a high-efficiency, high regulation toroidal-coil transformer.

There's a lot more to the STR-V7 than power. This receiver takes the best that contemporary technology has to offer, and offers it in a single machine.

Other manufacturers may have the power to bring you power. But only Sony has the power to bring you more than just power.

SONY[®] AUDIO

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SOUND PROBE SOUND PROBE SOUND PROBE

(Continued from page 24)

Yamaha NS-10M



Circle No. 101 On Reader Service Card

convincing naturalness.

Like all small speakers, the Yamaha NS-10M is allergic to two things: very low frequencies and very high loudness levels. But to demand belly-wrenching bass and rafter-shaking volume from a small speaker is like asking a VW to outrace a Jag. Which, of course, doesn't mean that you can't enjoy a ride in the VW or that it isn't a good car.

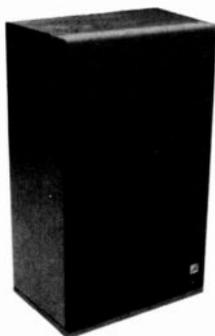
Here's what the NS-10M won't do, simply because it was never meant to: It won't put a 32-foot pipe organ or a life-sized kettledrum into your living room. And it won't—as the saying goes—blow your socks off. Anything else it does uncommonly well and with a rare sense of musical rightness. With just a touch of bass boost, it provides sweet, balanced sound that is a pleasure to hear for hours on end.

As for the vital statistics, the NS-10M weighs 13¼ lbs and measures a mere

15 inches high by 8½ inches wide by 7¾ inches deep. Nominal impedance is 8 ohms. A 7-inch woofer works into a sealed enclosure and the 1¾-inch tweeter taking over at a crossover frequency of 2 kHz is of the soft-dome type. The speaker can be driven with as little as 15 watts but will handle 25 watts input with 50 watt peaks.

The speakers come as a boxed pair and their tweeters are located in opposite corners: in the upper left in the left speaker, the upper right in the right one. This increases stereo separation for a given distance between speakers. The finish is an attractive black semi-gloss on a high-quality wood surface, with jet-black grilles. Our one and only gripe about this unusually fine unit is the absence of a tweeter level control—but that function is easily supplied by the treble control on the amplifier. List price per speaker is \$130. ▲

Electro-Voice Interface: B Series II



Circle No. 67 On Reader Service Card

Interface B, the gain in efficiency is so great that the speaker can be driven to adequate loudness levels with as little as 3.6 watts per channel. Yet despite responsiveness to low-wattage inputs, this speaker can withstand high-power wallops as strong as 200 wpc. E-V suggests that driving this speaker with anywhere from 12 to 36 wpc will assure ample power reserve.

The passive radiator design has further advantages. The drone can be tuned to a) eliminate false resonance and boom; b) at the same time extend bass response below that of the woofer itself. The 12-inch passive radiator in the Interface B sports a steel weight at the center for added mass (and therefore lower resonance). It takes over from the 8-inch woofer at 42 Hz and extends the bass all the way down to a skin-tingling 30 Hz, which lies below any frequency normally encountered in music. In fact, the Interface B is so active in the bottom range that a special filter is furnished to cut response below 30 Hz, to prevent turntable rumble and other subsonics from muddying the music.

The top end is equally unconventional. The Interface B uses two cone tweeters, one of them at the rear, facing the wall behind the speaker to create an ambience effect. The amount of sonic spaciousness generated in this way can be varied by altering the distance between speaker and rear wall, or by angling the speaker in relation to the wall. In our particular setting, we found a distance of about 1½ feet between the speaker and the wall be-

hind it highly effective. The sense of spaciousness is further enhanced by the broad treble dispersion from the front tweeter, achieved through an acoustic lens, consisting of a diffraction grating to fan out the highs.

Both tweeters are protected against overload by a "variable speed relay"—a unique feature of this unusual speaker. The relay reduces power to the speaker whenever the signal level becomes excessive. As soon as the potentially damaging peak is passed, the tweeters are instantly brought back fully into the circuit. Yet the sensing element of this circuit does not measure signal strength alone. It also takes account of peak duration. A brief high-energy burst that poses no danger to the tweeter will pass freely, leaving intact the full sonic impact of such instantaneous peaks. Yet a longer rise in signal level that might heat up the coils and cook the tweeters to death will be checked before it can do any harm. This unique circuit partly accounts for the exceptional power-handling capacity of the Interface B. A pilot lamp on the front panel flashes whenever the safety relay switches in, giving you visual warning of excessive power levels.

The Interface B requires a separate equalizer which is furnished with the speakers and connects to the tape-monitor terminals of your receiver or amplifier. Detailed instruction for making these connections are given in the owner's manual, which also contains technical specifications that are a model

(Continued on page 82)

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



“Records and tapes just seem to sound more crisp with the Koss Pro/4 Triple A.”

Rob Hernandez
Audio Salesman
Kansas City, Missouri

“The cleaner high end and the richness of the bass... it seems like it's always been a Koss characteristic. The Triple A is just a great stereophone. ●●

The Triple A's drivers were specially designed with an extra large diaphragm and oversized voice coil that reproduce a full-bandwidth dynamic Sound of Koss over the entire frequency range of 10Hz to 22kHz.

“You'd be amazed at the number of people who come back and say how much better their receiver sounds when they're listening to their Triple A's. In fact, a lot of people have even come back to buy better speakers after hearing their records or tapes through their Triple A stereophones. ●●

That's great Rob. Here are some of the reasons why the Pro/4 Triple A's make one's favorite records or



tapes sound like a whole new musical library. First, unlike speakers the Triple A's mix the music in your head not on the walls of your living room or den. Second, the superb seal of the Triple A's Pneumalite[®] earcushions not only seals out ambient noise but it also provides for an extended bass performance to below audibility. And third, the seal of the earcushions creates an ideal environment for minimizing

the linear excursion of the driver. Thus, the driver is able to produce any volume level without distortion. So you hear all the fundamentals and harmonics of your favorite music the way they were recorded.

“There's a big increase in women coming in to buy stereophones. They come in and already know their stuff. Some of them even ask for the Koss Triple A's with the Pneumalite[®] earcushions. ●●

Chances are, Rob, that most of your customers can't spell Pneumalite.[®] But when it comes to seal, and the ultimate in comfort they know that Koss developed them.

“My wife Kathy was crazy about the Pro/4 Double A's. But the new Triple A's, wow! She can't get over how great they sound and how much more comfortable they are. ●●

Thanks Kathy... and Rob. We're sure you join us in inviting music lovers everywhere to write c/o Virginia Lamm for our free full-color stereophone and CM loudspeaker catalogs. Or to visit their Audio Dealer for a live demonstration of the Koss Pro/4 Triple A's. We're sure they'll agree with Rob, that when it comes to the Pro/4 Triple A, and other Koss stereophones and speakers: hearing is believing.

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KOSS[®] stereophones/loudspeakers
hearing is believing[™]

KOSS CORPORATION, 4129 N Port Washington Ave. Milwaukee WI 53212 International Headquarters Milwaukee facilities Canada France Germany Ireland Japan

ReVox B790

the beginning of the
second hundred years



True Tangential Tracking Turntable

In the one hundred years since Edison recorded "Mary had a little lamb" on a tinfoil cylinder, no one found a way to eliminate the mass of bulky tone arms.

Then Willi Studer developed the revolutionary ReVox B790 true tangential tracking turntable. It replaces the conventional tone arm and all its problems with a unique, patented opto-electronic playback servo system. The cartridge moves up, down and laterally guided by a beam of light. It's easy on your record grooves and easy on your nerves. It's so simple and goof-proof even a child can safely play your most treasured records.

The new ReVox B790 looks and performs better than any turntable you've ever seen or heard. To give it the ultimate test, bring your favorite record to your ReVox dealer for a demonstration. For complete information and the name of your nearest ReVox dealer, circle reader service number or write to us.

REVOX

THE BLACK MAGIC OF SIGNAL PROCESSORS

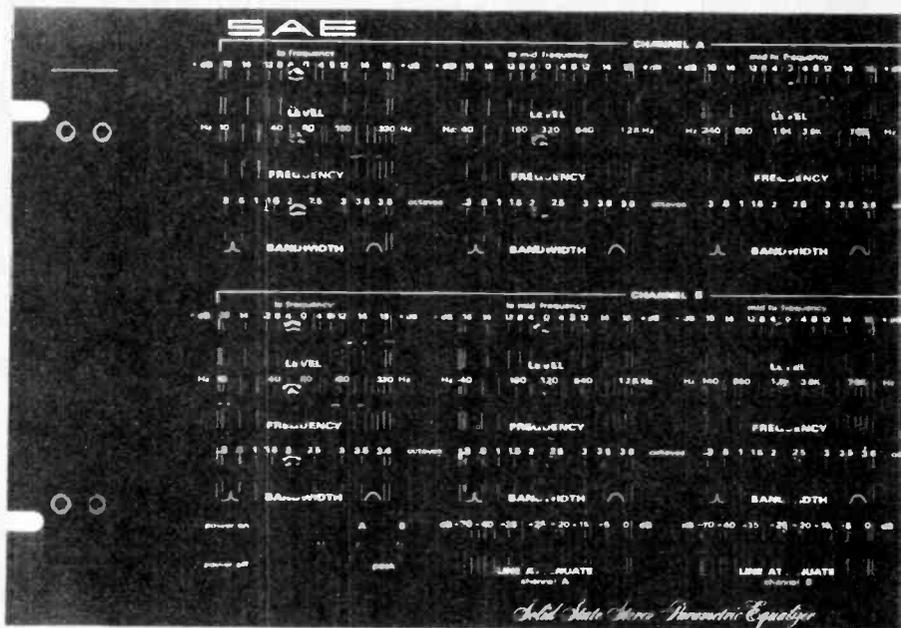
IMPROVE YOUR
SYSTEM'S
PERFORMANCE BY
ADDING ON ONE
OR MORE OF THESE
SOUND BALANCERS

by THE EDITORS OF
HI-FI STEREO BUYERS' GUIDE

Signal Processing. What a lovely term. It reads well, flows smoothly off the tongue, conveys a level of expertise even when used by the uninformed, and creates the mental image of professional sound studio use.

What, in the end, does it *really* mean? Bluntly put, signal processing is distortion—*desired* distortion, but distortion nonetheless. It means deliberate altering of the “original” sound (that is, the sound coming from whatever sound source you are using, be it recorded disc, tape, or AM/FM radio program material). Due to the mixdown process which is part of creating a multi-track recording, the program material you’re using will most often not be true to the way a live performance would sound. Given a means to manipulate the signal before it reaches your speakers, you may be able to re-tailor the sound to your liking. You also have the opportunity to make it far worse than when you started, adding undesired distortion to an already flawed musical selection.

Many years ago, RCA demonstrated a distortion-free amplifier. Using countless tubes, the device broke down the signal into many components so that all along the



signal path there was no real representation of the input signal. Somehow or other, they all came together at the output as a perfect replica of the input: distortion-free. This magic was accomplished by signal processing—systematic alternation of the signal waveform to attain a desired end result. That is, in a way, what you’re after in any signal processor you might consider using: a way to alter the signal without introducing new, undesired distortions while correcting old ones. (The amplifier mentioned above, incidentally, was never marketed. It was just a demo unit to show what could be accomplished by good engineering.)

There are many signal processing devices available in the hi-fi marketplace. Some are good, some are gimmicks. Some have a price tag resembling the price of a good used car, others can be purchased for pocket change. Tune up your ears, and be sure to bring them with you

SIGNAL PROCESSORS

when making your buying decisions.

Clicks, Pops, Scratches: Begone! You can find several devices designed to re-

move clicks, pops and scratches from disc recordings. It will allow you to take an old worn 78 rpm record, or one of the early LP recordings, and eradicate all the extraneous "rice crispy" sounds. Among manufacturers of these devices are Burwen, Garrard, and SAE. (See our *Spotlight On: Gar-*

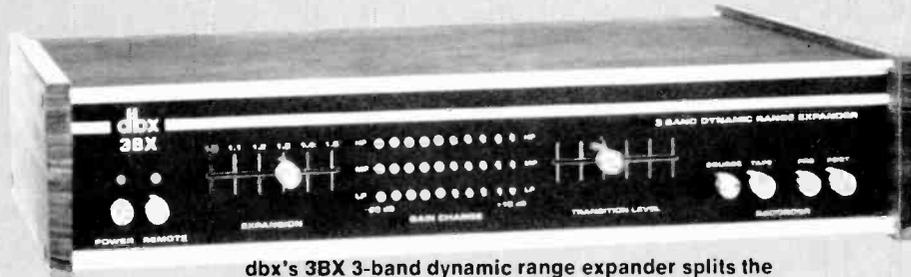
rard's Music Recovery Module, a feature to be found elsewhere in this issue).

Dynamic Range Expanders. Also in the signal processor category are devices designed to compensate for compression and limiting which occur while tape recording musical material at the recording studio. Simply stated, dynamic range expanders make soft sounds softer and the loud sounds louder, thereby creating wider dynamic range than is available through the untouched signal alone. Pioneer, dbx, RG Dynamics offer units of this kind.

dbx also offers a signal processor of another kind: the Model 100 subharmonic synthesizer, previously referred to as the Boom Box. It synthesizes frequencies between 25 and 50 Hz from program material above 60 Hz to give you the *feel* (right in the ribcage) as well as the sound of ultra-deep bass.

Ambience Simulators. Ambience simulators are designed to create the illusion of whatever sized concert hall you want for the music you are playing. Most units accomplish this through some combination of time delay techniques. Some simulator units generate more distortion than the reverb is worth. Others have such pinpoint control of the reverb that it is actually possible to simulate the acoustics of a large concert hall in a postage-stamp sized living room. (Some people may find it disconcerting to experience the sound of a 5000-seat auditorium in a 12 x 15-foot living room, but you can control the effect to suit your preferences.)

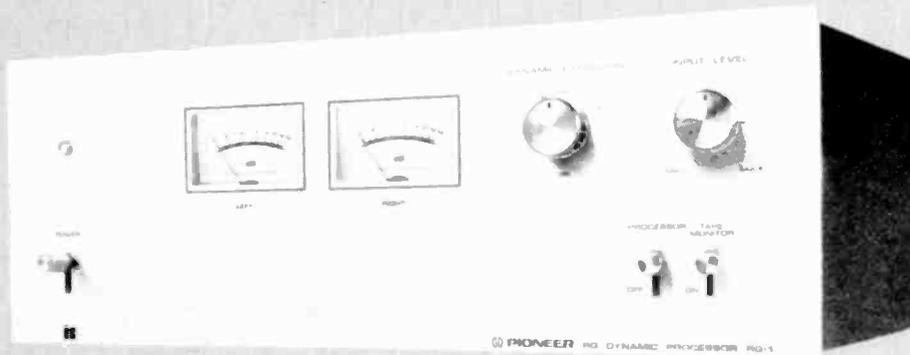
The important thing to watch for in any ambience device is any undesired distortion. You don't, for example, want harmonic distortion. The quality available from ambience devices varies from



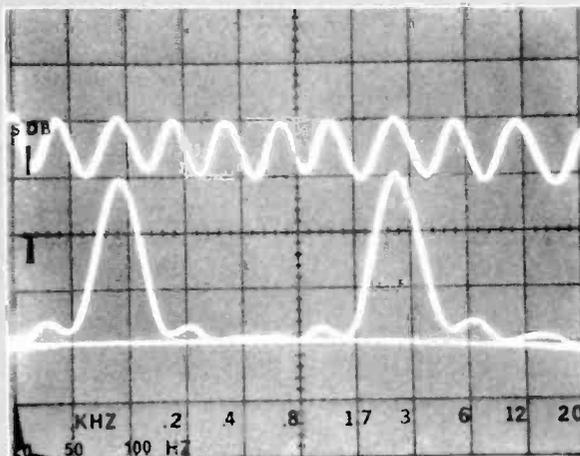
dbx's 3BX 3-band dynamic range expander splits the frequency spectrum into 3 bands and expands each band individually according to its content. \$650. Circle 127.



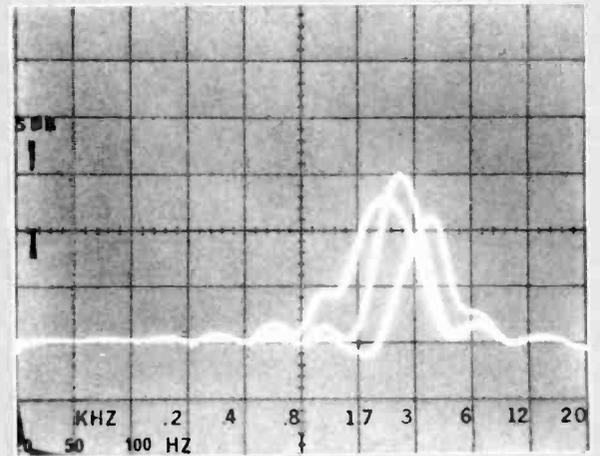
Audio Pulse's Model 100 Two digital time-delay system (\$539) has a built-in 25-watt amp. Secondary speakers are available for \$100 per pair. Circle No. 130.



Pioneer's RG-1 is a dynamic range expansion/noise reduction component. Its THD spec is .1% at 1kHz with 14 dB dynamic expansion. \$195. Circle Number 85.



1 At bottom: the straight solid line is the frequency response of a graphic equalizer, flat mode. The two peaks show 15 dB boost at 80 and 2500 Hz. Top trace shows all equalizer controls set at +15 dB.



2 Three traces were made with the 2500 Hz equalizer at +15 dB. Differences in response are due to use of the tuning control. We used full clockwise, centered, full counterclockwise positions.

very good to terrible in terms of harmonic and intermodulation distortion, so be certain to listen carefully (and not just for 30 seconds at a time) before you buy.

While all of the above are signal processors, most of the above mentioned units are relative newcomers to the audio marketplace. The term *signal processing* originated in the professional recording studios and described those pieces of equipment which modified the tonal characteristics of the sounds to be recorded, or of the listening room or auditorium in which the music was to be played. Tone controls which were used in professional recording studios, for instance, were referred to as signal processors. (The famous Pultec equalizer was a professionally used studio tone control.)

The two signal processors that live up to the professional definition of signal processing (tonal modification capability) are graphic and parametric equalizers, both of which can be used both in the recording and in the listening process.

Graphic Equalizers. The graphic equalizer — professional version — can boost or cut approximately 12 dB in narrow bandwidths of 1/3 octave. It requires 30 individual equalizers spaced 1/3 octave apart to cover 20 to 20,000 Hz. It is used to *tune* a room to specifically desired sound characteristics, generally "flat" to 8000 Hz and then a mild roll-off towards 20,000 Hz. (Contrary to popular belief, a room that is tuned absolutely flat produces an unnaturally "hot" sound.) The graphic equalizer is particularly effective at taming low frequency room resonances, the type that cause one or more specific frequencies to drone in the listener's ear.

As you might expect, anything with 60 equalizer controls is expensive. To reduce costs many full-octave graphic equalizers were introduced. With the equalizer center frequencies spaced a full octave apart 10 or 11 controls per channel are all that's needed to cover 20 to 20,000 Hz. In most applications the precision of the 1/3 octave spacing isn't required, and a full octave will suffice. In the event that a note or standing wave is so narrow that it cannot be handled by octave equalization, a device such as the Crown EQ2 will permit the equal-

izer's center frequency to be "rubbered" (slightly shifted) so it can be tuned anywhere within the full octave range.

The photographs illustrate how the graphic equalizer works. We used the Crown EQ2 graphic equalizer for our illustrations. Details on the performance of the equalizer are to be found in the Test Report. Keep in mind that while we illustrate only boost for clarity, a graphic equalizer provides both boost and cut: the EQ 2 is rated for ± 15 dB per equalizer. In Fig. 1 the straight solid line (two major divisions up from

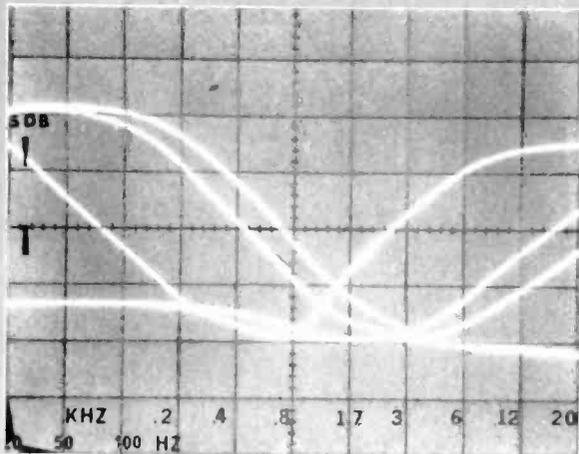


Garrard's Music Recovery Module removes clicks, pops, and other extraneous transient noises from damaged discs. \$220. See our *Spotlight* in this issue. Circle 70.

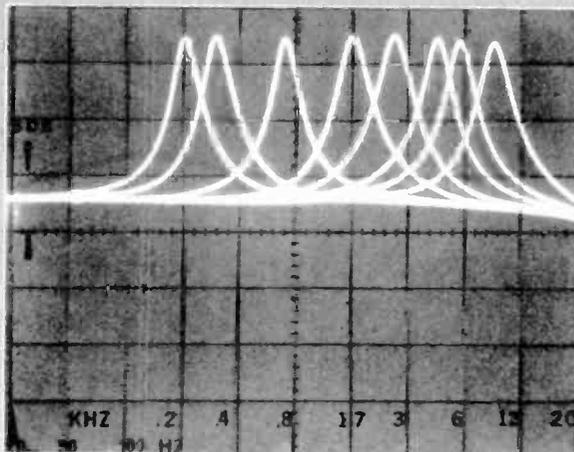
Burwen's TNE 7000 transient noise eliminator has both a sensitivity level control and a threshold level control. Price: \$299. Circle Reader Service No. 129.



SAE's Model 5000 impulse noise reduction system includes a threshold adjustment, a system defeat (bypass) button, a tape monitor switch. \$225. Circle No. 141.



3 These traces show the effect of varying the hinge frequency of the tuneable shelf tone control. Hinge frequency was set, in turn, to full clockwise, centered, full counterclockwise positions.



4 The eight traces here were achieved with a single parametric equalizer tuning control, which was adjusted to the extreme-end/frequencies, and to six random frequencies in between.

SIGNAL PROCESSORS

the bottom) represents the frequency response of the EQ2 in the flat mode. The two peaks represent full 15 dB boost at 80 and 2500 Hz. The top trace is the result with all equalizers in at +15 dB. Because of "overlap" the equalizer gains are additive so the maximum signal boost becomes 20 dB per center frequency.

Figure 2 illustrates the unusual "rubber" or "tuning" effect which can be attained with the Crown EQ2. All three traces were with the 2500 Hz equalizer at +15 dB boost. The differences are due to use of the tuning control (one is provided for each equalizer control). Traces reflect performance when this tuning control is adjusted full clockwise, centered, and full counter-clockwise. Note how the center frequency can be tuned towards the center frequencies of the adjacent equalizers.

To round out the EQ2, Crown also provides a tuneable shelf tone control as illustrated in Fig. 3. The EQ2 is presently the only graphic device combined with tone controls which can be used in conjunction with the graphic controls. There is but one bass and treble control per channel, but each channel has a tuneable, continuously variable "hinge"—the frequency at which the tone equalization commences. Figure 3 shows the hinge controls set full clockwise, the maximum tone control range with centered, and full counter-clockwise.

Because of the growing good reputation of the graphic equalizer, many "junior" models with four to eight

center frequencies are available in the hi-fi marketplace. Their capabilities vary tremendously and should be considered carefully with respect to your particular needs. See the feature on *Equalizers* elsewhere in this issue for a detailed discussion on this subject.

Parametric Equalizers. Cousin to the graphic equalizer is the parametric equalizer, called "para" for short. Used properly it has virtually no equal because of its performance/price ratio; abused, it results in absolutely disastrous sound.

Each channel of a parametric equalizer contains two or more frequency equalizers that can be tuned anywhere within a portion of the 20 to 20,000 Hz spectrum. The 20-20,000 Hz range is divided up so that each individual equalizer tunes a specific, non-overlapped, frequency range. Associated with each individual equalizer tuning control is an attenuator providing about ± 15 dB equalization and a *bandwidth control*. The bandwidth control adjusts the equalization so that it is very narrow, essentially the equal of a graphic equalizer, or very broad, much like back to back shelving tone controls.

Because the para is fully tuneable in terms of frequency and bandwidth you can easily pull off many tricks that would be much more difficult with a $\frac{1}{3}$ -octave graphic equalizer, and almost impossible with a 5- or 10-octave band graphic equalizer. For example, let's assume you find your listening room has a low frequency resonance at about 95 Hz that causes the bass to drone in your ear. Or maybe the resonance is around 250 Hz, causing a muddy, low definition sound.

Using a program sound source, you use about -6 dB equalization and slide the tuning control until you hear

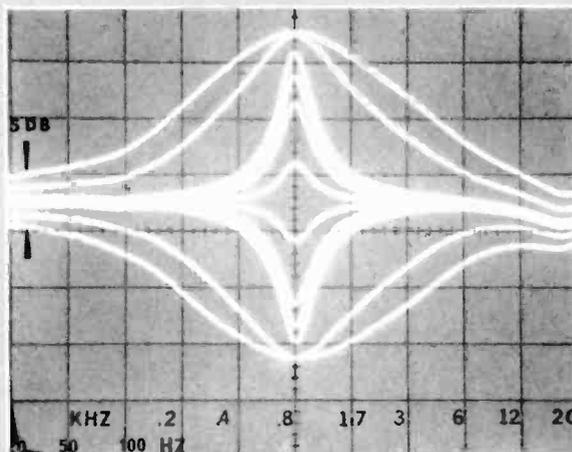
attenuation of the drone, or the definition improve. Then you carefully interact the tuning, bandwidth and attenuator controls to "clean up" the resonance. Alternately, if your sound source was deficient in low frequency information you would start with +6 dB equalization and tune to eliminate the strident sound.

Another example is that of moving a vocalist forward. You might feel that the vocalist on a recording lacks luster. That the performer is being buried under the instruments. With a para you could tune (at least one equalizer) to the "voice range" (within 80-1500 Hz) and using a broad bandwidth literally pull the voice forward. Or, we might tune down the frequencies around 500 Hz to tone down overall brightness.

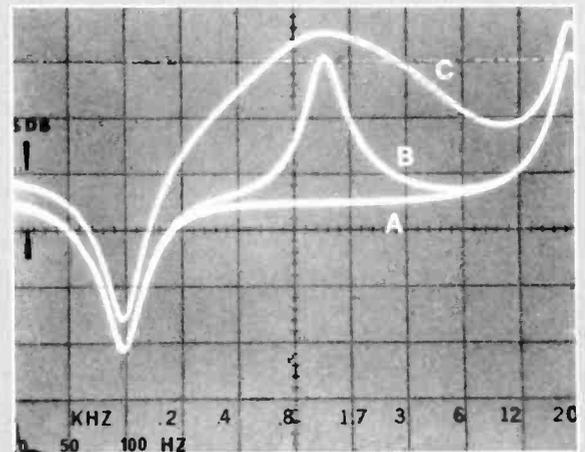
Figures 4 through 6 illustrate the unusual flexibility of a parametric equalizer. They were made using an SAE model 2800, which features four "para equalizers" per stereo channel. The basic "para" section consists of a tuning control that covers a 32:1 frequency range, such as 10 to 320 Hz; a level control providing ± 16 dB equalization; a bandwidth control that provides 0.3 to 3.6 octaves bandwidth. To use the *para* you tune one or more sections to the frequency or frequency band needing equalization and then adjust the level and bandwidth for the desired results.

Note Fig. 4. It shows eight traces which you might imagine were obtained using eight separate equalizer controls. In fact, all eight traces were achieved using a single *para* tuning control adjusted at the extreme end frequencies and six random frequencies in between. In use, the section can be tuned to any

(Continued on page 80)

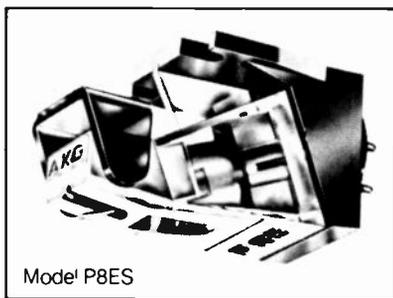


5 The four inner traces were made with the *para* tuning control at 800 Hz (narrow bandwidth), progressively increasing boost and cut. Outer traces show effects of increasing the bandwidth.



6 Demonstrating parametric's versatility: (A) Notch out 100 Hz and boost 20 Hz (narrow bandwidth). (B) Add full boost at 1 Hz (narrow bandwidth). (C) Maximally widen bandwidth at 1000 Hz.

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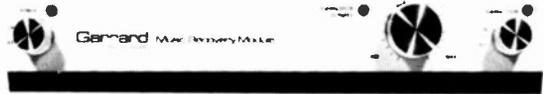
*Transversal Suspension System
U.S. Patent No. 4054758

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CIRCLE 5 ON READER SERVICE COUPON

GARRARD MUSIC RECOVERY MODULE

Circle No. 70 On Reader Service Card



SNAPS, CRACKLES, AND POPS DISAPPEAR FROM OLDIES RECORDS

□ "What! You *rutch* a stylus across a record and then play it back with nary a click or pop. Forsooth man! Ye invoke the devil himself and his black arts!"

"Nay. Not the devil. Rather, the Garrard Music Recovery Module."

True, it might seem like magic the way Garrard's Music Recovery Module (MRM) eliminates snaps, crackles, and pops, but it has taken the very latest in technology (not magic) to turn the trick.

The MRM is a black-box device that eliminates impulse noise when reproducing records. Unlike continuous record scratch, or tape hiss, which continuously overlays the program material and that cannot be suppressed other than by attenuating the highs—which also attenuates high frequency program material—impulse noise is a sharp transient that more or less stands alone from the program. By simply reducing the level of the noise impulse to that of the program just prior to the impulse it is possible to bury the noise into the program level, thereby effectively eliminating the noise impulse. In fact, impulse suppression systems which have been used in communications for many years, actually work by literally punching a hole in the signal. The hole is so small it usually goes unnoticed. To insure it goes unnoticed in Garrard's MRM, a small amount of low frequency signal is fed through at the moment of suppression, thereby in-

sureing total continuity of program content.

Figure 1 illustrates the *black arts* of Garrard's MRM. Both the top and bottom traces represent approximately 10 seconds of the same program material from a record with a *rutch* caused by the tonearm being dropped after having been lifted off the record. The record is also many years old, with a goodly accumulation of fingerprints, dust, grime, and some undefined residue of New York City atmosphere.

The top trace is that of the signal from the phono preamplifier as it is normally fed to the associated amplifier. The lower trace is the exact same program signal after processing by Garrard's MRM.

The very large spikes in the top trace are caused by the *rutch*, their nominal peak value is some 8 dB greater than the absolute peak value of the program material. (Imagine these 8 dB peaks socking it to your speaker and recorder.) The smaller spikes are *rice krispies* (snaps, crackles, pops).

Note that after processing—shown by the lower trace—virtually all the noise spikes have been eliminated. You can see an occasional mini-spike that sneaked through—like at 4.3 seconds in—but we've heard brand new records

with worse noise pulses. Otherwise, the processed signal is astonishing; it sounds at least as clean as a brand new record from some of the best labels.

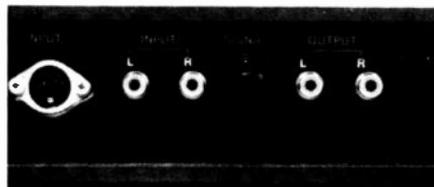
Imagine the possibilities! you can dig all those *oldies but noisies* out of the closet, process them through Garrard's MRM, and then make a perfectly clean tape copy. Considering what it would cost at today's prices to duplicate just a handful of your oldies transcribed to tape would more than justify the cost of the MRM.

How It Works. Punching a hole in a signal at precisely the right moment isn't really the easiest thing to accomplish (one good reason we haven't had audio MRMs until now). In the Garrard MRM it's done by using a *bucket brigade* delay to hold back the signal until special electronics locate the noise impulse and then set up the suppressor. The input to the MRM feeds an equalized phono preamplifier (the pickup connects directly to the MRM). The preamplifier's output is passed to a splitter; part of the signal is fed to the *bucket brigade* delay, the

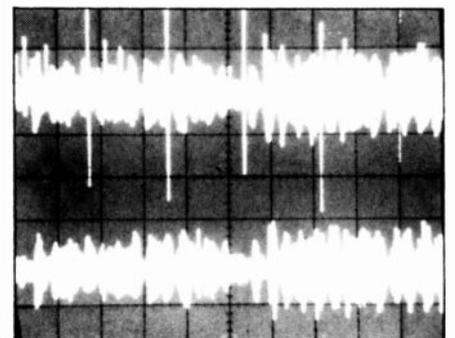
(Continued on page 80)



- The LED above the suppressor in/out switch simply indicates that the suppression circuit is switched in. The LED labeled SUPPRESSOR ACTIVITY flashes when the suppressor is active, that is, when it is eliminating clicks and pops. The threshold for suppression is set with the MIN-MAX control. Normally this control is advanced until the suppressor activity LED lights up. You can also just advance the threshold until you hear the degree of suppression you want.



- The input phono jacks on the back apron feed an equalized phono preamplifier. The outputs are at line level, and are generally fed to an amplifier's AUX input. The amplifier's normal magnetic phono preamp isn't used.



• Figure 1. These oscilloscope traces provide the best possible illustration of the effects of the Garrard MRM. The top trace 10 seconds of program material from an oldie. The spikes are noise pulses caused by a deep stylus scratch. The smaller spikes come from assorted other impulse noises. Below is a graph of the same material after processing by the MRM—clean as a hound's tooth.

THEY DON'T JUST FLASH AND GLITTER. HERE'S A LOOK AT THE WIDE VARIETY OF FUNCTIONS THEY PERFORM

by FRED PEIRAS

They're only an eighth of an inch in diameter, but they're brightening the world of audio components significantly—and doing it in color. More importantly, they're injecting audio components with new life—in the form of greater versatility, expanded operating capability, and heightened operating pleasure.

We're talking about LEDs—light-emitting diodes—those tiny, electrically-excited, cool-running, semi-conductor devices that are glowing from more and more audio components as the industry "discovers" their attributes. You see them in the form of dial pointers, moving across the face of tuners and receivers, helping to pinpoint a station quickly. You see them as rows of tiny lights that flash red if you've "cranked up" your amp into the clipping zone. They'll tell you that you can move the level control on the cassette deck two detentes higher for optimum dynamic range in the recording you're making. They reveal the degree of expansion occurring in your

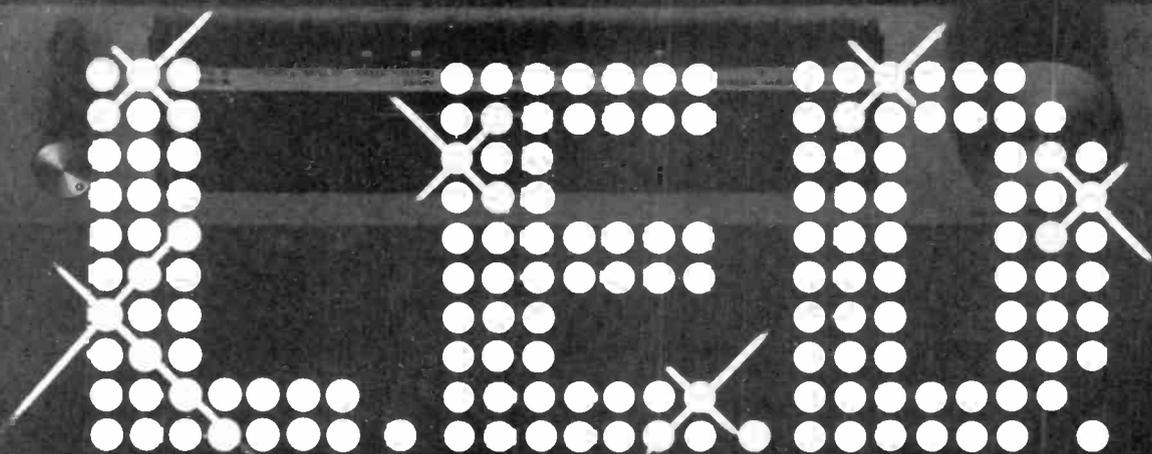
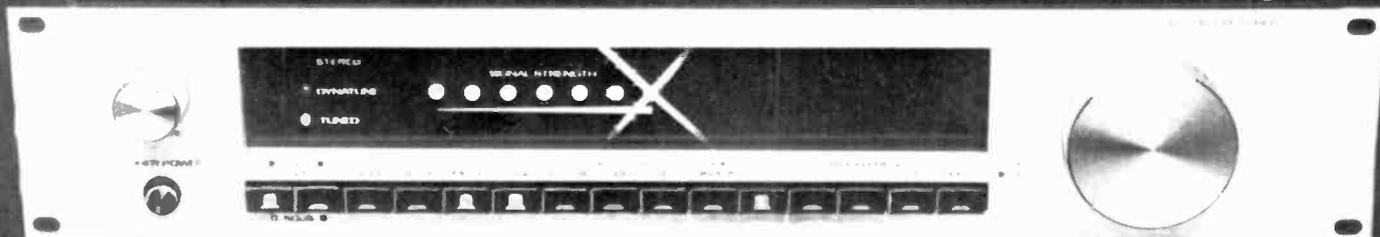
dynamic range expander; they indicate the relative content of low, mid and high frequency information in reproduced program materials; and they read out the operating characteristics and mode functions of various other audio components, including time delay systems.

While LEDs have been around for a few years in the audio component field, initially they served mainly as simple mode indicators. It's just recently that they've "taken off" in a big way. There are three key reasons. One, they are practical, highly sensitive devices for accurate input and output signal level readings; that is, they give true peak readings, unlike meters which give average level readings. Two, they can be color-coded for instantaneous recognition. In the words of Mel Kaplan, vice president of Rotel, they can be "set up to read green for *Go*, or *Safe*, and red for *Stop*, or *Danger*, which you can't do nearly as well with meters." Three, they are a new "cosmetic" concept, important in an in-

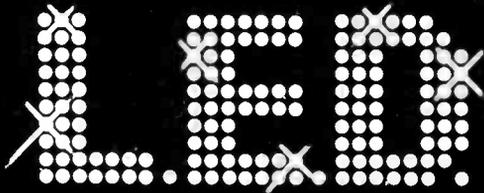
dustry where changes—external as well as internal—are among keys to survival. To many audio buffs, LED readouts are more appealing than meters (which are now considered "old hat" in circles where state-of-the-art is the buzzword).

Cassette Decks. LEDs have been used for some years in tape recorders, but their application has been limited to a single unit—as a peak indicator that flashes a warning that distortion is imminent. Today, a handful of cassette decks sport a series of LEDs, for comprehensive monitoring of the signals being inscribed on a tape.

JVC is perhaps the leader in the use of LEDs in tape equipment. Initially, the firm in 1975 offered a deck with five LED indicators covering a dynamic range from minus 10 dB to plus 6 dB. Now JVC is offering models with one bank of five LEDs, two banks of five LEDs, and two models with 25 LEDs each. The 25-LED system is called the "Spectro Peak Indicator" and consists of LEDs arranged in ver-



INDICATORS



tical bars of five frequency ranges—100, 300, 1,000, 3,000, and 10,000 Hz. Their dynamic range is indicated in increments of plus 6, plus 3, zero, minus 5, and minus 10 dB. This permits a cassette recordist to visually monitor the high frequency peaks that are likely to cause distortion. He is immediately warned of distortion before it occurs, and can make appropriate adjustments to prevent it. Since the Spectro Peak Indicator has 25 peak-reading LEDs—each one responding within one millisecond—he has much more control than if he depended on VU meters alone. An LED's rise/fall time is 300 times quicker than that of an ordinary VU meter. The JVC multi-LED peak indicator, the company claims, can also respond to brief-duration pulsive signals—and register them accurately, while VU meters cannot. On playback, the Spectro Peak Indicator displays the frequency spectra of

the reproduced music, letting you know at a glance if the music is bass-rich, mid-rich, or otherwise.

Rotel in its new Model RD-2200 stereo cassette deck uses 26 LEDs arranged in two rows for peak level readings, in a range from minus 20 to plus 6 dB. The essential visual effect is that of a double bar graph.

Dual in its Model C-939 cassette deck (now considered a "classic"), places two banks of 12 LEDs on a single plane, one row for each channel. Individual LEDs read input levels from minus 20 to plus 5 decibels, with seven lighting green, five red. The LED display is housed in a tilt-up section that can be positioned for easy reading in any of the positions in which the set is used (angled, horizontal, vertical). In addition to dB indications, the 939 display also includes percentage-saturation readings. The LEDs can be operated two ways—in the VU mode for average level reading, or in the peak mode for reading level peaks. For still more insurance against distorted recordings, a special limiter can be switched in to protect against overload—without compressing normal dynamic range.

LEDs can also serve in other capacities in tape equipment. Nakamichi, for example, uses two LEDs for record head azimuth alignment. When improperly aligned, only one light flashes; when alignment is perfect, both lights flash, alternately. This feature is offered in the Nakamichi Model 1000 II and Model 700 II.

Mitsubishi in a new series of elegant micro-components introduced last June, offers LEDs in the Model M-PO1 pre-amp for indication of tone control settings. The system utilizes a bank of eight LEDs for bass settings, and eight for treble settings. Each bank is arranged in 1, 2, 4 and 6 dB increments, plus or minus (boost/cut) from a flat reference.

Tuners. The firm also employs LEDs in a matching FM tuner, Model M-FO1. Here a series of five LEDs provides signal strength indication, and three show center tuning. Mitsubishi also uses the same approach in a regular sized FM tuner, the Model DA-F20.

SAE recently boarded the LED bandwagon via its Model 3200, in which five LEDs show signal strength readings, and three indicate center

Eumig's CCD cassette deck employs an LED light source in its capstan drive control. LEDs are also used in its peak reading record/playback and function indication. \$1300. Circle 126.



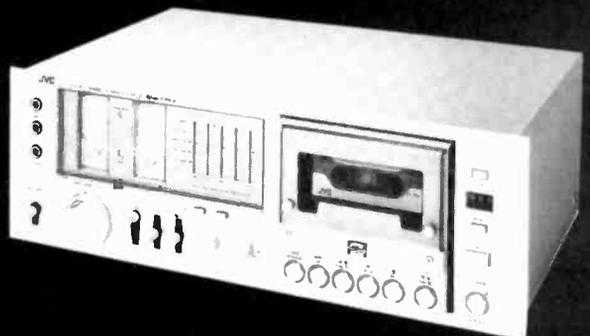
Pioneer's CT-F900 cassette deck utilizes a microprocessor in its record/play level display. Owners use a switch to select average VU display or peak indicating display. \$475. Circle 85.



CASSETTE DECKS

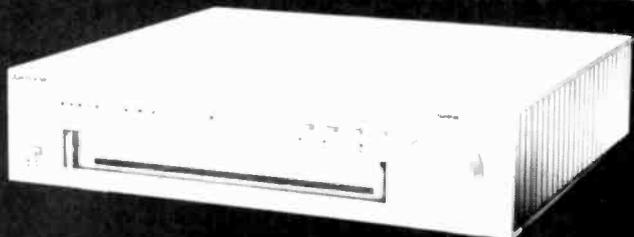


Rotel's RD-2200 cassette deck features LED peak level indicators. Also included in the package are user-adjustable bias, Dolby noise reduction, cue/review facilities. \$390. Circle 87.



JVC's KD-85 cassette deck includes a 25-LED Spectro Peak Indicator, which indicates levels (—10, —5, 0, +3, +6 dB) of 5 frequency ranges (100, 300, 1,000, 3,000, 10,000 Hz). \$500. No. 74.

Mitsubishi's M-F01 FM tuner has an LED signal strength tuning meter, an LED tuning lock indicator, and an LED stereo reception indicator. \$320. Circle Reader Service No. 78 for details.



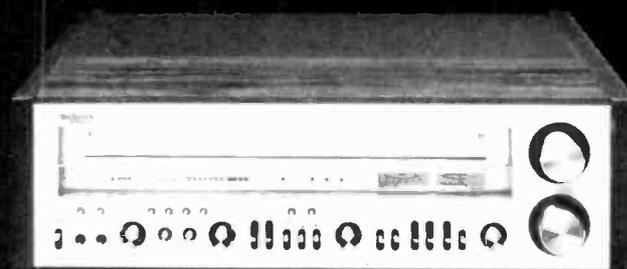
Nikko's Gamma V FM tuner has LED station frequency readout and LED signal strength indicators. Also included are six-station memory and muting threshold control. \$650. Circle No. 79.



RECEIVERS/TUNERS



Toshiba's SA-7150 receiver has LED signal strength indicator, digital LED station readout, LED-indication of Dolby reception, stereo reception, station memory, speakers A/B/C. Circle 99.



Technics' Model SA-100C receiver offers a 12-lamp LED power level indicator for each channel. Program source is also indicated by LED indicators. \$1500. Circle Reader Service No. 98.

tuning.

Nikko, in its Gamma Five synthesized digital FM tuner uses five LEDs for signal strength indication, and one for indicating the stereo operation mode. Lux Audio in its Luxman Model T-12, applies LEDs in a similar fashion.

Seven LEDs are utilized by Rotel in its Model RT-2100 FM tuner for signal strength readings. At the flick of a switch these LEDs will indicate multipath interference in the received signal. The set also uses LEDs for center tuning.

Lux Audio in its Luxman 5T50 frequency-synthesized digital stereo FM tuner puts LEDs to a new use; station tuning is indicated in two ways—a digital readout, and a separate LED display that indicates both MHz and each 200 kHz interval.

Toshiba, in addition to utilizing three LEDs for signal strength indication in its new ST-910 digital synthesizer FM stereo tuner, also uses three more for muting level indication.

Finally, we have Dynaco employing a bank of seven LEDs for signal strength indication in its Model 2501 digital varactor FM tuner. The LED display range covers 60 decibels, in 10 dB increments.

Amplifiers. LEDs have also appeared in amplifiers for some time, as power indicators in lieu of traditional meters. Among pioneers in this area is

Harman Kardon, which designed two banks of eight LEDs—one bank for each channel, into its Citation Model 16A power amplifier. Each bank is arranged diagonally, to combine into a shallow "V" configuration on the panel. There's an LED for each channel reading for zero, and minus 3, 6, 9, 12, 18, 24 and 30 dB. The high figure readings are via green LEDs, the 6 and 9 dB settings via yellow LEDs, and the minus 3 and zero readings are via red LEDs.

SAE puts LEDs to work for output level readings in three of its amplifiers, Models 3100, 2200/2300, 2400L, and the Model 2100L preamplifier. The 3100 has a single bank of 17 LEDs for both channels, with eight readings per channel in decibels as well as watts. The other three models have twin banks of 15 LEDs, also marked for decibel and watt readings.

Rotel has been using LEDs for some time, and now incorporates them in three of its integrated amplifiers, Models RA-2040, RA-2030, and RA-2020. Each unit has two rows of 13 LEDs, one row for each channel, to show power levels in a bar graph configuration, at full power or minus 20 dB. The company also uses LEDs in conjunction with meters in its deluxe 500-watt-per-channel Model RB-5000 power amplifier. The meters offer average power readings and the LEDs provide instantaneous peak power in-

dication. Power level readings can be made at one-quarter, one-half, or full power, at the flick of a switch.

Nikko recently joined up-to-the-minute manufacturers using LEDs via its brand new Alpha Three MOS FET LC power amplifier. It has two vertical rows of 13 LEDs, color coded in red and green for instant and accurate power level readout for each channel.

Two layered horizontal banks of eight LEDs appear in Dynaco's new Model 2521 100 wpc power amplifier, just as they appeared in a forerunner, the Model 416 of a year or two ago. Each channel's levels can be read in decibel or percentage form, from 0 to minus 21 dB, or 0.78 to 100 percent. A push-button two-stage range switch alters the decibel readings by minus six and minus 12 decibels for more comprehensive readouts.

One of the most significant new audio products of 1978 also features LED readouts. It is the Threshold Model Stasis 1, a single-channel, feed-forward, error nulling power amplifier whose design end-result is a spec of 0.02 percent distortion—comparable to the residual of test equipment. Used in this unit are 14 LEDs for peak output display—11 for average output level readings, and six for various mode indications. Threshold also features LEDs for individual channel peak level readout in its Model 4000 full cascade/Class A stereo power amp. In



this case a dozen LEDs show peak readings for each channel from minus 20 to plus 2 dB. Nine additional LEDs serve for average level readings for each channel. The firm's Model 400A Class A power amp also has an LED display, consisting of nine-LEDs-per-channel for peak readings, and seven-per-channel for average level readings.

Receivers. To the best of our knowledge, Lux Audio was the first company to utilize LEDs for peak power level output readings in stereo receivers. They appear in that firm's Luxman Models R-1040, R-1050, and R-1120. In each model two banks of six LEDs are used, one bank per channel, with readings from 0 to minus 18 decibels.

Now offering similar equipment is Technics, with LEDs in five newly-introduced receivers, including the 330 wpc Model SA-1000. The SA-1000, plus Models SA-5000, SA-700, and SA-800, use two end-to-end banks of 12 LEDs in red, green, and yellow coloration. The Technics Model SA-600 uses a single line of 11 LEDs, five for each channel, plus one for zero dB reference.

Toshiba has also climbed on the LED bandwagon, incorporating them in its deluxe digital synthesizer receiver, Model SA-7150. In this case they are limited to the tuner section, with five LEDs providing signal strength indication.

Thirty LEDs are put to work in the dbx Model 3 BX three-band dynamic range expander. The unit splits the audio frequency spectrum into three separate bands, and each band is expanded linearly in decibels, according to the energy content within that band. The readout of 30 front panel LEDs, 10 for each frequency band, gives a continuous display of the upward and downward expansion occurring in each frequency band via yellow and red colors. The set also has an LED for each of two function controls—power, and remote.

Peak Level Indicators. Among the most singular LED-oriented products in the audio field are the Model 510 peak responding LED display from Audio Technology, the Model PMS-1 professional metering system from Uni-Sync, Inc., and the Luxman Model 5E24 LED peak indicator from Lux Audio. The 510 features two rows of 10 LEDs in a layered horizontal arrangement, calibrated from minus 39 dB to plus 6 dB, to display the peak value of complex audio waveforms to an accuracy of plus/minus 0.25 dB.

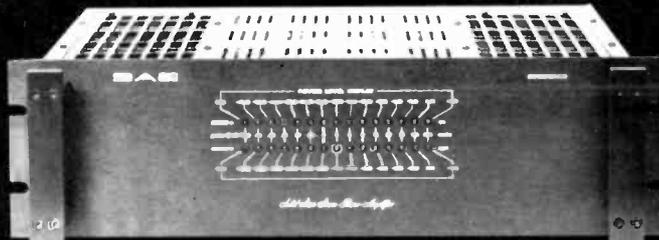
The instrument was designed to measure peak level input signals (pre-amp output, tuner output, tape recorder input) or peak output from a power amplifier. A front panel switch selects either mode. In the power mode, the Model 510 is capable of accurately measuring peak power amplifier output from 0.00085 watts to 1,600 watts. In the line level mode each input is independently and continuously variable over a range of 50 mV to 5V for a 0 dB indication. The PMS-1 uses two end-to-end rows of 12 LEDs in a slencher-profiled unit for the same basic function as the Model 510. Ten LEDs are calibrated in 10 percent increments, with one performing to indicate *peak*, and one to indicate *ready*. The LEDs glow red, yellow and green. The Luxman unit is similar in appearance and layout to the Uni-Sync but contains a range switch that provides two power-reading sensitivities (0 dB = 20 watts or 200 watts), and two ranges for voltage readings (0 dB = 1V or 0 dB = 0.316 V). The set also has a peak hold button that keeps the highest-reading LED (above minus 18 dB) illuminated until a higher signal level is reached or the control is released.

Time Delay Systems. Time-delay systems are a "natural" for harnessing LEDs, judging by the current product (Continued on page 82)

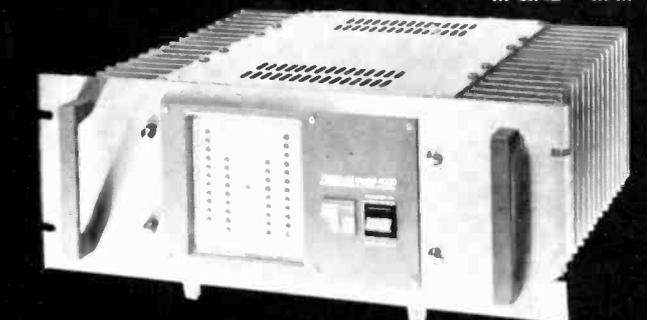
BGW's Model 410 power amplifier offers two arc-shaped LED displays which serve as power output indicators for each channel. Rated output is 200 watts per channel RMS. \$799. No. 128.



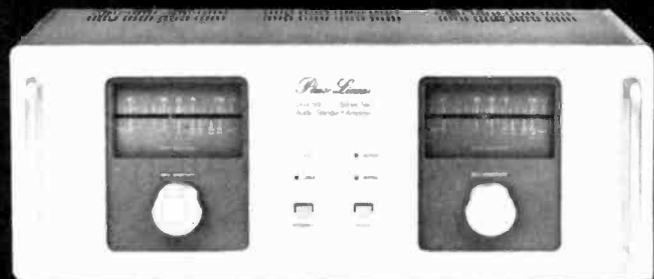
SAE's 2300 power amplifier includes an LED power level display. Its rated output is 150 watts per channel RMS into an 8-ohm load with no more than .05% THD. \$700. Circle No.141



AMPLIFIERS



Threshold's Model 4000 power amp offers two LED displays per channel. 12-lamp displays indicate peak power output, while 9-lamp displays indicate average power output. Circle No. 125.



Phase Linear's Dual 500 Series Two power amplifier is rated at 505 watts per channel RMS, and includes peak responding LED power output indicators. \$1350. Circle Reader Service No. 124.

NOISE REDUCTION DEVICES

by ALFRED W. MYERS

As audiophiles and hi-fi hobbyists become increasingly more sophisticated, we become equally more demanding in terms of the amount of noise and distortion that is acceptable. Of course, zero noise and zero distortion is the ideal that we would like to have as "standard." But, given the limitations of current audio technology, these ideals are still in the future. Once we can accept the fact that noise exists, we must find ways to either totally eliminate it or, at least mask it so that it can not intrude upon our enjoyment of music.

The various components used to deal with noise are generally termed processors, and today you can buy such devices to expand a program's dynamic range, remove clicks and pops as well as doing away with what is probably, to many people, the most annoying noise—tape noise. This is the hissing sound heard during quiet (or blank) portions of a taped program. Don't be misled—it is there during loud passages too, but it is masked by the volume of the audio signal. During soft music the hiss comes through as a steady sssssssss sound.

Although tape noise has always existed, we were made acutely aware of it when Philips introduced their cassette deck back in the sixties. Actually, when Philips initially unveiled the cassette format it was meant for dictation and speech—certainly it was not capable of high fidelity reproduction. But, an Englishman by the name of Ray Dolby changed all that, and when Advent brought out their first cassette deck with built-in Dolby "B" circuitry, it marked the start of a new era in audio and opened the world of tape recording to tens of thousands of audio enthusiasts who previously had never gotten involved with tape.

Dolby Noise Reduction

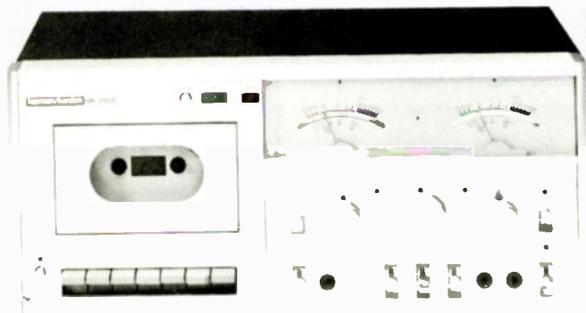
Obviously, tape hiss can be eliminated by simply turn-

ing down the treble control on your pre-amplifier or receiver or, if your equipment is so endowed, punching in the scratch filter. Both of these remedies also greatly reduce high frequency output. Bearing in mind that the high frequencies are the most difficult to accurately record in the first place, a further reduction in high frequency response is far from an ideal solution. So, we come to Dolby which, unlike a simple scratch filter, is a two-step process in which the tape is *encoded* during the recording process and *decoded* during playback.

Because the tape noise that Dolby is meant to correct is generated during the recording process, Dolby can do nothing about noise that already exists in a program you may be taping. In the Dolby process, low level (soft volume) signals in the mid and high frequency ranges are boosted by specifically controlled amounts before they reach the recording heads. This is known as *pre-emphasis*. Then as the music is recorded (in its boosted state) the noise (which has not been boosted) is also recorded. Although you are recording both music and noise, the musical signals are now considerably louder than the noise. Were you to play back the recorded signal at this point (without proper Dolby decoding) you would have an unnatural sound with the high frequencies being too dominant. However, when the Dolby-ized tape is played back through the Dolby decoding electronics, the low level signals that were previously boosted are now cut back in proportionate amounts (known as *de-emphasis*). Since the tape noise was added to the recording *AFTER* low level boosting, it is now also cut back bringing it considerably below the threshold of audibility. In this manner, the original dynamics and frequency range of the program is left intact, while tape noise is reduced anywhere from 10 to 15 dB. Because loud volume musical passages cover up the tape hiss anyway, the Dolby "B" differs from the professional Dolby "A" system which operates over the entire frequency range.

Dolby units were originally available as add-on devices, but now almost all high fidelity cassette decks are equipped

NOISE REDUCTION DEVICES



It's your choice whether you want 24dB or 30dB noise reduction. JVC's 24dB noise reduction system is available on the JVC CR-77.

NOISE
REDUCTION
DEVICES



with built-in Dolby noise reduction circuitry. One component manufacturer, JVC, offers a similar system, called ANRS, which is compatible with Dolby.

In theory, your built-in Dolby system arrives in your living room in perfect alignment to your cassette deck. It has been calibrated at the factory to perform optimally with the reference tapes chosen by the manufacturer. (Recommended tapes are to be found in most cassette deck owner's manuals.) Especially when using tapes other than the specifically recommended types, you will be well advised to check the Dolby calibration.

In short the quickest and easiest way to check the Dolby calibration is to record interstation hiss from your FM tuner, with Dolby on and then with Dolby off. Then play the recording back and listen for changes in the character of the hiss when you proceed from the Dolby on to the Dolby off portion. If there is relatively little difference, no need to worry. If you can hear changes in the relative dullness or brightness of the hiss, your Dolby calibration needs adjustment.

An increasing number of Dolby cassette decks are sporting user-adjustable Dolby calibration systems on their front panels. By following the instructions in the owner's manual, you can adjust your built-in Dolby to perform optimally with whatever tape you've chosen to use. Those decks that come without such a provision are meant to be set by a serviceman, when recalibration is necessary.

Recently, Dolby FM broadcasts have become popular, although the number of FM stations using Dolby are in the minority. Several cassette decks now available have Dolby-FM switches for automatically decoding Dolbyized FM transmissions. Also, there is a growing number of stereo receivers as well as FM tuners that have built-in circuitry to properly decode these broadcasts.

The dbx System

A second type of tape noise reduction which is becoming quite popular is the dbx compression/expansion approach. Although the principle aim of dbx, like Dolby, is to do away with tape noise, the manner of operation is totally different. While Dolby pre-emphasizes some

frequencies at some volume levels, dbx compresses all of the incoming sound on a 2:1 ratio. So, the signal is compressed before the recording is made and the tape noise is then recorded along with the compressed signal. Playing back a dbx-encoded tape at this point (without proper decoding would yield a totally unintelligible sound). But, when the tape is played back through the dbx unit, the previously compressed signal is expanded (on a complementary 1:2 ratio) back to its original level. When this happens, the tape noise (which was not compressed) is also expanded, downward, to the point of inaudibility.

One of the nicer things about using dbx is that there are no alignment or calibration procedures to follow. Although dbx compressors do have "play and record level match" potentiometers, they are used just to match the volume levels to associated components. Their settings are not critical—incorrectly setting these controls will have no adverse bearing on the operation of the dbx circuitry. Unlike Dolby, when you use dbx for taping, you continue to have full use of the tape recorder's output and recording level controls.

Because the dbx compression and expansion is linear,



The dbx 128 is an add-on device which combines a dbx noise-reduction system with a dynamic range enhancer. About \$450. No. 127.

KLH/Burton Research offers the DNF1201A, a variable low-pass filter which processes tape, disc, or FM broadcast material. \$379. No. 146.



USE SECTION
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Phase Linear PL-200 Stereo Variable Noise Reduction System. Includes a dynamic range enhancer system. \$350. Circle Number 145.

operating across the entire audio range, there is none of the breathing and pumping side effects so often encountered with earlier versions of the compander. By not having any threshold at which the circuitry takes effect, and by compressing everything, the original signal is reduced to one half of its original value—yielding an additional 10 dB “headroom” on the tape, while also giving you a 30 dB reduction in noise. The dbx method of compression and expansion can be far more useful to the recordist than just removing tape noise.

If this were a perfect world, we would be able to record the sound of a live performance (with an imaginary dynamic range of 100 dB) with absolutely no tape noise (hiss) or distortion caused by tape saturation. Unfortunately, even the best audiophile tape recorders are limited to a dynamic range of about 60 dB—and allowing a safety margin of 10 dB for musical transients and peaks means that you are faced with the task of trying to record a program with a range of 100 dB into a format with a limit of 50 dB. The same problem is faced by the professional recording engineer, although they have some tricks to help them do it. They can ask the musicians to play less loudly,

(Continued on page 79)

Checking with several audio equipment dealers has yielded a list of the six most often asked questions about Dolby and dbx:

(1) I have a cassette deck with built-in Dolby. Should I add dbx?

The main objective of both Dolby and dbx is to mask the audible hiss of a tape recording. Both Dolby and dbx do this very well, but in totally different ways. Using the two systems together would not result in a greater degree of noise reduction. In fact, dbx cautions that any irregularities in the Dolby circuitry would be magnified by the dbx unit. However, should you want to record a program with a very wide dynamic range (live recordings or some borrowed direct-cut discs) then it is almost imperative that you use dbx.

(2) If I make a Dolby recording on my cassette deck and give it to a friend, will it sound O.K. on his Dolby deck?

In theory all Dolby play-back circuitry is perfectly compatible (otherwise, pre-recorded Dolby-ized cassettes would be impossible). However, neither Dolby nor dbx can make a silk purse out of a sow's ear. If you record a program on an expensive Nakamichi deck and play it back on a low quality “budget” deck, don't expect to get Nakamichi results.

(3) Can either of these noise reduction systems be used to eliminate noise that already exists in a musical program?

No.

(4) Can I use a dbx compressor/expander to expand the dynamic range of a conventional recording?

Only with the dbx model 128 which is a combination dynamic range expander and tape noise reducer (compander).

(5) I have a medium quality open reel deck with no internal noise reduction circuitry. Will I benefit from adding Dolby or dbx, or are they meant mostly for cassettes?

Since open reel tape recordings have a lower amount of noise (than cassettes) to begin with, the improvement will be less noticeable than with cassettes, but there will be improvement—especially at the slower recording speed of 3¾ ips.

(6) Since Dolby “B” circuitry boosts high frequencies during recording and cuts back during playback, can not the same results be achieved with the high frequency bands of an octave equalizer?

No. Although the action of Dolby “B” is, in simple terms, a combination of boosting and cutting, it is also dependent on signal level (amplitude) to determine the amount of required boost and cut.

Opera

For Today

Jon Vickers

by Spreight Jenkins

□ A little more than 18 years ago, on a March night still vividly alive in my recollection, the Canadian tenor Jon Vickers

not become reality. Vickers simply did not want to be another Melchior, and he chose to handle all Wagner with exceed-

1958, when he was Jason to the famous Dallas Medea of Maria Callas, and shortly thereafter he sang his first Aeneas in Berlioz' monumental *Trojens* at the Covent Garden (London) performances that rescued the Berlioz masterpiece from oblivion. But as with so many other singers, it was the Metropolitan Opera that made him into an international tenor. His debut there took place in January of 1960, not in German opera, but as Canio in *Pagliacci* (a role he has only sung some 5 times in his whole Met career).

As Canio he proved his voice was loud and had color, but it seemed a little harsh and not too Italianate. Later that month he sang his first Florestan in the new pro-



Vickers is unexcelled in roles which allow him to bring out in his voice characteristics of wounded manhood.

duced his first Siegmund in Richard Wagner's *Die Walküre* at New York's Metropolitan Opera. Nine curtain calls greeted the tempestuous conclusion of Act I, and to hear the intermission talk the audience seemed sure that with that season's debut of Birgit Nilsson the new Wagner team had been created. In the 1960's, we thought, it would be Nilsson and Vickers for Wagner just as Flagstad and Melchior had ruled the Wagner roost in the '30s.

Certainly the next act, the thrilling "Death-Announcement Scene," the only moment when Breunhilde and Siegmund sing together, seemed to carry out the dream, but the dream did

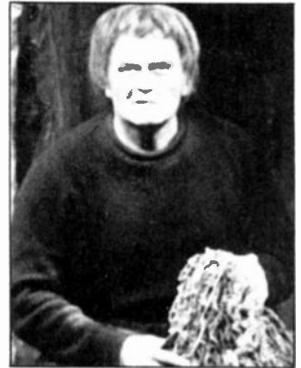
ing care. It was the first of many interesting career decisions for this complex tenor, surely one of the most difficult and fascinating artists ever to appear in opera.

Vickers was never a lumberjack. Someone once misread an early bio, and he is forever referred to as a one-time Canadian lumberjack. That he looks as though he could have been a lumberjack is unquestioned and that he did some work on a farm for several summers when he was a young man is true, but he never was a lumberjack. A product of Canada with training in England, he began his career singing Bach and Handel. His first major notice in opera came in



Jon Vickers' voice is a mixture of intellect and emotion—100% virile and yet also very vulnerable.

duction of *Fidelio*, and stardom was assured. In this opera one heard immediately his power and lyricism. At his best, Vickers has an immense, full,



One of Vickers' most well known roles, Peter Grimes in Benjamin Britten's opera of the same name.

true tenor; he can refine the tone to a bona fide, sweet pianissimo and can sing at every dynamic range in between. His voice has personality and interest, is 100 percent virile and yet very vulnerable, and always projects intellect and emotion in equal quantities. Vickers rarely if ever indulges in grandstanding, that is, holding or interpolating high notes. He sings with great musicianship and there is never a moment when a listener who knows the material can doubt that the tenor has thought through every note of his performance.

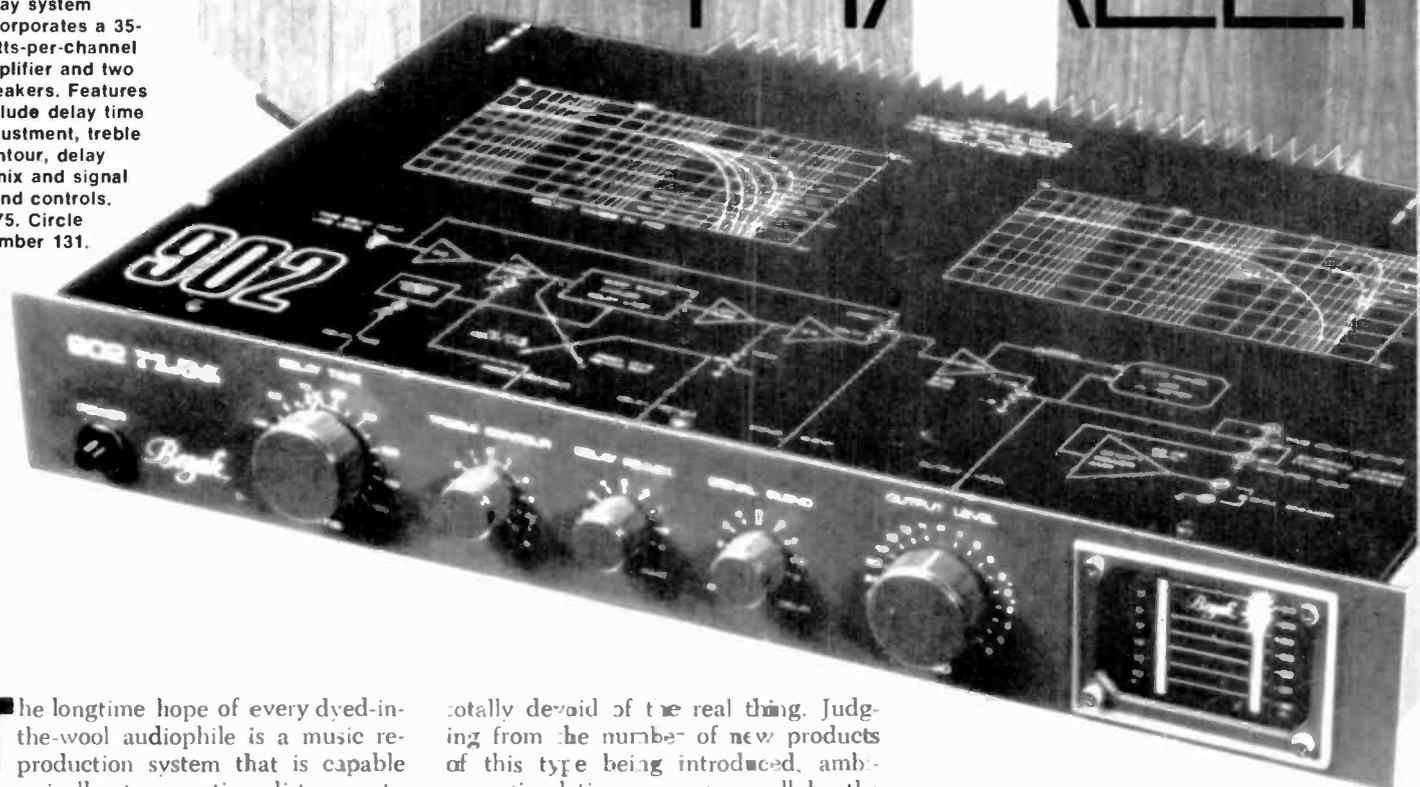
Indeed, his thinking is what has sometimes made him less than ideal, at least to this listener. Vickers is unexcelled in roles such as Florestan or Siegmund which allow him to bring out in his voice all those characteristics of wounded manhood that he can perfectly convey. Actually a loner, he often seems to feel himself put upon and an outcast, thus making him a perfect

(Continued on page 77)

Abracadabra:

CONCERT HALL!

Bozak's 902 time delay system incorporates a 35-watts-per-channel amplifier and two speakers. Features include delay time adjustment, treble contour, delay remix and signal blend controls. \$975. Circle Number 131.



The longtime hope of every dyed-in-the-wool audiophile is a music reproduction system that is capable of sonically transporting listeners to the hall where the live performance is taking place. We continually hope to recreate in our own living rooms the immediacy and excitement of a real concert. We aspire to surpass the merely average two-dimensional stereo panny.

The new raft of ambience simulators and restorers on the market promise to save the situation either by extracting the ambience information hidden within the recordings—stereo as well as quad—or by artificially creating a synthetic ambience should the record be

totally devoid of the real thing. Judging from the number of new products of this type being introduced, ambience simulation may very well be the wave of the future.

Setting up an ambience-simulation system is hardly an inexpensive proposition. If you already own a four-channel system, you're well on your way. You need only buy the ambience-simulation device itself. If your system is still strictly stereo, you'll need another pair of loudspeakers and a second power amp to drive them. To take some of the financial sting out of this, some simulators have power amps built in and are accompanied by a pair of speakers for the rear. They may be the

by WILLIAM S. GORDON

**THESE LITTLE BOXES
CAN CREATE THE
ILLUSION OF ANY
SIZED PERFORM-
ANCE HALL YOU
CAN IMAGINE**



The Audio Pulse Model One digital time-delay system comes without amplifier or speakers. Pushbutton controls allow for level match, initial delay and decay time adjustment. LEDs provide peak input level display. \$699. Circle 130.

CONCERT HALL!

best choice for upgrading a stereo system but are hardly a good buy for those who already have a 4-channel setup.

Fortunately, the rear-channel speakers for ambience simulation need *not* be as wide-range as your primary stereo speakers. They should, however, be of high quality in the region in which they operate. On most simulators, there is little rear-channel information above 6 kHz to 8 kHz—there is a natural high-frequency rolloff in the ambient sound field in a real hall—and so your rear speakers needn't handle the top-most octave or two. Really deep bass response isn't necessary either, although it doesn't hurt. You can get by with a system that covers the 80-Hz to 6-kHz region, but it should do that smoothly and with low distortion. Nor need the rear channels be capable of delivering as high a sound-pressure level as the front speakers. That saves both on rear-channel amplifier capacity and speaker size. (In general, the rear channels will be played much more softly than the front ones.)

The essential element of the ambience simulator itself is the "delay line," a means of storing the music signal for some period of time and recapturing it later. The delay line simulates the time delay experienced as sound travels through the air. Since the speed of sound in air is roughly 1000 feet per second, every millisecond of delay is equivalent to the time required for the sound to travel one foot. By delaying the music for 50 milliseconds, and then feeding it to the rear channels, we get the sonic impression of a hall 100 feet wide. We have artificially recreated a situation very similar to a seat in the

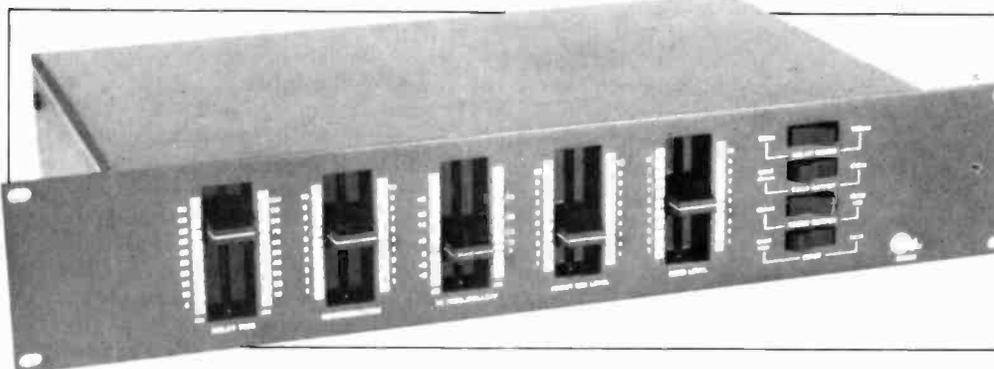
center of a vast concert hall in which we first hear the sound directly from the orchestra (from the front stereo speakers) and slightly later hear the sound bounced off the side walls of the hall. (Although we have referred to the ambience-simulation channels as being "rear" channels—as in a quad setup—the effect is even better with the "rear" speakers placed to the sides—and even slightly forward—of the listener.)

There are three types of delay lines used in hi-fi ambience simulators: the *bucket brigade*, the *shift register*, and the *random-access memory* (RAM for short). In all three types, the music signal is first "sampled," that is, the instantaneous value of the signal is determined at regular intervals. It is these "samples" that will be stored in the delay line, and, eventually, the signal will be reconstructed from these samples.

Theory indicates that the reconstruc-

tion can be perfect provided that at least *two* samples are taken for every cycle of the highest frequency in the signal. That means the sampling must be at a rate *at least* twice the highest frequency to be handled. Of course, the faster the sampling rate, the more samples must be stored to provide a given delay, and that ups the cost. That's why most simulators limit the bandwidth of the delayed signal to 6 or 8 kHz and use a sampling rate of about 16 to 20 thousand samples per second. (The minimum rate of two per cycle is a theoretical ideal impossible to achieve in practice.)

In the bucket-brigade delay line, the individual samples are stored in analog form as a charge on a capacitor. The first sample charges the first capacitor in the line. A brief time later, determined by an internal clock, the first sample is transferred to a second capacitor, and the second sample charges the first capacitor. At the next clock



Sound Concepts calls its time delay system the SD-550 ambience restoration system. Amplifier and rear channel speakers must be bought separately. \$700. Circle No. 133.

Sound Concepts' AD 1060 Concert Machine is an ambience device designed for use in the car—with both AM/FM radio and tape machines. The amplifier to power the rear speakers is built-in. \$300. Circle Reader Service Number 136.



Advent's Sound Space Control includes two continuously variable operating controls which adjust the apparent size of the listening space and the apparent liveness of the room. \$595.

time, each sample shifts down the line to the next capacitor leaving room for the third sample. The action is similar to the motion of a bucket of water down a firefighting bucket brigade. Eventually, the first bucket of water reaches the end of the line and becomes the "output."

The bucket-brigade delay line is an "analog" storage device, for the samples are stored as a voltage that corresponds to the actual signal. Just as water can be spilled in a fireman's bucket brigade, a little of the signal can be lost during each transfer down the line. This puts an upper limit on the length of the bucket-brigade delay line.

The shift-register delay line is a digital device that works very much like the analog bucket brigade. The value of each sample is converted into a digital number, and it is that number that is stored and shifted down the line. Since the number can be repre-

sented as binary ones and zeros which themselves cause transistors to be switched either on or off, no capacitor-storage elements need be used (merely transistor switches), and there is no degradation in signal-to-noise ratio as the delay is increased.

However, there is a *basic* signal-to-noise ratio limitation to any digital system—that of converting the signal from analog to digital form and then back again. The analog signal can have *any* level whatsoever, while the digital representation of it can only be in discrete steps represented by "whole" binary numbers. Obviously then, the same digital number represents a *range* of analog values and, to that extent, is "wrong" or "noisy." This is called "quantization noise". The signal-to-noise ratio of a digitized signal can be made arbitrarily good by decreasing the interval represented by each number. However, the smaller the intervals, the more digits must be used (and

stored) to represent each sample, and that ups the cost.

The bucket-brigade and shift-register delay lines are similar in that the signal samples are fed into the line in sequence and emerge from it in the same sequence as they went in. Each simply provides a delay in the signal. To synthesize "reverberation," that is, the continual bouncing about and gradual decay of a sound in a real hall, a portion of the delayed-output signal is mixed in with the original signal so that it continually (but in a decaying manner) recirculates (reverberates) through the line. In some designs, the line is "tapped" at various points so signals of intermediate delay can be recirculated to increase the "echo density" and produce a more realistic reverberation. In the random-access (RAM) ambience simulator, the samples are digitized and stored in a mass memory. Any sample can be retrieved at any time and in any order by a computer-like algorithm.

The time-delay of any of these devices can be changed by changing the clock rate or the point in the line that the output is taken. The initial time delay is the parameter that establishes the apparent size of the hall. Although many simulators provide delays of up to 100 milliseconds, shorter delays are usually more appropriate. Once the delay exceeds 50 milliseconds, we begin to perceive the delayed signal as a separate echo rather than as a pleasant liveness.

The length of the delay should be adjusted to suit the music. Small chamber groups sound best with a rather short delay (perhaps 20 milli-

(Continued on page 82)



ADS offers the ADS-10 acoustic dimension synthesizer, a system which includes a 100 watts per channel amplifier and two 2-way speakers. Price: \$1000. Circle 132.

Before you race out to buy an equalizer, there are a few tidbits you should know. An equalizer is not a panacea for all sonic ills. It will not make a silk purse out of a sow's ear. Yet it can be one of the most useful of the add-on components—provided that you know what to expect from it, which type is best for you, and how to use it once you bring it home.

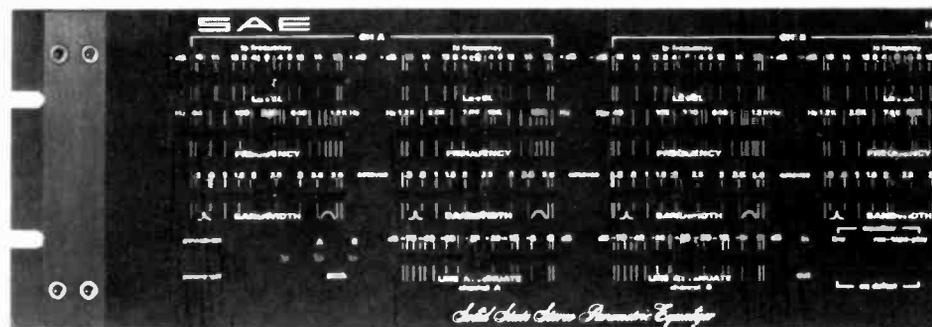
Why would you want an equalizer anyway? That question is best answered by explaining what an equalizer is and what it does. Essentially, an equalizer is a super tone control. But even the simplest of equalizers can perform feats of which the normal tone control is incapable. Virtually every receiver, preamp or integrated amp includes a bass and treble control. On some models, the "turnover frequency" of these controls can be altered with a switch. But, regardless of the switch setting, the bass control boosts or cuts *all* frequencies below the turnover point, and the treble control does likewise at *all* frequencies above its turnover point. There is no such thing as boosting only frequencies around, say, 5 kHz, leaving the music above and below that frequency unaffected. The only "standard" tone control that has that sort of selectivity is the midrange control, and relatively few receivers include such a control. In those that do, the midrange control generally affects a relatively wide region (several octaves being typical) around 1 kHz.

Frequency-selective boost and cut are what equalizers are all about. An equalizer affords a *number* of controls, each of which affects only a small part of the musical spectrum. The total music spans about 10 octaves. (A musical octave, as you probably know, is the range between corresponding notes in the scale; say from middle C to the next higher—or lower—C. Mathematically, one octave is equivalent to a doubling—or halving—of the frequency.)

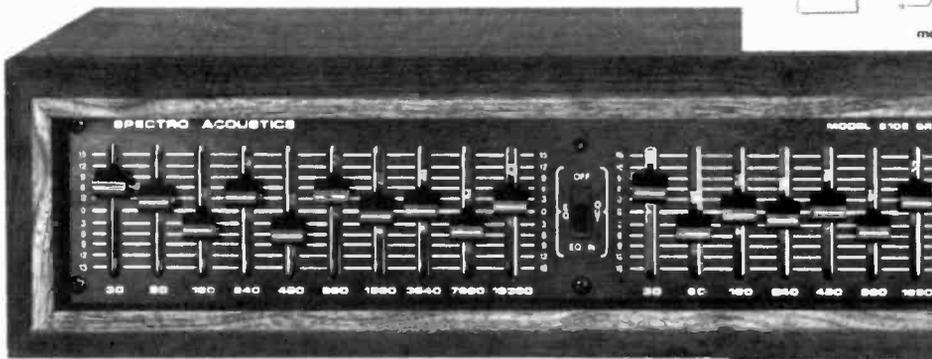
Types of Equalizers to Consider. The simplest high-fidelity equalizers are "five-band" types. Each of the five controls (for each stereo channel) affects approximately a two-octave range about its center frequency. The center frequencies may be at 40 Hz, 160 Hz, 2.5 kHz, and 10 kHz, although such "even" spacing need not be used. With such an equalizer, you can boost just the extremes of the spectrum (to compensate for deficiencies in the response of your speakers or room acoustics), reduce the response in the 160-Hz region (to clean up a chesty-sounding speaker), and perhaps add a bit of

EQUAL

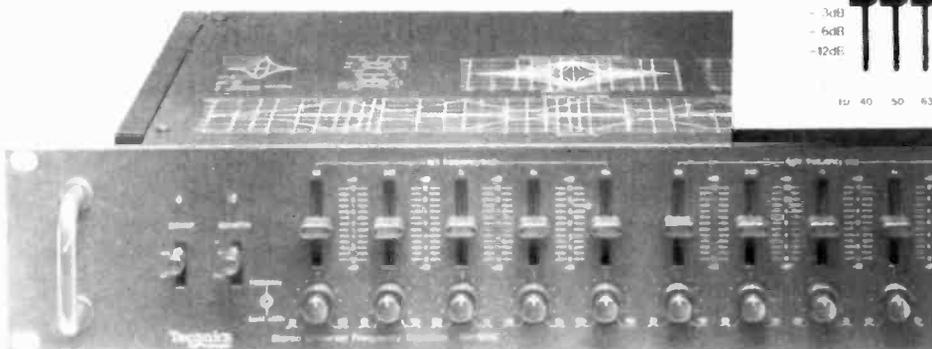
A GUIDE TO WHETHER OR NOT AN EQUALIZER PURCHASE IS LIKELY TO BE OF HELP TO YOUR PARTICULAR SYSTEM



Onkyo's F-30 audio equalizer allows frequency response adjustment at nine different notches. The bottom-most frequency is switch-selectable (32/46/63 Hz). \$550. Circle No. 80 for details.



Klark Teknik (right) offers this DN27 graphic equalizer for about \$765. Twelve dB boost and cut possible over 27 1/3-octave bands. No. 135.



EQUALIZERS

by William S. Gordon

emphasis in the 640-Hz and 2.5-kHz regions to improve the presence.

A ten-band equalizer provides an even finer control since it divides the music into one-octave regions. For this reason, such components are often called "octave-band" equalizers. For professional applications there are devices with even greater resolution (so-called "third-octave-band" equalizers) with upwards of thirty controls per channel.

While it would seem that the finer the resolution the better, such is not always the case in a home stereo system. The more controls you have to fiddle with, the harder it is to tell by ear what each is doing. You may turn up one control and hear little effect because the particular piece of music to which you are listening has little energy in that band. Moments later, the sound may seem strident or ringing because there is now energy in that band and you'll discover you have boosted it too much.

Octave-band equalizers are more flexible and therefore more desirable than five-band equalizers if you use them properly. With such an equalizer, you can reinforce the crossover region between woofer and midrange (or midrange and tweeter)—places where many speaker systems show a dip in response. A five-band equalizer would be much too broad for such corrections and would emphasize the music well beyond the relatively narrow crossover region.

Such sonic corrections are best made using test equipment—a pink-noise generator, filter set, microphone, and sound-level meter. Some well-equipped hi-fi showrooms have such equipment for loan or rental—or their technicians will come to your home and perform the equalization for you. Without such equipment, you will have to rely upon your ears, but, fear not, you can get very good results that way too.

Making the Optimal Adjustment. First rule is: don't try to accomplish the basic equalization with a music record. You can't tell what the music really *should* sound like. You may end up with a more pleasing reproduction of *that* record, but the next one may sound horrible. You may have compensated for flaws in the first recording; flaws that might be missing or even just the opposite in the next recording.

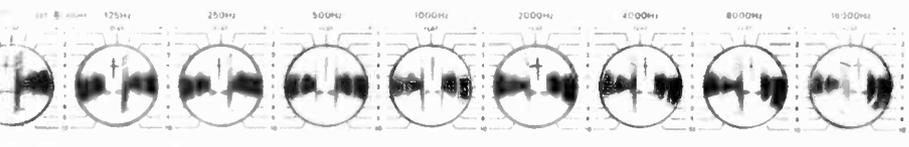
What you need is a source of broad-band signal—a noise source. The poor-man's noise source is the interstation hiss you get by tuning your receiver between stations with the mute off.

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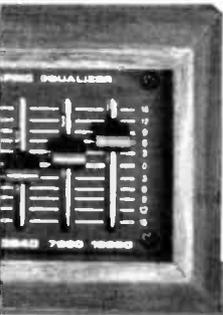
Crown's EQ-2 1/3-octave band graphic equalizer includes a tone control system, with variable hinge frequency adjustment. \$1100. Circle 110.

SAE's 1800 two-band per channel parametric equalizer offers 16 dB boost/cut, variable center frequency, variable bandwidth. \$350. Circle 88.

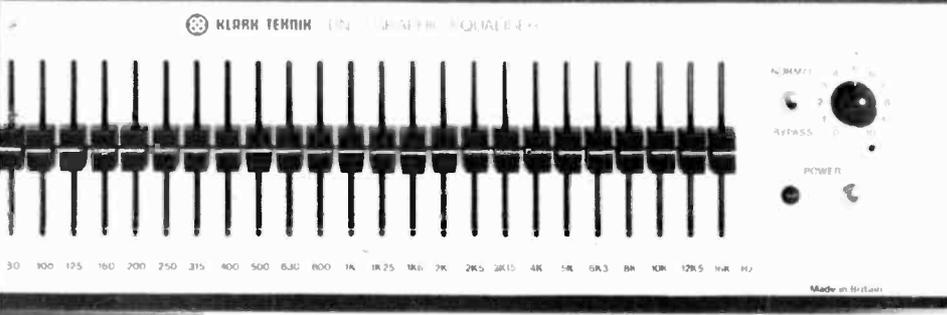


PH E-30 AUDIO EQUALIZER

manufactured by OHEVO



Spectro Acoustics' (left) Model 2102 10 octave-band graphic equalizer offers up to 15 dB boost/cut for each band. \$200. Circle R. S. No. 137



Technics SH-9010 equalizer provides ± 12 dB for 5 frequency bands per channel. For each band: center frequency adjustment (± 1.6 octaves) and bandwidth control are included. \$500. Circle 98.

EQUALIZERS

While this noise is not "pink," that is, it does not have equal energy content in each octave, it *does* contain all frequencies simultaneously and in a constant and repeatable statistical pattern.

It is practically impossible for me to describe the "sound" of such noise except to say it should be "smooth" and have no particular "character." That is, it should *not* sound like any particular note—even in the slightest way. It should not sound hollow or cavernous. If you have an equalizer now, you can quickly get an idea of what I mean by purposely turning up one of the controls while listening to the interstation noise. You will hear the "character" of noise in *that band* as soon as you've boosted it noticeably. Your job is to adjust the equalizer controls until the sound is smooth and basically indescribable by any other term.

It's a great help to have heard the sound of FM noise on a well-equalized system. Perhaps some particularly good system in your dealer's showroom or at a friend's home will serve you as a model. While FM hiss can guide you in making the adjustments, and act as a quick check that all is well at any time in the future, there are more convenient means of making the initial adjustments that require no test instruments—just your ears.

Adjustment Aids. You will need a special test record. Soundcraftsmen, one of the pioneers in high-fidelity equalizers, has been well aware of the problem of extracting optimum use from its products without test equipment and has produced just such a disc. The Soundcraftsmen disc contains 30-second bands of pink noise on one channel, with a 1-kHz reference tone recorded on the other channel. There is a band for each control of the normal 10-band equalizer. You adjust each control in turn until the sound of the noise is equal in loudness to that of the reference tone, and, of course, you do one channel at a time. The level of the reference tone changes for each frequency band following the Fletcher-Munson equal-loudness contours. (Since we do not perceive sounds of equal intensity, but different in frequency, as being equally "loud," the reference tone, which is at a constant frequency, must change in level so that its *perceived* loudness will be the same as the loudness of the band that is being adjusted. Soundcraftsmen

chose to maintain the same power level in each of the bands so that, if a precision sound-level meter is available, it can be used to make the adjustments.)

CBS Laboratories has produced a similar test record, "Seven Steps to Better Listening" (STR-101). On the CBS disc, the noise bands alternate with the reference tone on the *same* channel; first on the left, and then on the right. Each band is repeated six times and, again, Fletcher-Munson compensation is employed to let your ears be the measuring instrument. The CBS record also contains a number of other useful phono-setup tests. And it uses a greater number of test bands, each of narrower bandwidth, than the Soundcraftsmen disc. Crown also has a set-up record for use with their equalizers, however, it is designed for use

with a sound-level meter.

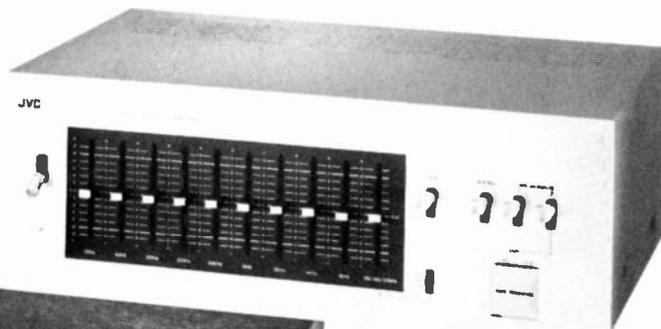
Setting up an equalizer for speaker and room deficiencies can be a rather enlightening task. Bear in mind several important points. The speakers should be in their normal position when you make the adjustments. The position of the speakers has a great effect on the sound coloration. And, because of the standing-wave pattern in a room, the frequency response will not be uniform *everywhere* within its listening area. So, when you make the adjustments, have the measuring instrument at your normal listening position. If the "instrument" is your ears, sit in your normal chair and have an assistant twiddle the controls.

(Continued on page 78)



Sontec's HF-230 two channel parametric equalizer is basically a single-ended RCA phono terminated version of a professional equalizer. \$900. No. 139.

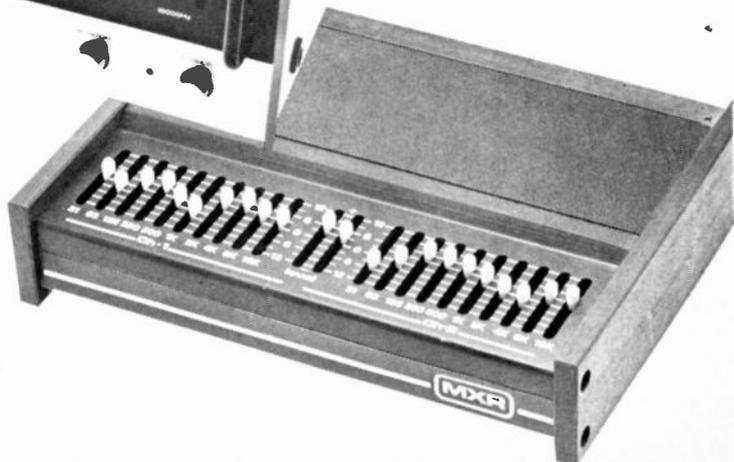
JVC's octave band equalizer, SEA-50 offers ten center frequencies, uppermost is switch-selectable (12k/16k/20kHz). Front switches allow for equalization. \$260. Circle No. 74.



ADC's Sound Shaper One a five band equalizer gives ± 12 dB at 60, 240, 1000, 3500, and 10,000 Hz. \$200. Circle No. 138.



MXR's ten octave-band graphic equalizer provides up to 12 dB boost or cut at 31, 63, 125, 250, 500, 1000, 2000, 4000, 8000, and 16,000 Hz levels. Price: about \$200. For details, circle R. S. No. 134.



TEST REPORTS

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AMPS

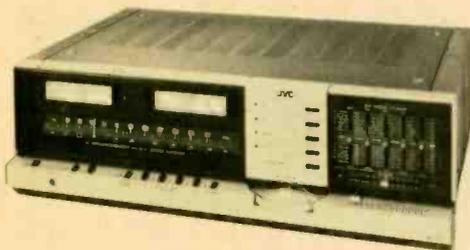
59 / CASSETTE
DECKS

63 / EQUALIZERS

66 / RECORD
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PHONES



JVC JR-S201—\$350.00

Circle No. 74 On Reader Service Card

RECEIVERS

JVC JR-S201 AM/FM RECEIVER

Graphic-type tone equalizers permit a more precise match of the overall sound quality to the listening room. \$350.00 in metal cabinet.

Description: An AM/FM stereo receiver FTC rated at 35 watts RMS per channel into 8 ohms, 20 to 20,000 Hz, at a distortion no higher than 0.03% THD at any frequency. Features include a stereo beacon, FM center channel and AM/FM signal strength tuning meters, SEA graphic-type equalizers with center frequencies of 40, 250, 1000, 5000 and 15,000 Hz, SEA equalization applied to the tape output, a subsonic filter, automatic dubbing between two recorders, and an amplifier 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, phones, and the FM detector.

Controls are provided for tuning, volume, balance, and SEA (5 equalizer controls). Switches for power, speaker system 1, speaker system 2, subsonic filter, SEA to recorder feed, tape monitor 1/dub, tape monitor 2/dub, mono, loudness compensation, FM muting, and input selection.

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

Overall dimensions are 19 $\frac{3}{4}$ in. wide x 6-9/16 in. high x 14-15/16 in. deep. Weight is 23.3 lbs.

Performance—FM Tuner: Full mute release was attained with 4.5 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 10 μ V. The stereo high fidelity sensitivity (55 dB quieting) measured 85 μ V. Full mute release was attained with 6 μ V.

At standard test level the stereo frequency response measured +0/-0.8 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.08% THD. Stereo distortion was 0.09% THD. The signal-to-noise ratio measured 76 dB. Stereo separation was 40+ dB. Selectivity was very good. Note: Minimal distortion requires precise center channel tuning.

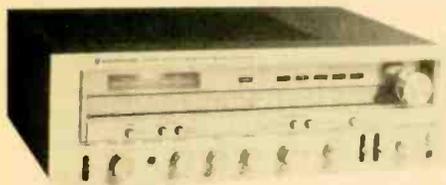
Performance—AM Tuner: Average.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 36 watts RMS. The frequency response at 36 watts/8 ohms measured +0/-0.2 dB from 20 to 20,000 Hz at a distortion no higher than 0.015% THD at any frequency.

The equalization range at the center frequencies of the SEA controls measured \pm 12 dB except for the 15,000 Hz control which measured +12/-11 dB.

The subsonic filter resulted in the frequency response being 2.8 dB down at 20 Hz.

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



Kenwood KR-8010—\$675.00
Circle No. 75 On Reader Service Card

KENWOOD KR-8010 AM/FM STEREO RECEIVER

A very pleasant overall sound. Amplifier distortion is even lower than Kenwood's unusually low spec. \$675.00 in metal cabinet.

Description: An integrated AM/FM stereo receiver FTC rated at 125 watts RMS per channel into 8 ohms, 20 to 20,000 Hz, at a distortion no higher than 0.05% THD. Features include a stereo beacon, FM center channel and AM/FM signal strength tuning meters, 75/25/50 uSec FM de-emphasis, a monophonic microphone input that can be mixed with other signal sources, automatic dubbing from/to either of two tape recorders, a midband tone control in addition to bass and treble controls, a subsonic filter, a two-level FM mute, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

In addition to the mixing monophonic microphone input there are stereo inputs for two magnetic phono, aux, and two tape. Outputs for three speaker systems, two tape, and phones. The pre-amplifier outputs and main amplifier inputs are available on the rear apron.

Controls are provided for tuning, volume, balance, ganged bass, ganged midband, ganged treble, sound injection (microphone mixing level), input selection, and speaker selection. There are switches for power, tone control defeat, subsonic filter, high filter, FM mute on/mono, FM muting level (and 2), loudness compensation, tape monitor selection, and tape dubbing selection. A switch on the rear selects the FM de-emphasis.

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

Overall dimensions are 21-1/32 in. wide x 6-19/32 in. high x 18-1/16 in. deep. Weight is 40.3 lbs.

Performance—FM Tuner: Full limiting was attained with 1.6 uV. The monophonic high fidelity sensitivity (60 dB quieting) measured 8 uV. The stereo high fidelity sensitivity (55 dB quieting) was 51 uV. Full mute release was attained with 1.4 or 10 uV, depending on the position of the FM muting level switch.

At standard test level, with 75 uSec de-emphasis the stereo frequency response measured +0.6/-0.4 dB from 20 to 15,000 Hz. With 25 uSec de-emphasis the stereo frequency response measured +0.2/-0.4 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.1% THD. Stereo distortion was 0.25% THD. The signal-to-noise ratio measured 79 dB. Stereo separation was 40+ dB. Selectivity was excellent.

Note: The distortion was even lower, by an appreciable amount, with the tuning slightly off the meter-indicated center channel.

Performance—AM Tuner: Overall sound quality considerably better than average, with much lower than average background noise.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 143 watts RMS. The frequency response at 143 watts/8 ohms measured +0/-0.5 dB from 20 to 20,000 Hz at a distortion no higher than 0.01% THD at any frequency.

The tone control range measured: ±12 dB at 50 Hz; ±10 dB at 1000 Hz; ±11 dB at 10,000 Hz.

The subsonic filter produced an attenuation of 2.3 dB at 20 Hz.

The magnetic input hum and noise measured -72 dB; stereo separation was the noise level.

Average is the rigid performance standard we require a component to pass to make it a good buy in its price range. Anything less than this rating we do not consider suitable for review purposes or for you to consider buying. An average rating is in no way derogatory, because we have deliberately kept our standards high. For example, if a \$1,000 Pilgrim receiver is rated average, this means it is equal to other average-rated receivers in the same price range, is superior to an average \$600 Minuteman receiver, and far superior to an average-rated \$200 Tory receiver. Each receiver is average within its own price range, and should be compared only with similarly priced components.

Worst case: The test results given are the "worst case" for stereo and 4-channel equipment. For example, if the frequency response of an amplifier's left channel is ± 2 dB from 20 to 20,000 Hz while the response of the right channel is ± 3 dB from 20 to 20,000 Hz, the test report shows the worst case, which is ± 3 dB. Similarly, if an FM tuner's stereo separation is 40 dB left-to-right and 32 dB right-to-left, the test report will show a separation of 32 dB. You can therefore be certain that the performance levels of all other channels are equal to or better than the indicated results.

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. Manufacturers list prices in several ways. For example, some precede all prices with "approximately," while others list "nationally advertised value." For the purpose of simplicity and consistency, our editorial policy is to report prices as prices. It is assumed that prices vary at the discretion of individual dealers and that advertised prices may change.

Note: The listening panel reported an unusually pleasant sound in all modes: FM, AM, and amplifier. ▲

SANKYO SRC-4040 AM/FM STEREO RECEIVER

Essentially average performance for its price range. \$350.00 in metal cabinet with wood trim panels.

Description: An AM/FM stereo receiver FTC-rated at 40 watts RMS per channel into 8 ohms, 20 to 20,000 Hz, at a distortion no higher than 0.5% THD at any frequency.

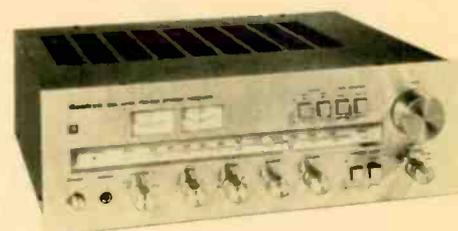
Features include a stereo beacon, FM center-channel and AM/FM signal strength tuning meters, automatic dubbing from one tape to another, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

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, balance, ganged bass, ganged treble, speaker selection, and input selection/FM mute. There are switches for power, mono/stereo, low filter, high filter, loudness compensation, tape monitor A (dub), 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 18 $\frac{1}{2}$ in. wide x 5 $\frac{1}{2}$ in. high x 13 $\frac{1}{2}$ in.



Sankyo SRC-4040—\$350.00
Circle No. 120 On Reader Service Card



Sankyo SRC-4040—\$350.00
Circle No. 120 On Reader Service Card

deep. Weight is 20.7 lbs.

Performance—FM Tuner: Full limiting was attained with 3.3 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 8.5 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 70 μ V. The mute release faded in over the range of 2 to 8.5 μ V.

At standard test level the stereo frequency response measured +0.5/−1.5 dB from 30 to 15,000 Hz, down 3 dB at 20 Hz. Monophonic distortion measured 0.06% THD. Stereo distortion was 0.22% THD. The signal-to-noise ratio measured 71 dB. Stereo separation measured 36 dB. Selectivity was very good.

Note. Critical center channel meter-indicated tuning is required for lowest distortion.

Performance—AM Tuner: Average, with lower than average background noise.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 40.5 watts RMS. The frequency response at 40.5 watts/8 ohms measured +0/−1.2 dB from 20 to 20,000 Hz at a distortion no higher than 0.13% THD at any frequency.

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

The magnetic input hum and noise measured −63 dB. Stereo separation was into the noise level. ▲

SHERWOOD S-7250 CP AM/FM STEREO RECEIVER

Performance is much better than specifications in manual. A very good low power budget-priced receiver. \$250.00 in wood cabinet.

Description: An AM/FM stereo receiver FTC-rated at 20 watts per channel, 20 to 20,000 Hz into 8 ohms at a distortion no higher than 0.2% THD. Features includes a stereo beacon, combination FM center channel and AM signal strength tuning meter, and 25, 50 and 75 μ Sec FM de-emphasis.

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

Controls are provided for tuning, volume, balance, ganged bass, ganged treble, input selection, and speaker selection. There are switches for power, loudness compensation, noise filter (high filter), FM muting, and tape monitor. The de-emphasis selector switch is on the rear.

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

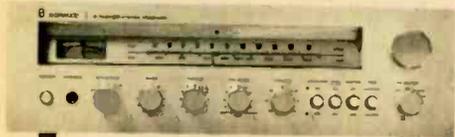
Overall dimensions are 16-15/16 in. wide x 5 3/8 in. high x 12 3/8 in. deep. Weight is 18 lbs.

Performance—FM Tuner: Full limiting was attained with 2.8 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 10 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 68 μ V. Full mute release was attained with 6 μ V.

At standard test level the stereo frequency response with 75 μ Sec de-emphasis measured +0.1/−1 dB from 20 to 15,000 Hz. Monophonic distortion measured 0.09% THD. Stereo distortion measured 0.18% THD. The signal-to-noise ratio was 76 dB.

With 25 μ Sec. de-emphasis the stereo frequency response measured +0.1/−1.1 dB from 20 to 15,000 Hz.

Note: Alignment was perfect. Minimum distortion was attained



Sherwood S-7250 CP—\$250.00
Circle No. 92 On Reader Service Card

with the tuning indicator precisely on the mark. Tuning for minimum distortion is critical.

Performance—AM Tuner: Essentially average with a higher than average background noise.

Performance—Amplifier: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 21.5 watts RMS. The frequency response at 21.5 watts/8 ohms measured $+0/-0.7$ dB from 20 to 20,000 Hz at a distortion no higher than 0.06% THD at any frequency.

The tone control range measured $+12/-14$ dB at 50 Hz; ± 11 dB at 10,000 Hz.

The magnetic input hum and noise measured 54 dB; separation was into the noise level.

Note: The listening panel reported an unusually good sound considering the power and price. They gave it special recommendation for a budget priced system. ▲

TUNERS

AKAI AT-2600 AM/FM STEREO TUNER

Features a deviation meter indicating the modulation of the FM transmitter. \$299.95 in wood finish cabinet.

Description: An AM/FM stereo tuner featuring a stereo beacon, FM center channel tuning, meter, combination AM/FM signal strength and FM deviation meter, continuously variable FM muting, mpx filter, and an AFC (automatic frequency control) indicator lamps that light when the AFC "locks" the FM tuning to a station's center channel frequency.

Fixed and variable level line level outputs are provided.

There are controls for tuning, output level, and FM muting sensitivity. Switches for power, signal strength/FM deviation meter mode, high blend (mpx filter), and FM mute.

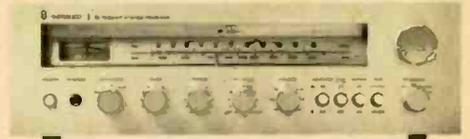
The FM antenna input is 75/300 ohms. A rod antenna and external connection are provided for AM.

Overall dimensions are 17.3 in. wide x 5.6 in. high x 13.2 in. deep. Weight is 16.7 lbs.

Performance—FM Tuner: Full limiting was attained with 9 μ V. The monophonic high fidelity sensitivity (60 dB quieting) measured 25 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 140 μ V. Full mute release was attained within the range of 7 to 450 μ V, depending on the adjustment of the FM mute sensitivity control.

At standard test level the stereo frequency response measured $+0.1/-2$ dB from 20 to 15,000 Hz. Monophonic and stereo distortion measured 0.4% THD. The signal-to-noise ratio measured 73 dB. Stereo separation was 40+ dB. Selectivity was good.

The deviation meter calibrations were precise when receiving mono and 10% low for stereo. Actually, since the deviation meter is really calibrated in terms of audio output the stereo readings are correct if allowance is made for a 10% stereo pilot signal at the transmitter. (Basically, the deviation meter serves no real purpose other than to let the user know that poor recordings might be due to station modulation rather than the recorder.)

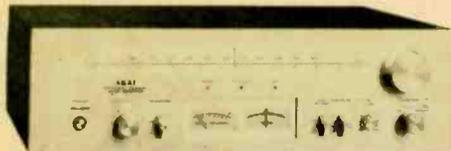


Sherwood S-7250 CP—\$250.00
Circle No. 92 On Reader Service Card



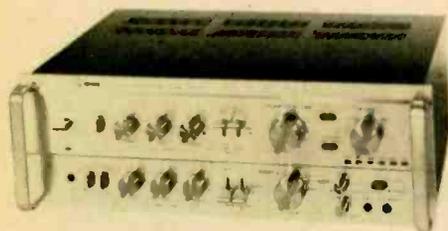
Akai AT-2600—\$299.95
Circle No. 62 On Reader Service Card

TEST REPORTS/PREAMPLIFIERS



Akai AT-2600—\$299.95

Circle No. 62 On Reader Service Card



Setton PS-5500—\$549.95

Circle No. 91 On Reader Service Card

The AFC does not lock to precise center channel tuning even when the indicator lamp is on. For lowest distortion the tuning should be adjusted for a center channel meter reading. (Actually, this is typical of all standard AFC systems, with or without a "center tuning" indicator lamp.)

Performance—AM Tuner: Average with somewhat lower than average background noise. ▲

PREAMPLIFIERS

SETTON PS-5500 STEREO PREAMPLIFIER

Provides for sound source mixing and cross-fading as well as for wide range tone control. \$549.95 in metal cabinet.

Description: A stereo preamplifier featuring: dual range bass turnover frequencies (250, 500 Hz); a midband tone control; dual range treble turnover frequencies (2.5k, 5k Hz); dual range low (15, 40 Hz) and high (7k, 12k Hz); filters; a fader control that fades from either the tuner, aux 1, or phono 1, input to phono 2 or aux 2; stereo or automatic-mono microphone inputs that can be mixed with other signal sources; an amplified headphone output; automatic dubbing from/to either of two recorders; and an output hold-off that prevents turn-on transients from being fed to the main power amplifier.

There are stereo inputs for microphones (automatic mono if only the right microphone jack is used), phono 1, phono 2, aux 1, aux 2, tuner, and two tape. There are outputs for three line level, two tape, and phones.

Controls are provided for concentric volume/balance, left bass, left midband, left treble, right bass, right midband, right treble, stereo/mono modes, input selection tuner/aux 1/phono 1, fader, and microphone level. There are switches for power, tone control defeat, bass turnover frequency, treble turnover frequency, low filter cut-off frequency, high filter cut-off frequency, 20 dB audio mute, loudness compensation, aux 2/phono 2 fader input selector, tape dubbing selector, and tape monitor selector. The rear apron has sensitivity controls for the phono 1 and aux 1 inputs.

Overall dimensions are 19 $\frac{3}{4}$ in. wide x 13 $\frac{1}{8}$ in. deep, x 7 in. high.

Performance: Note: The rated output is 2 volts. Tests were conducted at the more common high fidelity output level of 1 volt.

The frequency response measured +0/-1 dB from 20 to 20,000 Hz at a distortion no higher than 0.006% THD at any frequency. The maximum output level at the threshold of clipping was 8 volts.

The tone control range depended on the settings of the turnover selectors. With a 250 Hz bass turnover the tone control range at 50 Hz measured +13/-12 dB; +15/-14 dB with a 500 Hz turnover. At 10,000 Hz the range was ± 11 dB with a 5k Hz turnover; ± 6 dB with a 2.5k Hz turnover. The midband tone control range was ± 6 dB at 1000 Hz.

The magnetic input hum and noise measured -66 dB; stereo separation was 58 dB.

The microphones, aux 2 and phono 2 inputs turn on and off as a unit, controlled by a push-pull switch on the microphone level knob.

When the unit is off, only the tuner/aux 1/phono 1 selector is active. When a microphone plug is inserted only into the right jack, the signal is fed to both channels (mono). In the fader mode, the complete stereo signal in both speakers is faded from one signal source to another; for example, the aux 1 signal is cross faded to a phono 2 input signal.

The low filter also functions as a subsonic filter (15 Hz cut off), and results in attenuation of only 1 dB at 20 Hz. ▲

INTEGRATED AMPLIFIERS

AKAI AM-2600 INTEGRATED STEREO AMPLIFIER

Has a unusually good deep bass. Nice choice when miniature speakers are used. \$300.00 in wood cabinet.

Description: An integrated stereo amplifier FTC-rated for 8 ohms at 60 watts RMS per channel, 20 to 20,000 Hz, at a distortion no higher than 0.1% THD.

Features include: left and right output power meters calibrated 0.1 to 80 watts and 0.01 to 3 watts into 8 ohms; dual range low filter (30, 60 Hz); dual range high filter (7, 10 kHz); dual range audio mute (-15/-30 dB); loudness compensation for low and high frequencies; switch-selected loads of 33k, 47k, or 100k for one of two magnetic phono inputs; automatic dubbing from/to either of two recorders; 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 concentric volume/balance, ganged bass, ganged treble, input selection, speaker selection, and tape monitor/tape dubbing selection. There are switches for power, audio mute, low filter, high filter, tone control defeat, meter range, mono/stereo mode, and loudness compensation.

Two switched and an unswitched AC outlet are provided.

Overall dimensions are 17.3 in. wide x 5.6 in. high x 13 in. deep. Weight is 22 lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 67 watts RMS. The frequency response at 67 watts/8 ohms measured +0.3/-0.1 dB from 20 to 20,000 Hz at a distortion no higher than 0.07% THD at any frequency.

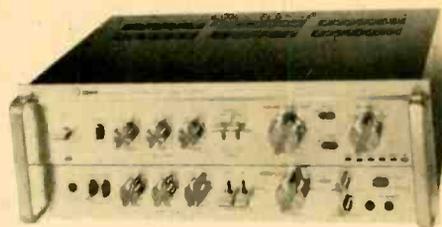
The tone control range measured ± 12 dB at 50 Hz; ± 10 dB at 10,000 Hz.

The magnetic input hum and noise measured 69 dB. Stereo separation was into the noise level.

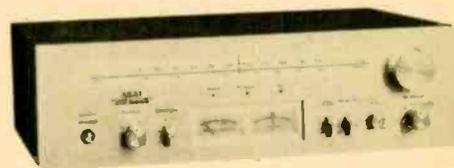
The frequency response of the output meters was "on the mark" from 20 to 20,000 Hz, rising to a 10% high reading at 20,000 Hz.

The power output calibrations on the low range were exact. On the high range the calibrations were within 15% accuracy to 2 watts, and on the mark above 20 watts.

The listening panel reported an unusually good deep bass from smaller "bookshelf" speakers. ▲



Setton PS-5500—\$549.95
Circle No. 91 On Reader Service Card



Akai AM-2600—\$300.00
Circle No. 62 On Reader Service Card



Scott 480A—\$449.95

Circle No. 90 On Reader Service Card

SCOTT 480A INTEGRATED STEREO AMPLIFIER

Measurements far outclass even Scott's high-performance claims. Superb overall performance and sound quality. \$449.95 in metal cabinet.

Description: An integrated stereo amplifier FTC-rated for 8 ohms at 85 watts RMS per channel, 20 to 20,000 Hz at a distortion no higher than 0.03% THD at any frequency.

Features include: left and right output power meters calibrated in X10 increments from 0.001 to 100 watts and -30 to +20 dBW (dBW is a different way of expressing absolute power output) for 8 ohm loads; record selection of any signal source independent of the signal passing through the amplifier; a midband tone control; automatic tape dubbing from/to either of two recorders; capacitance (100, 250, 400 pF) and impedance (30k, 50k, 100k ohms) selection for one of two phono inputs; high/low sensitivity for the second phono input; break-in accessory connections switched from the front panel; subsonic filter; switch selection of 85 or 55 watts per channel output; an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for two magnetic phono, tuner, aux, two tape, and accessory.

Outputs for two speaker systems, two tape, phones, and accessory.

Controls are provided for volume, balance, ganged bass, ganged midband, ganged treble, input selection, speaker selection, recorder/dub selection, phono #1 input capacity, phono #1 input impedance, and stereo/mono modes. There are switches for power, tone control defeat, subsonic filter, high filter, loudness compensation, and accessory input. There are switches on the rear apron for phono #2 sensitivity and output power selection.

Switched and unswitched AC outlets are provided.

Overall dimensions are 17 in. wide x 5¼ in. high x 14¼ in. deep. Weight is 29 lbs.

Performance: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 94 watts RMS. The frequency response at 94 watts/8 ohms measured +0/-0.4 dB from 20 to 20,000 Hz at a distortion no higher than 0.008% THD at any frequency.

The tone control range measured ±13 dB at 50 Hz; ±6 dB at 1000 Hz; ±11 dB at 10,000 Hz. (The midband tone control frequency range is relative broad, allowing a smooth rather than peaked midrange boost.)

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

The subsonic filter resulted in an attenuation of 0.2 dB at 30 Hz; 2.1 dB at 20 Hz.

The frequency response of the output power meter(s) was ruler flat from 20 to 20,000 Hz. The precise power calibrations were within 20% accuracy, for example; the meters indicated 100 watts for an actual output of 80 watts. There are no meter calibrations between the X10 steps.

There appears to be no valid reason for the output power selector. Even the instruction manual provides no reason or suggestion for use of the switch.

Our listening panel was considerably impressed by the sound quality, giving this amplifier one of its highest ratings. They par-

ticularly singled out the excellent overload recovery for special mention. ▲

CASSETTE DECKS

AIWA AD-6900 STEREO CASSETTE DECK

MAGNIFICENT! This is high fidelity. You must try one at your dealer's even if you're not in the market for a deck. \$850.00 in metal cabinet.

Description: A front-loading Dolby cassette deck featuring a three-head simultaneous playback system, two-motor drive, solenoid operation permitting full remote control through an optional plug-in remote control unit, microphone/line mixing, selectors for tape equalization and bias for "normal," chrome, and Ferrichrome tapes, a test oscillator system and individual controls for optimizing bias adjustments for all three types of tape, a record level control for each type of tape for optimizing the Dolby tracking, dual pointer left and right record level meters indicating the VU record level and the peak record level (there is a peak hold feature to indicate the absolute peak level of any program), a front panel line input in addition to the usual rear inputs, automatic end-of-tape stop/disengage, a record mute that interrupts the input signal while permitting tape drive, a rear control jack for remote control starting of a record player suitably equipped for synchronized start with the tape deck, timer-control preset switching, and a memory reset counter that provides auto-stop and automatic repeat play after rewind.

There are inputs for microphones and line. Outputs for line, phones, and remote record player synchronization.

Controls are provided for concentric-clutched left and right microphone record level, concentric-clutched left and right line level, ganged output level, normal tape bias adjustment, chrome tape bias adjustment, and Ferrichrome tape bias adjustment. Each bias adjustment has a screwdriver-adjustment in the center for Dolby tracking calibration using the built-in bias/Dolby test oscillator system.

There are switches for power, tape bias selection, equalization selection, Dolby/Dolby with mpx filter, test oscillator, tape/source monitor, VU meters on, peak meters on, peak meters maximum level hold, timer control selection, and memory counter function.

The tape mechanism has touch controls for the record interlock, REW, stop, FWD, FF, pause, and record mute. A lever is provided for cassette ejection.

Overall dimensions are 17¾ in. wide x 4¾ in. high x 12¾ in. deep. Weight is 20.9 lbs.

Performance: The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured +1.5/-0.4 dB.

Using Maxell UD/XL Type I tape: without Dolby, the record/play frequency response measured +0.1/-1 dB from 30 to 15,000 Hz, down 2.5 dB at 25 Hz. Distortion at the meter-indicated peak, or 0-dB, record level measured 0.08% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 45 dB.

With the Dolby active, the record/play frequency response



AIWA AD-6900—\$850.00
Circle No. 121 On Reader Service Card

TEST REPORTS / CASSETTE DECKS



AIWA AD-6900—\$850.00
Circle No. 121 On Reader Service Card



Kenwood KX-630—\$275.00
Circle No. 75 On Reader Service Card

measured +0/-1 dB from 30 to 15,000 Hz, down 2.5 dB at 25 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 49 dB wideband, 57 dB narrowband.

Using Maxell UD/XL Type II (chrome) tape: with Dolby, the record/play frequency response measured +0/-0.5 dB from 30 to 15,000 Hz, down 3 dB at 25 Hz. Distortion at the meter-indicated 0-dB record level measured 0.06% THD with 7.5 dB headroom to 3% THD. The signal-to-noise ratio referenced 0-dB record level was 49 dB wideband, 57 dB narrowband.

Using Scotch Master III (Ferrichrome) tape: with Dolby, the record/play frequency response measured +1.5/-0.6 dB from 30 to 15,000 Hz, down 3 dB at 25 Hz. Distortion at the meter-indicated 0-dB record level was 0.07% THD, with 9.5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 47 dB wideband, 58 dB narrowband.

The maximum output level corresponding to a 0-dB record level was nominally 680 mV.

Wow and flutter measured 0.06% steady.

The bias and Dolby calibration controls work exactly as claimed, providing precise bias and Dolby tracking adjustments. However, while the manual specifies the left and right meters should indicate the same when making the bias adjustments, the most precise adjustment is attained when the right meter is adjusted to indicate 0.5 to 1 dB lower than the left meter. (We have seen this effect on other AIWA recorders, it's not uncommon.) The Dolby test system calibrations were precise.

While the signal-to-noise ratio figures appear to be lower than expected, bear in mind they are referenced to a peak reading that still has at least 7.5 dB headroom; you can essentially add at least 7.5 dB to the noise figures to get a better idea of the quiet background attained from this machine.

Overall sound quality when recordings are made using only peak readings (the way they should be made) are superb. We have not heard better. A dub sounded exactly the same as the record from which it was made. ▲

KENWOOD KX-630 CASSETTE DECK

Using the specifically recommended tapes the performance is quite impressive for the price. \$275.00 in metal cabinet.

Description: A front-loading Dolby cassette deck featuring individual bias and equalization selectors for "normal," chrome, and reserve (Ferrichrome) tapes, calibrated left and right VU meters, automatic end of tape stop/disengage, and reset counter.

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

Controls are provided for concentric-clutched left and right record level and concentric-clutched left and right output level. There are switches for power, microphone/line input, bias, equalization, and Dolby.

The tape mechanism has piano key controls for the record interlock, REW, forward, FF, stop, and pause. The cassette is directly inserted and removed from the mechanism by the user: there is no loading/eject mechanism.

Overall dimensions are 16-15/16 in. wide x 6¼ in. high x 13¾ in. deep. Weight is 14.3 lbs.

Performance: Note: TDK D, AD, and SA tapes are specifically

recommended by the manufacturer. Tests were conducted with the AD and SA tapes.

The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured $+1.2/-1.5$ dB.

Using TDK-AD tape: without Dolby, the record/play frequency response measured $+2/-3$ dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.4% THD with 6 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 50 dB.

With the Dolby active, the record/play frequency response measured $+1.5/-3$ dB from 35 to 15,000 Hz (down 4 dB at 30 Hz). Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband, 60 dB narrowband.

Using TDK-SA tape (for chrome): with Dolby, the record/play frequency response measured $+0.5/-3$ dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.4% THD with 5.5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 53 dB wideband, 60 dB narrowband.

None of the Ferrichrome tapes produced an acceptable frequency response with bias and equalization set for "reserve," so no additional tests were made. This machine is obviously adjusted for the two recommended tapes.

The maximum output level corresponding to a 0-VU record level was nominally 720 mV.

Wow and flutter measured 0.1% with peaks to 0.16%.

The tape mechanism is the new direct insertion/removal type, an excellent choice especially if the machine is to be handled by younger children.

If signal peaks are held below -4 dB and the recommended tapes are used, the recordings are notably good for the machine's price range. ▲

MARANTZ 5030B STEREO CASSETTE DECK

Dolby system has unusually accurate tracking. \$419.95 in metal cabinet.

Description: A front-loading 3-head system (simultaneous record/playback) Dolby cassette deck featuring microphone/line mixing, a master record level control, selectors for "normal," Ferrichrome, and chrome tapes, two calibrated VU meters, left and right peak record level indicator lamps, a record level limiter, automatic end-of-tape stop/disengage, and a memory reset counter.

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

Controls are provided for master record level, concentric left and right microphone level, and concentric left and right line level. There are switches for power, tape type, limiter, Dolby, tape source monitor, and counter memory. An MPX filter can be switched into the Dolby through a rear apron switch.

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

Overall dimensions are $17\frac{3}{8}$ in. wide x $5\frac{3}{4}$ in. high x $11-11/16$ in. deep. Weight is 16.3 lbs.

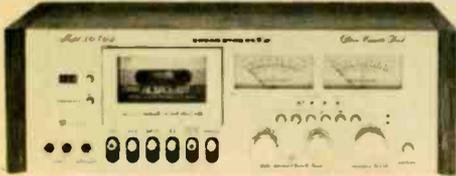


Kenwood KX-630—\$275.00
Circle No. 75 On Reader Service Card



Marantz 5030B—\$419.95
Circle No. 77 On Reader Service Card

TEST REPORTS / CASSETTE DECKS



Marantz 5030B—\$419.95
Circle No. 77 On Reader Service Card

Performance: The playback from a standard test tape with a 50 to 10,000 Hz frequency range measured +2.2/−1.5 dB.

Using Maxell UD/XL tape without Dolby, the record/play frequency response measured +1.8/−0.5 dB from 30 to 10,000 Hz, rising to +3 dB at 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 7.5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 49 dB.

With the Dolby active, the record/play frequency response measured +2.5/−0.7 dB from 30 to 15,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 52 dB narrowband; 60 dB wideband.

Using Sony Ferrichrome tape with Dolby, the record/play frequency response measured +0.5/−2.5 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 9.5 dB headroom to 3% THD. The signal-to-noise ratio measured 52 dB wideband, 63 dB narrowband.

Using Scotch Master II tape for chrome, with Dolby, the record/play frequency response measured +3/−2 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 0.7% THD with 12 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 50 dB wideband, 60 dB narrowband.

The output level corresponding to a 0-VU record level was nominally 680 mV.

Wow and flutter measured 0.09% steady.

The peak indicator lamps turn on when the input level is 4 dB above 0-VU.

The limiter has a fast cut-in at 0-VU, but its release is moderate and provides a 10 dB "gain riding action" on the signal immediately following a peak that triggers the limiter. (Because of the relatively large headroom with all types of tape, the use of the limiter isn't really necessary for the average recording.) ▲

SANYO RD-5350 DOLBY STEREO CASSETTE DECK

Features very good Dolby tracking and notably good performance with budget priced tapes. \$219.95 in metal cabinet.

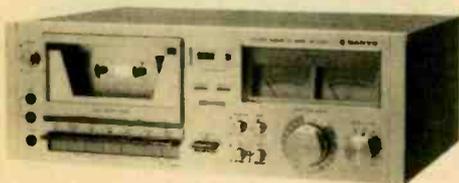
Description: A front-loading Dolby cassette deck featuring: bias and equalization selectors for "normal," ferrichrome and chrome tapes; two calibrated VU meters; three peak record level indicators calibrated at 0-VU, +3 dB, +6 dB; automatic end of tape stop/disengage; timer control through the pause mode that permits a timer-controlled start in the record mode; a record mute that turns off the input signal when the tape is driving in the record mode; a reset counter.

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

Controls are provided for concentric-clutched left and right record level, and ganged output level. There are switches for power, Dolby, input selection, bias, and equalization.

The tape mechanism has piano key controls for the record interlock, play, REW, FF, stop, eject, record mute, and pause/timer control.

Overall dimensions are 16½ in. wide x 6½ in. high x 11-7/16 in. deep. Weight is 13.2 lbs.



Sanyo RD-5350—\$219.95
Circle No. 108 On Reader Service Card

Performance: The playback frequency response from a standard test tape with a 50 to 10,000 Hz range measured $+1.5/-0$ dB.

Using TDK-AD tape: without dolby, the record/play frequency response measured $+0.6/-1.8$ dB from 40 to 14,000 Hz; down 2.5 dB at 35 and 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.1% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 49.5 dB.

With the Dolby active, the record/play frequency response measured $+1.5/-2.5$ dB from 35 to 13,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband; 59.5 dB narrowband.

Using Scotch Master III Ferrichrome tape: with Dolby, the record/play frequency response measured $+0/-3$ dB from 38 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.3% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 57 dB wideband; 65 dB narrowband.

Using Scotch Master II chrome tape: the record/play frequency response measured $+0/-2.5$ dB from 35 to 14,000 Hz. Distortion at the meter-indicated 0-VU record level was 2% THD with 3 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 57 dB wideband; 65 dB narrowband.

The maximum output level corresponding to a 0-VU record level was nominally 620 mV.

The peak record level indicator calibrations were precisely on the mark at 0-VU, -3 dB, and $+6$ dB.

Wow and flutter measured 0.09% with peaks to 0.15%.

The tape mechanism is one of the best we've seen in terms of loading, overall handling, and cleaning of the tape path. It's an excellent front loader for handling by young children. ▲



Sanyo RD-5350—\$219.95
Circle No. 108 On Reader Service Card

EQUALIZERS

CROWN EQ-2 GRAPHIC EQUALIZER

Two steps beyond even the best of octave graphic equalizers. \$1095.00 in metal cabinet with 19-inch rack front panel.

Description: A stereo octave equalizer with variable center frequency for each of 11 equalizers combined with bass and treble tone controls, each having a continuously variable hinge-frequency adjustment. Each channel of the equalizer is totally independent of the other except for a common power switch. Each equalizer control is rated for ± 15 dB variation at the center frequency.

One set of line level inputs is provided: balanced and unbalanced. Both normal (in phase with the input) and inverted line level outputs are available. A bridge connection of the inverted and normal outputs produces a 600 ohm balanced output.

Controls are provided for: each equalizer, equalizer "tuning" (variable center frequency), bass, treble, bass hinge frequency (180-800 Hz), treble hinge frequency (1k-10k Hz). There are switches for: power, equalizer in-out, tone control in-out. A switch on the rear provides unity or 10 dB gain. An overload indicator lamp is provided for each channel.

All input and output connections are through phone jacks. A



Crown EQ-2—\$1095.00
Circle No. 110 On Reader Service Card



Crown EQ-2—\$1095.00

Circle No. 110 On Reader Service Card

set of phono-to-phonograph adapter patch cords is provided.

Overall dimensions measured 16½ in. wide (19 in. with rack panel "ears") x 7¾ in. high x 14¼ in. deep.

A clear plastic panel cover for control protection is supplied predrilled to fit the 19-in. rack-size configuration.

Equalizer center frequencies are precisely spaced one octave apart from 20 to 20,000 Hz.

Performance: Note: Tests were conducted at 0.5 volts, a level we consider the maximum that might be found in most hi-fi equipment. The device's rated output is 2.5 volts. Our tests were conducted at unity gain, hence, 0.5 volt in produced 0.5 volts out.

With the tone controls switched out, the frequency response was essentially ruler-flat from 20 to 20,000 Hz at a distortion no higher than 0.008% THD at any frequency. Each individual equalizer provided a range of ±15 dB at the center frequency, the maximum equalization ranging to ±20 dB depending on the total number of additional equalizers set for maximum. The tuning control provided a "shift" of 0.2 to 0.5 octave at slightly less equalization than attained at the center frequency.

At maximum equalization the distortion actually is lower than with no equalization, nominally 0.002% THD at any frequency.

With full equalization applied, the maximum input signal before clipping was 2.8 volts, a much higher level than will ever be required in high fidelity or most professional uses.

With the tone controls switched in, overall performance is essentially the same with the tone controls set to the indicated zero (out) position, though the frequency response was down 1 dB at 20,000 Hz.

The maximum tone control range at 50 Hz measured +22/-20 dB at 50 Hz; ±18 dB at 10,000 Hz. Depending on the hinge frequency the maximum range will range to ±5 dB at 50 Hz; ±5 dB at 10,000 Hz.

Referenced to a 0.5 volt input and output, the signal-to-noise ratio measured 79 dB.

Listening panel report: Despite the complexity of the graphic and tone control equalization, the EQ2 is an unusually easy system to use. Its instruction manual is a virtual primer on equalizers and equalization written in easy-to-understand layman's terms, with excellent illustrations. We recommend the manual to the serious audiophile even if not presently interested in an equalizer. The manual is available directly from Crown for \$6.) ▲

SAE 1800 STEREO PARAMETRIC EQUALIZER

A stereophile version of a studio parametric at a hobbyist's price. A superb performer. Next best thing to the pro version. \$350.00, in metal cabinet with 19-in. rack panel.



SAE 1800—\$350.00

Circle No. 88 On Reader Service Card

Description: A stereo parametric equalizer essentially consisting of two identical, independent sections with common switching. Each section has two frequency selectors covering the range of approximately 40-1.2k Hz and 1.2k-15k Hz, two ±16 dB attenuators, two bandwidth adjustments covering the range of approximately 0.3 to 3.6 octaves, a level control from unity gain to full off, and an L.E.D. lamp that indicates overload anywhere along the equalizer chain.

The device utilizes an amplifier's or receiver's tape recorder

connections, with the tape connections being moved to the equalizer.

Common switching for both stereo sections provides: power control, equalizer to the main amplifier signal, equalizer to the tape recorder input, equalizer to the tape recorder output, and tape monitor.

Overall dimensions are 19 in. wide x 5.25 in. high x 3.5 in. deep.

Performance: Note. The rated output is 2.5 volts. But tests were conducted at 1-volt input, which we consider the maximum level that might be applied by associated hi-fi equipment.

With the equalizers in the center, or unity gain, setting the frequency response measured $\pm 0/-0.5$ dB from 20 to 20,000 Hz at a distortion no higher than 0.003% THD at any frequency.

With maximum equalization applied the worst-case distortion was no higher than .04% THD at 20 Hz, decreasing to 0.005% THD at 20,000 Hz. With the section level control reduced so the output did not exceed 1 volt even with full equalization applied, the distortion did not exceed 0.01% THD at any frequency.

The overload indicator lamp turns on precisely at the condition that would exceed 2.5 volts output, or the equivalent level for 0.04% THD, which is generally very close to rated output.

The frequency calibrations are approximate and serve to get the user inside the ballpark; then it's up to the user to fine-tune the equalization to personal preference. The instructions, though sparse, are adequate for the stereophile, though this unit is so good it deserves a more detailed set of instructions.

With a 1-volt input signal, the signal-to-noise ratio measured 86 dB.

The listening panel reported the unit was relatively easy to use, and particularly praised its performance as a "general stereophile's equalizer." ▲

SAE 2800 STEREO PARAMETRIC EQUALIZER

The pro parametric. A superb performer, though it might be a little too much for the average stereophile to handle; in which event use the stereophile version. \$600 in metal cabinet with 19-in. rack panel.

Description: A stereo parametric equalizer essentially consisting of two identical, independent sections with common switching. Each section has four frequency selectors covering the approximate range of 10 to 320 Hz, 40 to 1.2k Hz, 240 to 1.6k Hz, and 1.2k to 15k Hz, four ± 16 dB attenuators, and four bandwidth adjustments covering the range of approximately 0.3 to 3.6 octaves. Each stereo section has a line attenuator that adjusts the output from full off to unity gain, and an L.E.D. lamp that indicates overload anywhere along each stereo section's equalizer chain.

The device utilizes an amplifier's, or receiver's, tape connections, with the tape recorder connections moved to the equalizer.

Common switching for both sections provide: power control, equalizer to main amplifier signal, equalizer to the tape recorder input, equalizer to the tape recorder output, and tape monitor.

Overall dimensions are 19 in. wide x 8.75 in. high x 3.5 in. deep.

Performance: Note: The rated output is 2.5 volts. Tests were conducted at 1 volt input, which we consider the maximum level that might be applied by associated hi-fi equipment.

With the equalizer attenuators in the center, or unity gain, posi-



SAE 1800—\$350.00

Circle No. 88 On Reader Service Card



SAE 2800—\$600.00

Circle No. 88 On Reader Service Card

TEST REPORTS / RECORD PLAYERS



SAE 2800—\$600.00

Circle No. 88 On Reader Service Card

tion the frequency response measured ± 0.5 dB from 20 to 20,000 Hz at a distortion no higher than 0.003% THD at any frequency.

With maximum equalization applied the worst-case distortion was 0.05% THD at 20 Hz, decreasing to 0.004% THD at 20,000 Hz. With the stereo section line attenuator adjusted so that the output at maximum boost (equalization) did not exceed 1 volt, the distortion did not exceed 0.009% THD at any frequency.

The overload indicator lamps illuminated at precisely 2.5 volts output.

The frequency calibrations are approximate and serve only as a general reference for the user; it's then up to the user to fine-tune the equalization to the desired overall sound quality. Because there are four equalizer sections per stereo channel, sound quality can get out of hand if the tuning isn't done with care and discrimination. This unit can produce "giant" tonal modifications; it can literally rearrange the performer's stereo image position.

The instructions are sparse, virtually identical to those of the stereophile version. For stereophile use, a more detailed manual would be advantageous. ▲

RECORD PLAYERS

AIWA AP-2200 STEREO TURNTABLE SYSTEM

Features unusually high resistance to external shock and vibration. \$220 includes integral base and dust cover.

Description: A two-speed (33, 45 rpm) electronically controlled turntable with integral base and dust cover featuring automatic return and shut-off at the end of play, or if the eject control is depressed. Other features include: mounting feet whose height may be individually adjusted for turntable leveling and front-to-rear adjustment of the feet ranging from 6.9 to 11 inches; full time illuminated 33 and 45 rpm strobes around the rim of the platter; 33 and 45 pitch adjustments (fine speed); all front-mounted operating controls; and a sync output for remote start of any of several AIWA cassette decks equipped for remote control in conjunction with this record player.

There are controls for speed select, 33 pitch, 45 pitch, tonearm lift, and start/eject. The motor starts when the tonearm is moved off its rest. Play is started by pressing the start/eject lever which simultaneously moves the tonearm lift control down. Simultaneously, the sync output is activated for remote start of a cassette deck.

The tonearm has a micrometer-adjust counterweight that also serves as an 0 to 2.5 gram VTF (stylus force) adjustment calibrated in 0.1 gram increments. A fixed counterweight is also provided for use with "heavy" pickups. There is a calibrated anti-skate. No stylus overhang gauge is provided; the dimension is given in the manual and a ruler must be used when adjusting the pickup. The output cable capacity was 120 pF. The tonearm rest does not have a positive lock.

Performance: Both speeds held constant over an applied test range of 90 to 140 VAC with complete immunity to transient line



AIWA AP-2200—\$220.00

Circle No. 121 On Reader Service Card

voltage variations. The pitch control range measured $+2.2/-4\%$ at 33 rpm; $+3.8/5.4\%$ at 45 rpm. Wow and flutter measured 0.04% with peaks to 0.1%.

The tonearm's VTF calibrations read 0.25 gram high (indicating, say, 2 grams when the actual VTF was 1.75 grams).

Note: This record player is unusually resistant to external shock and vibration. Its horizontally adjustable legs permit installation on narrow shelves. A relatively broad vertical adjustment range for each mounting leg permits leveling of the player on virtually any household shelf or cabinet. The remote start feature can be used with virtually any cassette deck equipped for a wired remote-control start. The sync output connector is closed when the start/eject lever is operated to start play. The sync connection opens to stop the cassette deck—each time the tonearm is raised via the tonearm lift; the sync is closed each time the tonearm is lowered. At the end of play the sync is opened as the tonearm lifts and recycles back to the rest. This start-stop action causes the cassette to record only when the tonearm is tracking; it pauses along with the tonearm lift. ▲

GARRARD GT35AP AUTOMATIC RECORD PLAYER

Features continuous repeat play in addition to automatic operation. \$219.95 includes integral base and dust cover.

Description: A two-speed (33, 45 rpm) electronically controlled automatic record player with integral base and dust cover. Features include: full-time illuminated 33 and 45 rpm strobes around the platter's perimeter; automatic record size (tonearm indexing) selection in the automatic mode (12 in. for 33 rpm, 7 in. for 45 rpm); automatic tonearm return to the rest and motor shut-off at the end of a record in both the manual and automatic modes; continuous repeat play until manually stopped.

There are controls for speed/record size, off/manual/auto/repeat modes, auto start/reject, 33 pitch, 45 pitch, and tonearm lift.

The tonearm has a micrometer adjust counterweight that also serves as an 0 to 3 gram vertical tracking force (VTF) adjustment calibrated in 0.25-gram increments. There is a calibrated anti-skate. The pickup mounts in a universal plug-in shell for which a stylus overhang gauge is provided. The tonearm rest has a positive lock. The output cable capacity is 130 pF.

Performance: Both speeds held constant over an applied test range of 90 to 140 volts with total immunity to transient line voltage variations.

The 33 rpm pitch control had a range of $+4.8/-3.8\%$. The 45 rpm pitch control range was $+7.7/-3.4\%$. Wow and flutter measured 0.07% with peaks to 0.2%.

The VTF gauge had an accuracy of $\frac{1}{8}$ to $\frac{1}{4}$ gram depending on the particular VTF (error was less in the 1-gram region).

Note: The pickup shell can be accidentally twisted during installation so it is not laterally parallel to the record. Make certain that both the pickup and the shell are parallel when sighting into the front of the pickup. The adjustment can be corrected by gently twisting the shell after the shell's locking collar is tightened. ▲



AIWA AP-2200—\$220.00
Circle No. 121 On Reader Service Card

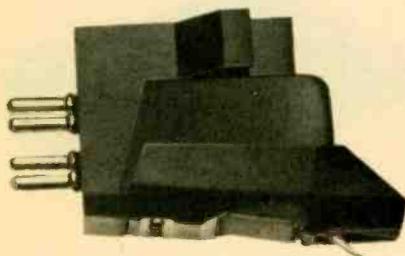


Garrard GT35AP—\$219.95
Circle No. 70 On Reader Service Card

TEST REPORTS / RECORD PLAYERS



Philips AF-877—\$240.00
Circle No. 84 On Reader Service Card



ADC ZLM—\$135.00
Circle No. 61 On Reader Service Card

PHILIPS AF-877 SEMI-AUTOMATIC RECORD PLAYER

Has better than average resistance to external shock and vibration. \$240.00 includes integral base and dust cover.

Description: A two-speed (33, 45 rpm) semi-automatic record player with integral base and dust cover featuring: touch-to-operate speed select, stop, and reject controls; a tonearm lift; individual 33 and 45 fine-speed (pitch) controls; a nine L.E.D. speed indicators calibrated $\pm 4\%$ in 1% increments; a built-in vertical tracking force (VTF) gauge calibrated 0.5 to 3 grams in 0.5 gram increments that automatically indicates the VTF when the tonearm is in the rest.

The motor starts when either speed select button is touched. At the end of play, or if the reject button is touched, the tonearm cycles back to the rest and power is turned off. If the tonearm is manually lifted from the record and returned to the rest the motor stays on, and must be turned off by touching the stop button.

The tonearm has a micro-adjust counterweight that serves as the VTF adjustment. A calibrated anti-skate is provided. The pickup mounts in a proprietary (non-universal) plug-in shell for which a stylus overhang gauge is provided. The tonearm rest has a positive lock. The output cables' capacity is 90 pF.

Performance: Speeds held constant over an applied test range of 90 to 140 volts with total immunity to transient line voltage variations. Wow and flutter measured 0.06% with peaks to 0.1%.

The L.E.D. speed indicator is precise at the "0", or "no-deviation," calibration. The $\pm 1\%$ and $\pm 2\%$ indications were "on the mark" for 33 rpm; 0.5% high for 45 rpm. The $\pm 3\%$ calibrations were 0.5% high for both speeds. The end indicators have no calibrations; they are marked "+" and "-" and show when the speed variation exceeds plus or minus 5%.

The built-in stylus force (VTF) gauge calibrations were "on the mark" from 0.5 to 1 gram, with an error of 0.5 gram high between 1 and 3 grams.

Resistance to external shock and vibration was better than average, with exceptional resistance to direct shock of the record player (an important feature if the player is to be used by younger children).

Note: The instructions for the overhang gauge specify a stylus-to-gauge distance impossible to attain with the supplied hardware or common pickups. Use sufficient spacers to insure the pickup tracks parallel to the record and then center the stylus in the gauge. ▲

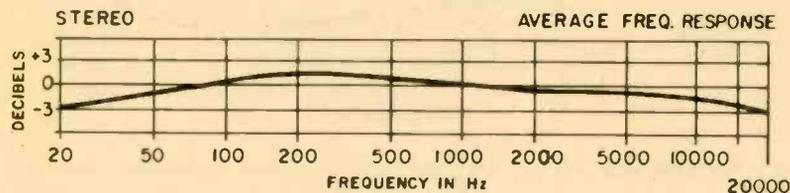
PHONO PICKUPS

ADC ZLM STEREO PHONO PICKUP

Very good overall sound quality. At this level you must look for your own nuances in sound quality. \$135.00.

Description: A magnetic pickup with an "Aliptic" stylus. The manufacturer's recommended VTF is 0.5 to 1.25 grams. Best re-

sults were attained between 1 and 1.25 grams.

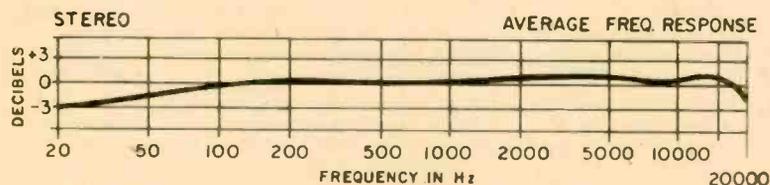


Performance: The frequency response measured within ± 1 – 2 dB from 20 to 20,000 Hz with an unusually smooth high end. Overall channel balance was better than 1 dB. The worst-case stereo separation was 27 dB at 1000 Hz; 24 dB at 15,000 Hz. ▲

DYNAVECTOR 10X STEREO PICKUP

A notably excellent sound quality. At this level of performance you must search out your own nuances in sound characteristics. \$120.00. (Note: Stylus is not user-replaceable.)

Description: A moving-coil stereo pickup with an output level approaching that of a typical magnetic pickup; a head amplifier is not generally required. A slip-on stylus guard does not lock into place and extra care must be taken to secure the guard when a guard is required. Recommended stylus-force range is 1.2 to 1.8 grams with best results attained in the range of 1.5 to 1.8 grams.



Performance: The frequency response was within ± 2 dB from 50 to 20,000 Hz, down 3 dB at 20 Hz. Actual sound quality, however, does not appear deficient in the deep bass, and in fact ranks with the higher quality pickups. Worst-case stereo separation measured 19 dB at 1000 Hz; 20 dB at 15,000 Hz. Channel balance was essentially exact. ▲

NAGATRONICS HV9100 STEREO PICKUP

Magnificent sound. Creates a "live" sound quality from records that is impossible to pin down with words. Spectacular definition. \$220.00. (Requires a head amplifier).

Description: A ribbon stereo pickup with a 0.4 x 0.8 elliptical stylus. A head amplifier is an absolute necessity. A battery-powered (eight C-cells) head amplifier specifically designed for this pickup is available as the HA9000. Pickup is supplied premounted in a universal plug-in shell adjusted for precise stylus overhang and depth. (Pickup is presently available only with integral shell.) Recommended VTF is 1.6 to 1.8 grams and results are essentially similar throughout the range.

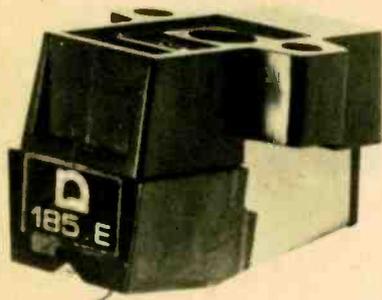


Dynavector 10X—\$120.00
Circle No. 122 On Reader Service Card

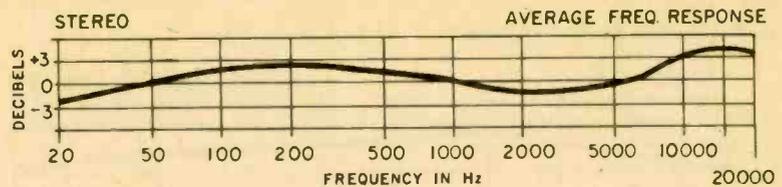


Nagatronics HV9100—\$220.00
Circle No. 123 On Reader Service Card

TEST REPORTS / HEADPHONES



Nagatronics 185E—\$38.00
Circle No. 123 On Reader Service Card

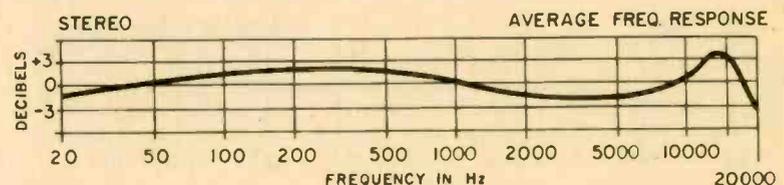


Performance: Using the matching HA9000 head amplifier the frequency response measured essentially $+3/-2$ dB from 20 to 20,000 Hz, with the right channel rising $+5$ dB at 20,000 Hz. Worst case stereo separation measured 18 dB at 1000 Hz; 17 dB at 15,000 Hz. Channel balance was within 1 dB from 20 to 15,000 Hz, increasing to 3 dB at 20,000 Hz. Overall sound quality is far superior to that implied by the measurements; the system is one of the very best heard by our listening panel. ▲

NAGATRONICS 185E STEREO PICKUP

Very good sound quality. An excellent choice for budget priced record players and changers. \$38.00.

Description: A magnetic stereo pickup with a 0.3 x 0.7 elliptical stylus. The manufacturer's recommended VTF is 1.5 to 5 grams with 1.8 grams recommended. Essentially similar results were attained throughout the entire VTF range. Pickup is also a good choice for just below top-of-the-line record players.



Performance: The frequency response measured $+3/-2$ dB from 20 to 20,000 Hz with the left channel having a 4 dB peak at 16,000 Hz. The worst-case stereo separation measured 20 dB at 1000 Hz; 20 dB at 15,000 Hz. Channel balance was essentially precise, rising to 1.5 dB at 15,000 Hz. ▲

HEADPHONES

SENNHEISER HD-424X STEREO HEADPHONES

Unusually efficient headphones. An especially good choice for owners of low-power amplifiers. \$101.00.



Sennheiser HD-424X—\$101.00
Circle No. 143 On Reader Service Card

Weight: 7 oz. Cord: 10 feet long. Cushioned headband, pressure phone cushions. An unusually comfortable pair of headphones, with light pressure on the ears and a generally light feel. They offer broad, full bass, bright highs, and average definition for their price range. They are also unusually efficient, and produce a lot of volume from relatively low amplifier power. An especially good choice for owners of low-power amplifiers. ▲

LITERATURE LIBRARY

301. There are over 400 kits described in the new *Heathkit* catalog for virtually every do-it-yourself interest—amateur radio, hi-fi components, color TV, test instruments, digital clocks and weather instruments, radio control equipment, marine, aircraft and auto accessories, and many more.

302. *Electro-Voice* will send complete information on Thiele-Small parameter speakers and systems which combine flat, wide response, high efficiency, and small size (to half size of sealed systems) including Interface and Sentry systems. There's also information on new separate component speakers.

303. *Crown* offers a new four-color brochure illustrating and describing the company's complete line of hi-fi amplifiers, preamplifiers, speaker systems, control centers and tape recorders.

304. *Sony's* "High Fidelity Components" has a glossary defining major specification, control and convenience feature terminology, which complements the reference chart of specifications for components.

305. The new 20-page, full-color stereo-phone catalog from *Koss* features lively photography and art to show 15 of the company's dynamic and electrostatic stereophones and listening accessories. There is a specification comparison chart and prices.

306. *Kenwood's* wide range of receivers, amplifiers, tuners, tape decks, stereo compacts, and speakers is described in a new brochure.

307. The full range of *Magnavox* audio products from the tuner/amplifiers to combination stereo FM/AM radio phonographs and 8-track tape player/recorders are featured in this new 60-page four-color audio catalog.

309. *JBL* offers four-color brochure which describes the nine loudspeakers which comprise their current line. Included are the L300, D44000 Paragon, L65, L212, L166, L110, L50, L40 and L19.

310. *Klipsch* loudspeaker systems are attractively presented, including explanation of the Klipschorn corner horn and corner mirror effect. Available for a few dollars are reprints covering design, stereo re-creation, etc.

311. "Hearing Is Believing," a booklet from *ESS, Inc.*, has a serious theme and a constructive purpose. Fundamentals of loud-speaking technology are examined. How to develop a superior loudspeaker is spelled out.

313. *Pickering* has attractive specification sheets on stereo headphones. Also offered is a colorful brochure on cartridges in the UV-15, XV-15 series, as well as the V-15 Micro IV series.

316. For tips from leading sound engineers, send for "The Music-Maker's Manual of Microphone Mastery" from *Shure*. It describes how to match voices and instruments.

320. This full-color booklet by *Dynaco* is subtitled "High Fidelity Components for the Audio Perfectionist." There are two introductory articles to help you choose your component stereo system. Following is detailed information on the components.

321. A new series of product literature is now available from *Jensen Sound Laboratories*. The new catalogs feature four-color photographs and graphic illustrations of the high fidelity line.

322. *TDK* has a new booklet, "SA... a new state of the cassette art," in which they claim great things: much lower noise levels, greatest dynamic range, unexcelled frequency response, high precision, among others. So send for the booklet to see if you agree.

323. A free consumer guide to car audio is now available from *Panasonic's* Auto Products Division. Included in this 128-page paperback are tips on how to go about selecting the equipment you'll be happy with, what you need to know about specifications and features, how much power do you need, a directory of what equipment is offered by *Panasonic*, how to install it yourself, and a listing of *Panasonic* service centers nationwide.

324. Before you purchase your hi-fi equipment, read "The *Garrard* Guide," what every hi-fi shopper should know about *Garrard* automatic turntables. There are 11 pages of information and pictures.

325. As part of a broad educational campaign, *Sansui* is making available a booklet, "A Non-Technical Guide to QS 4-Channel Sound," for the consumer. It describes the various forms of 4-channel, their advantages, disadvantages and availability of material.

327. *Tandberg* has an attractive color booklet displaying its tape decks, cassette deck, receivers, speakers and accessories.

328. *Pioneer* value-packed receivers are gracing more and more living rooms as audiophiles turn on, and tune into, the quality sounds of *Pioneer*. Circle, the number 228 and let *Pioneer* do the rest.

330. Make your own evaluation of why *Acoustic Research* (AR) components, designed basically for home use, are often selected for critical professional and scientific applications.

331. *JVC* offers three catalogs—"Tape-it-Live" is in English, French and German and features portable stereo cassette deck and accessories. "Listening for the Future" is all about the *JVC* FM/AM-stereo receiver series. The "JVC High Fidelity Catalogue" is a 36-page full-color delight.

332. *Sherwood Electronics Laboratories* has literature available on its full line of receivers, amplifiers, and tuners. Included are specifications and independent reviews.

333. In "Meet the Creator," *TEAC* invites you to explore the realm of musical creativity with the *TEAC* 3340 4-Channel Simul-Sync Tape Deck. The booklet introduces some of the basic effects that can be produced, using ample diagrams.

337. The 32-page *Pioneer* booklet, "How I Install Car Stereo," by a 26-year-old expert who has installed nearly 5000 car stereo systems, shows in detail how to mount, wire, troubleshoot and maintain hi-fi in your automobile.

338. *Fuji* has just made available a new booklet on their tapes—"Cassette Tape and How to Make It Work for You." It is written on a non-technical level and contains practical information on the selection and use of cassette recorders/players.

341. *Allison* loudspeaker systems claim to be unique in producing in real-room environments. This booklet on their models One through Four explains in quite some detail how they work. Each system is pictured alongside its specifications.

342. A new four-color brochure from *VOR* describes in detail the inner workings of the patented automatic "dry" vacuum record cleaner—the *Vac-O-Rec*. It cleans by lifting dust and dirt with mohair brushes, and a fan blows them away.

343. A new 12-page catalog from *Quam-Nichols* lists 127 loudspeakers, covering virtually any application and providing a tool for selection. It includes listings for new mobile 2-way radio replacement speakers—CB and land mobile business.

344. *Beyer Dynamic's* full-color brochure presents their large assortment of dynamic microphones and headphones. They claim to have the right headphone for every job—monaural, binaural, 2- or 4-channel listening, hi-fi equipment, receivers, televisions and dictating machines.

345. *Celestion* speaker systems are created in England, but are now being made available throughout the world. Send for this brochure to see why they claim such excellence in the speakers they conceive, design and produce.

346. *B&F Enterprises' Truckload Sale* catalog features 10% off their already low prices. All merchandise is high-grade military or industrial surplus: speaker kits, TV games, computer terminals, tools, TV components, lenses, transformers, semiconductors, and more.

347. *Ace Audio Co.* offers a short form catalog of kits and wired units. Pictured are preamps, equalizers, and amplifiers. Descriptions and specifications aid you in making your choices.

348. *NCI Premium Distributors* has a completely illustrated 165-page wholesale price catalog for \$4. Send for information on how to get this display of all major brand radios, televisions, stereos and appliances.

349. Send for information on *Dubie's* Recording Control Systems with mixing, fading, and monitoring controls. Special features and capabilities are described, and specifications listed. Check their customer satisfaction guarantee and the one-year warranty.

HI-FI STEREO BUYERS' GUIDE, Dept. LL-20
Box 1849, G.P.O., New York, NY 10001

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January/February 1979

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(Continued from page 22)



acoustic arrangements (oh, there's *some* flash) of tunes penned by Sayer, Jackson Browne, Billy Nicholls and a Buddy Holly classic ("Raining In My Heart") written by Felice and Boudleaux Bryant, who composed so many of the Everly Brothers' early hits. "Stormy Weather" opens the album on a slow tempo country note with Dave Lindley's steel guitar providing the seasoning along with Sayer on harmonica and overdubbed vocal. "Dancing the Night Away" ups the beat a little, while "I Can't Stop Loving You" returns to the slower rhythm. All in all, it's a relaxed and relaxing collection. The sound is full, rich, well-balanced and stereophonically effective—a typical Richard Perry production.

Jane Olivor: "Stay The Night" Columbia JC-35437 \$7.98.

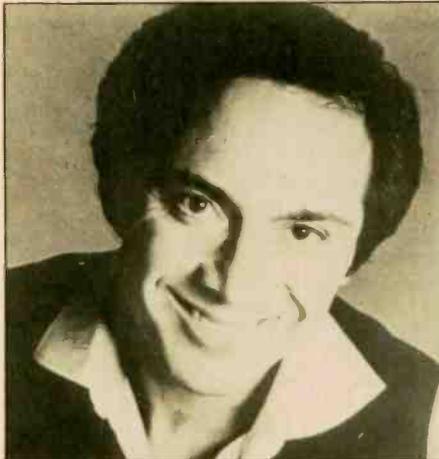
She tiptoes along the notes like a ballerina. Jane Olivor's is a delicate, crystalline voice without the airy false-



ness of some of her contemporaries. In this album she sings of the sweet and bittersweet faces of romance. A slowed down, sexy remake of the Chiffons' "He's So Fine" (complete with doo-lang-doo-langs) is a highlight. Neil Sedaka's "Solitaire" is a real spine-chiller, building from a simple piano introduction through a fully instrumented emotional crescendo and fading to a gentle end. This is Olivor's third album; nowhere near her last.

Paul Anka: "Listen To Your Heart" RCA AFL-1-2892 \$7.98.

Full orchestration, up-front crispy clean rhythm and percussion and Anka's smooth vocal professionalism make this item an easy listening highlight of the year. The full complement of Los Angeles' star session players are very much in evidence. The horn and string arrangements are superb. Anka wrote four of the 10 tunes, with one contributed by gifted composer and songstress Carole Bayer Sager. Paul



has been, as we say, simmering beneath the Hot 100 for a while. This set could bring him back to a full boil. Particular standouts are "Brought Up in New York (Brought Down in L.A.)" and the title tune.

Bonnie Koloc: "Wild And Recluse" Epic JE-35254 \$7.98.

This is the sixth album from one of the pop music world's most private and therefore "mystical" persons. In a time when many resort to vocal gimmickry to be distinguished from the crowd, Bonnie Koloc can still be counted on to deliver a group of songs simply, strongly, eloquently, without the embellishment of false flourishes and mannerisms. Haunting is the only word for "Roll Me On the Water," whose dramatic effect is heightened by a subdued, gospel-like chorus. Producer Joel Dorm keeps it simple. Koloc's voice is the most prominent element.



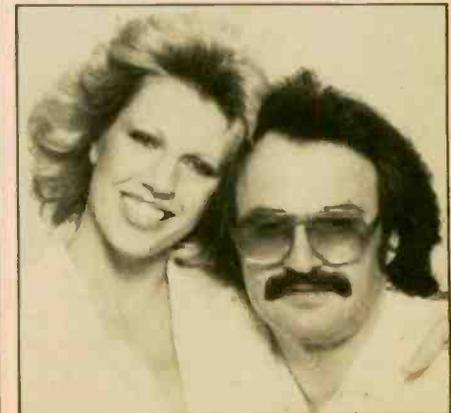
In fact it's the only element on two acapella cuts. If you like pop, blues, folk, romantic ballads, you'll find what you want on this masterful album.

Livingston Taylor: "3-Way Mirror" Epic JE-35540 \$7.98.

Backed by a coterie of West Coast instrumental superstars, James' little brother, a veteran of substantial concert work if not many records, delivers a set of laid back, easy going, mostly "up" tunes with an occasional melancholy but not maudlin ballad ("Living Without You"). The velvety vocal sheen characteristic of the Taylors is present and blends well with the subject matter of the songs. Taylor wrote nine of the 10 tracks on the album.

Giorgio and Chris: "Love's In You, Love's In Me" Casablanca NBLP-7104 \$7.98.

Here's another surge of sizzling Munich techno-rock from the producer of Donna Summer's albums (Giorgio Moroder) and the satiny lead singer of the Munich Machine (Chris Bennett). All the electronic plunks, thumps, twangs, swirls, drones and whatever are here-bolted together by a solid disco beat. The music makers and the music reproducers (your system) are



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A GUIDE TO RECENT STEREO RECORDINGS

by THOMAS D. KELLY

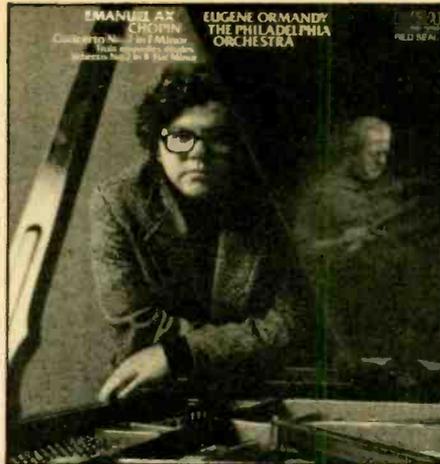
An avid record collector for nearly 20 years, Thomas D. Kelly has a keen ear for both live music and full-fi sound. Mr. Kelly played the records he reviews here on equipment consisting of an Empire 39 transcription system with a Shure V15 III cartridge, a C/M Labs 911 stereo amplifier, a Marantz 7T pre-amp,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

© Chausson: *Poeme de l'amour et de la mer*; Duparc: *Five Songs*, Dame Janet Baker, mezzo-soprano; London Symphony Orch., cond. Andre Previn, Angel S 37401.

Superb quality here—from every standpoint the album couples together some of the finest music of two French composers who were contemporaries, Henri Duparc, born in 1848, and Ernest Chausson, born in 1855. Both came to a tragic end, Duparc in 1933 from a severe nervous breakdown, composing nothing for the last fifty years of his life, and Chausson in 1899 from a bicycle accident. Both composers produced relatively little. Chausson is best known for his "Poeme" for violin and orchestra, very well represented on records, while Duparc, in his own search for perfection and self-criticism, destroyed almost everything he composed except 16 songs, a symphonic poem and several other minor works. *Poeme de l'amour et de la mer* has an impassioned text by Maurice Bouchor, and the score is exquisitely impressionistic. The five songs of Duparc include his most famous, "Phidyle," "La vie anterieure," "Le manoir de Rosemonde," "Au pays ou se fait la guerre" and "L'invitation au voyage." These are among the most effective and beautiful of French *lieder*, and they caress the ear. Janet Baker sings this repertory with cool perfection, and she is given knowing support by the fine orchestra. Complete texts and translations are provided.

© Chopin: *Piano Concerto No. 2 in F Minor, Op. 21*. Emanuel Ax, pianist; Philadelphia Orch., cond. Eugene Ormandy, RCA ARL1-2868.

Ax, who is not yet 30, won first



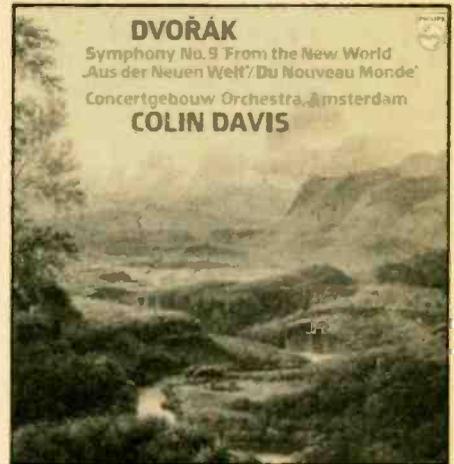
Original interpretation

prize in the Artur Rubinstein International Competition held in Israel in 1974, and for good reason. Since that time he has toured extensively, and already has to his credit several outstanding solo discs of music by Chopin, Beethoven, and Ravel. This is his first recording where he performs as soloist with a major orchestra, and he offers an original, thoughtful account of Chopin's concerto, giving fresh insight into the score. This really must be considered one of the finest versions of the work, although the reproduction is not totally satisfactory. The solo piano sound is superb, but the engineers have captured little of the rich beauty of the Philadelphians, yet *have* captured a liberal dose of decidedly boomy, undefined bass. Still it is superior to the last RCA recording of this music with Ormandy and the Philadelphia Orchestra, which featured Artur Rubinstein as soloist, and was a disc plagued by poor solo as well as orchestral sound. Ormandy's *Odyssey* disc with Eugene Istomin as soloist offers excellent orchestral reproduction, but Istomin is quite bland when compared with the felicities of Ax's new performance. This new RCA LP is filled out with Chopin's "Trois Nouvelles Etudes" and the "Scherzo No. 2 in B Flat Minor," in which Ax meets the high standards he set on his earlier solo discs.

© Dvorak: *Symphony No. 9 in E Minor, Op. 95 "New World"*. Amsterdam Concertgebouw Orch., cond. Colin Davis, Philips 9500 511.

With so many recordings already available of this familiar work (about two dozen) why a new one? Well, there is good reason if it contains the quality of this splendid Philips issue. The Concertgebouw Orchestra recorded his symphony twice before, once on Telefunken 78 rpm discs with Willem Mengelberg conducting, a fas-

cinating and sometimes wayward conception but valid in its own way, and again for Philips with Antal Dorati directing. On this third version Davis offers a relaxed but powerful reading, letting the score unfold leisurely. The playing of the orchestra is a delight, particularly the exquisite English horn solo of the Largo. Philips's engineering is exemplary, with exceptionally fine string tone, although generally it is not as spectacular as what is heard on their



Delightful version

recent disc of Stravinsky's *Rite of Spring*. Davis already has recorded Dvorak's *Symphony No. 7* with the Concertgebouw (Philips 9500 132), a highly acclaimed version, and it is reported that they plan to record a complete set.

© Liszt: *Hungarian Rhapsody No. 2 in C Minor, Hungarian Rhapsody No. 5 in E Minor, Hungarian Rhapsody No. 3 in D, Mephisto Waltz No. 1*. London Philharmonic Orch., cond. Willi Boskovsky, Angel S 37278.

The success of Boskovsky's Liszt disc with the Philharmonia Hungarica Orchestra (S 37277) doubtless prompted this second volume in the series, this time with the London Phil-



Vibrant gypsy music

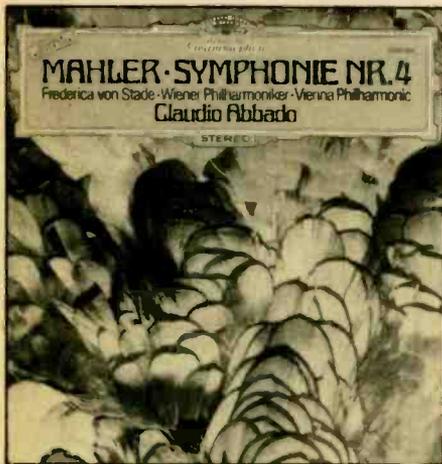
STEREO RECORDINGS

(Continued from page 73)

harmonic Orchestra. Boskovsky has a way with this repertory; his readings are vibrant and dynamic and he captures every ounce of gypsy flavor in the Rhapsodies. The London Philharmonic plays superbly and the engineering is everything it should be. I look forward to future releases in this series, which deserves its popularity.

© Mahler: *Symphony No. 4 in G Major*. Frederica von Stade, mezzo-soprano; Vienna Philharmonic Orch., cond. Claudio Abbado, Deutsche Grammophon 2530 966.

This most popular of all Mahler symphonies has been represented well on recordings. Over a dozen versions are currently available, including interpretations by some of the acknowledged Mahler specialists of the time: Bernstein, Haitink, Kubelik, Horenstein, Klemperer and Solti. Claudio Abbado is a relative newcomer to the repertory but obviously a formidable

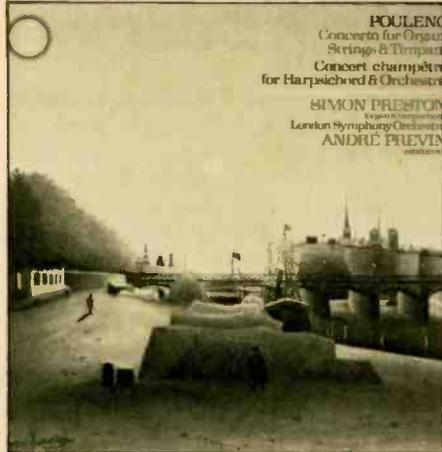


Controlled Mahler

contender. His recent recording of the composer's *Symphony No. 2* with the Chicago Symphony is superb and a study in controlled dynamics, shattering in its impact. His performance of the *Symphony No. 4* is equally controlled, with a third movement that is particularly expressive in addition to a voluptuous angelic sound for the finale. The Vienna Philharmonic strings, so crucial in this music, are in particularly fine form, with reproduction that is rich and wide-range. Abbado's interpretation of *Symphony No. 4* must be counted among the major recordings of this most idyllic of all Mahler symphonies.

© Poulenc: *Concerto in G Minor for Organ, Strings and Timpani, Concert champêtre for Harpsichord and Orchestra*. Simon Preston, organ and harpsichord, with the London Symphony Orch., cond. Andre Previn, Angel S 37441.

Both of these concertos happen to be great favorites of mine. They offer much for the listener, with interludes of the wistful, poignant writing representing Poulenc at his most personal, combined with wit and comic bravura. The Organ Concerto is already available in two superlative recordings, one

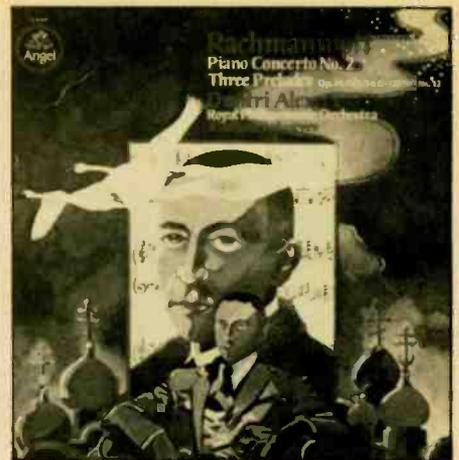


Thoroughly enjoyable

on Angel with Maurice Duruflé, who assisted Poulenc in the composition of the work, accompanied by Georges Prêtre and the French National Orchestra (S 35953), the other on RCA with Berj Zamkochian, Charles Munch and the Boston Symphony (RCA AGL1-2445). The *Concert champêtre* is currently available domestically only on Angel with Aimee van de Wiele as soloist with Prêtre conducting (S 35993), coupled with a delightful and essential performance of Poulenc's *Concerto in D Minor for Two Pianos* with the composer and Jacques Février as soloists (S 35993). Angel's new recording is stunning. Preston is as masterful at the harpsichord as he is playing the organ. He and Previn collaborate on performances that are committed, vivid and quite grand in their own way. Sonically this LP is one of the finest Angel's I've ever heard, with huge solid organ sound, a brilliant harpsichord and rich well-defined orchestral textures. I enjoyed this LP thoroughly, and you probably will too.

© Rachmaninoff: *Piano Concerto No. 2 in C Minor, Op. 18*. Dimitri Alexeev, pianist; Royal Philharmonic Orch., cond. Vladimir Fedoseyev, Angel S 37491.

It seems strange to release yet another recording of Rachmaninoff's *Piano Con-*



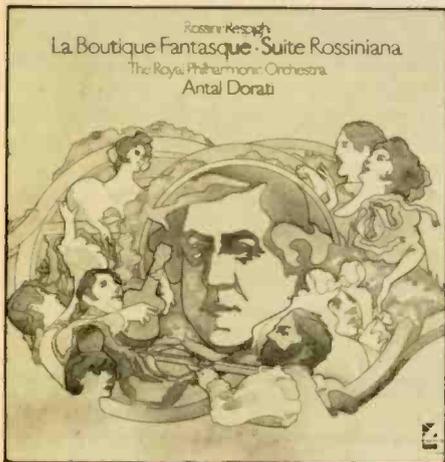
certo No. 2 when there are already two dozen versions in the catalog. This one features as soloist one of the most promising young Soviet pianists who has won prizes in no less than four international competitions. He plays the Rachmaninoff concerto broadly, emphasizing the lyricism of the score. It is very beautiful to hear, although rather lacking in pianistic fireworks. Most recordings of this concerto offer a substantial filler, usually the Rachmaninoff *Rhapsody on a Theme by Paganini* or another concerto. Angel's new LP contains only three Preludes from Rachmaninoff's Op. 23 and 32, with a playing time of less than ten minutes, hardly good value for the collector who purchases a premium-priced disc. To me perhaps the best of the extant recordings of the popular Rachmaninoff concerto is the Quintessence reissue of Earl Wild's glorious performance with Jascha Horenstein and the Royal Philharmonic, coupled with the *Paganini Rhapsody*, which lists at only \$3.98.

© Rossini-Respighi: *La Boutique Fantasque, Suite Rossiniana*. Royal Philharmonic Orch., cond. Antal Dorati, London Phase Four SPC 21172.

La Boutique Fantasque, a delightful toyshop ballet, has long been a favorite with sound buffs; some collectors may remember the superb early mono LP with Ernest Ansermet conducting, which established new sound standards when first issued. The percussion shines more brilliantly than ever on this fine new Phase Four release, and the engineers haven't missed an opportunity to beguile the listener with rich orchestral sonorities. The overside *Suite Rossiniana*, also based on short piano pieces, doesn't wear quite as well, but it does end with a lively Tarantella. Dorati and the Royal Philharmonic give their best on this disc, which can be highly recommended, should the repertory interest you.

© **Boulez Conducts Stravinsky.** Columbia M 35105.

This is an outstanding Stravinsky disc with the New York Philharmonic conducted by its ex-music director, Pierre Boulez. The three works included combine both the early and mature periods of the composer, with the *Pulcinella Suite* as the featured work, along with *Symphonies of Wind Instruments* and one of the composer's earliest orchestral works, *Scherzo fantastique*, Op. 3. Musically the most important of these is the "Symphonies," but one cannot help but respond to the humorous "Pulcinella" score and I find the "Scherzo" to be one of Stravinsky's most captivating works, rather like a



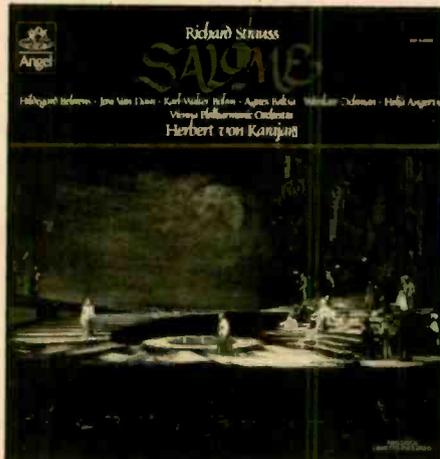
study for the *Firebird* which appeared in 1910, one year after the "Scherzo." At one time there was a fine recording of this music with the composer conducting, but it seems to have disappeared from the catalog, so this beautifully recorded new Boulez version is even more valuable.

© **Strauss: Salome.** Hildegard Behrend Behrens, soprano (Salome); Karl-Walter Bohm, tenor (Herod); Agnes Baltsa, mezzo-soprano (Herodias); Jose van Dam, baritone (Jokanaan); Wieslaw Ochman, tenor (Narraboth) and others, with the Vienna Philharmonic Orch., cond. Herbert von Karajan, Angel SBLX 3848, two records.

Here at last is the long-awaited *Salome* with Von Karajan (originally announced for release in the fall of 1977), and it was worth the wait. Karajan had said he would not perform or record *Salome* until he found the perfect voice for it, and obviously he feels he has found what he was looking for in Hildegard Behrens, a young German soprano whose singing career started in the early seventies. She recently had a tremendous success as Leonore in *Fidelio* at Covent Garden, and now, after *Salome* performances last year in Salzburg, has firmly estab-

lished herself in the operatic world. Her voice is intensely beautiful, firm and full in the upper register, and she seems to have no pitch problems whatever. It is a youthful sound, indeed perfect for the role, and interpretively she is strong. The recording was made in May of 1977; how unfortunate that the recording was not made after the Salzburg live performances two months later, as a tape of the latter shows Behrens more involved dramatically and more exciting vocally. Still, her recorded performance is superb and should be heard by all devotees of this opera. The supporting cast is exceptionally fine, with Van Dam as a powerful Jokanaan, probably the finest on discs, and Agnes Baltsa giving more dignity to the character of Herodias than one usually hears. Karajan is a master of things Straussian, and he gives an expansive interpretation, wonderfully played by the Vienna Philharmonic, which has recorded the opera twice before. The engineering on this set is not state-of-the-art. Decca engineers did the job for Angel-EMI and, while the sound is clear, there is not much bloom to the reproduction, which is somewhat dry and unresonant. The singers sometimes have a slight metallic quality and do not have the presence I like to hear in an operatic recording.

There currently are three other com-



Wonderfully played

plete stereo recordings of *Salome*. London's features Birgit Nilsson's stunning vocalism, although she hardly suggests the teenage Salome. Karl Bohm's Hamburg recording is flawed by Gwyneth Jones's inadequate performance, but the decade-old Caballé recording on RCA has much to offer. It is almost inconceivable to visualize Caballé on-stage in the role, but vocally she is excellent, far better on this recording than in the recent DG disc of the final scene in which she is accompanied by Leonard Bernstein. The RCA Caballé set also boasts stunning sonics, superior to the Nilsson London album and the

new Angel set as well. There are a number of recordings of the famous final scene. A London disc offers Anja Silja with the Vienna Philharmonic, vocally a trying experience for the listener, although the reproduction is magnificent, and the overside "Lulu" suite finds the soprano more in her element. Bulgarian soprano Ljuba Welitsch sang the role for the first time in 1944 with Strauss conducting (on his eightieth birthday) and was called by him "the ideal interpreter." It is said that Welitsch recorded the final scene in the mid-forties with Karajan conducting for EMI but that the masters were damaged. This is unfortunate, but we do have her two recordings of the final scene, both of which are essential for the vocal collector. One of these is from a 1943 radio broadcast (Seraphim 60202), the other recorded soon after the soprano's sensational Met debut in 1949 with Fritz Reiner conducting. (Odyssey 3216-0078). Both are unique; there is no other soprano who characterizes the role so completely both vocally and dramatically. It is unfortunate that she did not record the opera in its entirety, although the undercover tape circuit does offer both of her Met broadcasts.

© **Tchaikovsky: Symphony No. 5 in E Minor, Op. 64.** Amsterdam Concertgebouw Orch., cond. Willem Mengelberg, Bruno Walter RR 425, mono.

Willem Mengelberg developed the Concertgebouw Orchestra, of which he was music director for a half-century, into an incredibly responsive, plastic ensemble. Many Columbia and Telefunken 78 rpm discs display their unique artistry, and some of these have been reissued on LP in well-processed transfers. The warm acoustics of the Concertgebouw are ideal for recording, and the sound quality on the older mono discs was of extraordinarily high quality considering that the recordings were made in the thirties. Many of the Concertgebouw concerts were recorded on acetate discs by the Dutch Radio, and some of these performances have been made available, notably the recent Philips issue of all nine Beethoven symphonies. Now the Bruno Walter label offers this live performance of the Tchaikovsky *Symphony No. 5* from a broadcast of 1938. The playing is positively glorious, with a rubato that one would think impossible for an ensemble, but Mengelberg's control is absolute. The reproduction is dated, as one would expect, but the balance is good and the recording highly listenable. As a bonus the second side offers the same composer's "Serenade for Strings" minus the first few minutes. Apparently this part of the transcrip-

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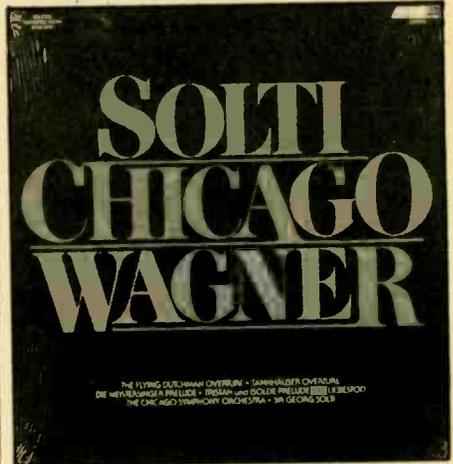
STEREO RECORDINGS

tion from the radio broadcast was damaged. If you're looking for a sample of the artistry of this unique Dutch conductor, you need look no further.

© Wagner: *The Flying Dutchman Overture, Tannhäuser Overture, Prelude to Die Meistersinger, Prelude and Liebestod from Tristan and Isolde.* Chicago Symphony Orch., cond. Sir Georg Solti, London CS 7078.

The combination of Solti and Wagner has always been volatile, and I still consider Solti's London recording of the *Ring Cycle* to be a landmark in the history of the phonograph. Leading his Chicago Symphony, Solti presents glorious performances of these familiar Wagnerian staples. The strings in the *Tristan* are quite fantastic, particularly in the *Liebestod* as they climb to the peak, playing with total unanimity. The *Tannhäuser* also is a test of orchestral

virtuosity, brilliantly executed, but I do not understand what happened at the conclusion of the *Meistersinger* prelude. There is a quick and electronic cutoff



of the final chord, which suggests that this is taken from London's recording of the complete opera, which was made with the Vienna Philharmonic, not the Chicago Symphony. In the complete recording the chorus enters at that point. Still, by any standards, this is a quality recording for those interested in the repertory, and the sonic quality is up to today's best standards. ▲

JAZZ: WES MONTGOMERY

(Continued from page 20)

gomery moved under the wing of Creed Taylor, whose record-producing skills had already helped organist Jimmy Smith, cross over from jazz onto the pop charts. The formulae that had worked well for the organist—basically an emphasis on current pop tunes, and limited space for improvised solos—worked wonders for the guitarist. Several Montgomery-Taylor collaborations on Verve and A&M were among the best-selling pre-1970s jazz releases, and one 1966 album may have been the biggest-selling LP of any idiom recorded through that date. Unfortunately, almost none of Montgomery's everyday performances with small groups were recorded during his last years. When stricken with a fatal heart attack in June 1968, he left relatively little evidence of his quarter-century of brilliant musicianship.

On the surface, Montgomery's story is a familiar one—the jazz musician who renounces his art in deference to the radio industry's idea of what good music is. But in essence, Montgomery always played *to* people; unlike many fellow modernists, his solos built towards simplicity rather than complexity. (Schuller described the typical Montgomery solo as a three-part form: "a single line, primarily melodic," then a line of "impossible-to-play, octaves," and a final section of "even 'impos-

sible' block chords," with each section growing rhythmically simpler as it becomes correspondingly harder to finger.) On the other hand, Montgomery was never given to the simplism of overstatement—his relaxation and lack of affected emotion have proven to be the least imitable aspects of his playing—and whether delivering a fairly straight melodic reading in the midst of an elaborate arrangement or reworking a two-bar riff at the end of a long solo, he was always a source of fresh ideas. His octave-doubling trademark became a necessary skill for all popular and jazz guitarists who followed him; in fact, an electronic device was even developed to allow less capable performers to sound octaves while fingering less difficult single lines. Beyond affecting his instrument's technology and technique, however, Montgomery was truly a popular artist in an age when many so-called artists lacked popularity or artistry or both; he won his victories in the face of a music industry that seemed to have less and less need for jazz musicians, and he maintained a musical identity that would not have existed without his decades of experience in jazz.

Beginnings (Blue Note) has the pre-1959 recordings with Buddy and Monk; one of these discs features saxophonist Harold Land, and the other is an

Indianapolis all-star date, including a very young Freddie Hubbard. The guitar on these sessions is busier than Montgomery's later work. *The Best of Wes Montgomery* (Fantasy) is harder to find, but a better representation of the three Montgomerys together.

While *We're Young* (Milestone) has sessions from 1960 (with pianist Tommy Flanagan) and 1961 (with pianist Hank Jones); "West Coast Blues" from 1960 is an outstanding single line/octave/block chord solo, and perhaps the best introduction to Montgomery. *Movin'* (Milestone) has an outstanding "live" session with saxophonist Johnny Griffin and the 1962 Miles Davis rhythm section, and a 1960 session which features Montgomery on bass guitar—no, not electric bass—in performances of complete flexibility. *Wes and Friends* (Milestone) includes selections with Modern Jazz Quartet vibraharpist Milt Jackson, long a Montgomery booster; and a Montgomery Brothers date with pianist George Shearing, employing arrangements in the extremely stylised Shearing manner. *Pretty Blue* (Milestone) is a grab-bag, with several pieces from Montgomery's first date as a leader; several more from his last Indianapolis period; and an entire record with arrangements for string section—an early and unsuccessful attempt at popularizing the guitarist.

Most of the Montgomery titles among the widely imported Japanese essentially duplicate the Milestone issues above. The Riversides invariably have cleaner pressings, while the Milestones are less expensive and include previously unissued takes. *Bags Meets Wes* and *George Shearing and the Montgomery Brothers* (both Riverside) otherwise equal *Wes and Friends*; *Incredible Jazz Guitar* with Tommy Flanagan and *So Much Guitar!* with Hank Jones (both Riverside) equal *While We're Young*; and *Full House* (Riverside) is the "live" half of *Movin'*. *A Dynamic New Jazz Sound* and *Boss Guitar* (both Riverside), however, each contain several small-group tracks not included in *Pretty Blue*.

Ironically, many of Montgomery's 1960s best-sellers are no longer in print. Among the heavily-produced Verves, for example, there are only *Bumpin'*, and two greatest-hits sets—the single-record *Best of Wes Montgomery* and the two-disc *Return Engagement*. The even more elaborate A&M albums—*A Day in the Life*, *Down on the Ground*, *Road Song*—are all still available. The best music from these years is on *The Small Group Recordings* (Verve), which has material from a 1965 tour with the Wynton Kelly Trio, as well as two lively cuts with Jimmy Smith. ▲

OPERA: JON VICKERS

(Continued from page 42)

Peter Grimes, a moving Samson, a fascinating Otello. To me, though, he can also be incredibly mannered. But no amount of interpretation, (provided he is singing, not crooning), can take away the beauty of his tenor or his thrilling power.

Certain roles have his stamp and will remain his until an equally powerful personality comes along. One of these is Peter Grimes. From first note to last he makes this miserable, cruel man powerful, misunderstood and strangely sympathetic. One senses his pain, torment and craziness, but one is never removed from him. Vickers has never scored less than an overwhelming success in this earliest of Benjamin Britten's operas, and he has long bewailed the fact that no record company has recorded his performance.

This has now changed and before this article appears, Philips Records will issue Vickers' Peter Grimes with Colin Davis conducting. It should be a treasure, because among his other virtues Vickers has an eminently phonic voice. In fact, no tenor currently in the big leagues sounds so real on disc as he does in live performance. The personality is there, the tension

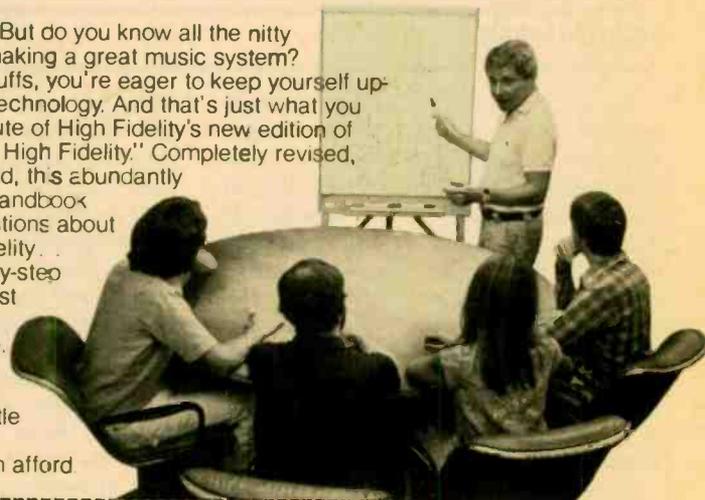
and the emotion of the voice. And though Vickers has longed to see his Grimes on record, he and we are lucky to have most of the rest of his repertory on a variety of albums.

His Florestan in *Fidelio* can be found on Angel (S-3625) in a performance filled with his best singing and almost total lack of the occasional huskiness that can sometimes creep into this voice. His Leonore is Christa Ludwig, recorded when the role was totally within her grasp. The problem of the performance, and it is a big one, is the conductor, Otto Klemperer. Although a genius himself, he reads Beethoven's titanic treatise on liberty in the slowest manner imaginable, thus robbing it of much inner intensity and fire. But Vickers gives one of his great performances.

Another role early associated with the Canadian is Aeneas in *Les Troyens*, and the only recording of the opera (Philips 670 9002) has Vickers in wonderful form under the baton of Colin Davis. Vickers as Aeneas has a full panoply of emotions: he must be heroic as he leads his men out of Troy and into battle for Dido, a romantic lover of Dido as well as a brooding,

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dreaming hero forced to set out for Rome. Throughout he has an epic sound in his voice.

Another role for which he is rightly famous is Saint-Saens' Samson. Though there are oratorio aspects to his work, it is an opera and demands a straight-out singing hero who can still be convincingly lost in his love for Dalila. Vickers handles the assignment with thrilling intensity as does his exciting, if always a bit crude, Dalila, Rita Gorr (Angel S-3639).

In the area of controversy comes Vickers' Otello, best heard with Karajan to the Desdemona of Mirella Freni and the Iago of Peter Glossop (DK SX 3809). Vickers is acclaimed over much of the world for his Moor, and he appeared in September on the first Metropolitan television presentation of this season in this role. My problem with his Otello is the very quality of reason and intellect that characterizes so much of what he sings. To me, he has always played Otello as though he were Hamlet, without the uncontrolled, purely emotional passion vital to the plot. That this is a minority report can be found in the number of Otellos Vickers has performed, always to vast enthusiasms. His singing of the role is strong, though in this as in much of his Italian singing, his mannerisms often verge on the precious. He is indeed almost too precise in his way with the notes and his varying of dynamics. One is conscious of his thinking, again and again, not the emotion of his singing. But the recording is a famous Otello—not because of Vickers or Karajan or

because it is very Italian, but rather because the recording is never less than interesting.

Other Italian roles—and French—have not proved ideal. A performance such as Radames (London 1393) does give us the young Vickers with the young Leontyne Price as Aida, but there are better operas for him and her second Aida is a more exciting performance.

But what about Wagner? Acclaimed at the beginning of his Met career as the hope of the Wagnerians, he has sung only a few Wagner roles to date, never touching either Siegfried, Walther in *Die Meistersinger*, Loge, Lohengrin, or Tannhaeuser. Finally, next spring he will sing his first Metropolitan (and U.S.) Parsifal for which he was announced in New York 18 years ago. Many reasons—some sensible, some not—have been given for his not taking on these roles, but he has not done so. And though his voice may have stayed better with the flexibility brought from a variety of repertory, it is a pity that this perfect sound for Wagner has not been used more in the works of the German composer.

Tristan, however, was taken on by Vickers a few years ago, and there is a fascinating recording of the opera, with Herbert von Karajan in the pit (Angel S-3777). It was made before the tenor had sung the role anywhere, and it therefore does not have the experience of phrase that it might. It is commanding, however, and though there are passages too stylized and—because of Karajan's preference—to

cosmeticized, it is a marvelous interpretation. Vickers really sings the third act, and makes one suffer as only a great Tristan can.

For many, Vickers' first Wagner in New York (Siegmond) is still his Wagnerian masterpiece, and though it is found on two recordings, neither is ideal. The first with Miss Nilsson as Bruennhilde was made early in Vickers' career, just after his first Met performances, when his voice was at its most flexible. It is fantastic singing, but the conducting of Erich Leinsdorf is pedestrian and the sound is not great by today's standards (London 1511). Still, it is the way to hear Vickers' great Siegmund. Unfortunately, his other Siegmund is a classic statement of what can be wrong with Vickers when he and Karajan decide to make a unique statement of a role. In the Karajan *Ring*, he serves as a mannered, molded Siegmund which is far too much crooned and rarely sung easily (DG 271 3002). It is a treasured performance for some, but it lacks the raw physical power combined with vulnerability that makes Vickers' Siegmund unique.

The history of this complex tenor is yet to be written, but we can look forward now to two events: a recording of Peter Grimes and his first comic role ever—the stuttering figure of Jenik in Smetana's *Battered Bride* which he takes on this month at the Met and which will no doubt soon find its way to disc. With Vickers it is always fascinating to guess what might happen next. ▲

EQUALIZERS

(Continued from page 48)

Actually, even a ten-octave-band equalizer does not have the resolution required to compensate for the room resonances or sharp peaks and dips in the response curve of the speaker. It can only control the *average* response of the speaker in that octave. Even this can produce a vast improvement in the sound quality of the system for research has shown that broad hills and valleys in the response curve are much more disturbing, that is, color the sound to a greater degree, than narrow, sharp anomalies of the same degree.

Nonetheless, a speaker may have a peak or dip much less than an octave wide but still of sufficient width to create a problem. Need you buy a one-third octave laboratory equalizer to compensate for such errors? No. Another option is a "parametric" equalizer. The common graphic equalizer offers you no control over the bandwidth or frequency location of each of its filters. They are set at the factory to be one (or two) octaves

wide and are spaced at regular intervals throughout the spectrum. A parametric equalizer affords you control over the filter width and location *as well as* control of the amount of boost or cut employed.

The center frequency of each of the filters used in a parametric equalizer is adjustable about its nominal value. Some models let you move the filter as much as an octave above or below its design-center value. And you can control the filter "Q" or bandwidth as well, making it much less than an octave in width or perhaps even broader than an octave. Thus, a parametric equalizer's characteristics can be tailored to match the particular anomalies of the room and speaker, and such an equalizer—even one with fewer individual bands than a conventional equalizer—can actually give you better results. However, because of the greater number of variables involved (width and center frequency as well as boost or cut), it is virtually impos-

sible to properly set the controls by ear. Test equipment is a must.

Once you've gotten your system equalized, it's a good idea to mark the control settings. Even better, make a cardboard template cut to a shape that matches the control settings. This is easily done with the "graphic" equalizer since slider-type (rather than rotary controls) are used to set the boost and cut. By the way, there's no mysterious meaning to the word "graphic." It merely indicates that the position of the sliders is similar to a "graph" of the equalization you've used. Once you've made your template (or marked the settings), you're free to alter the controls to compensate for deficiencies in a particular recording, and you can quickly re-establish "standard operating conditions."

Where To Hook Up. There are two places an equalizer can "go," that is be connected, in a hi-fi system. You can patch it between the preamp and

power amp by removing the connecting links between those two sections in an integrated amp. (Most new integrated amps and receivers have provision for separating the two sections.) Or, you can patch it into a tape-monitor loop. Each type of connection has its advantages and disadvantages.

In the tape-monitor loop, you needn't fear overloading the equalizer when you turn up the volume, or degrading the signal-to-noise ratio (by the noise of the equalizer) when the volume is turned down. The equalizer is connected "before" the volume control. The tape-monitor switch also serves to bypass the equalizer (in the monitor position) whenever you desire. However you must forgo this tape input for other purposes (unless the equalizer duplicates the connection—some

do), and you must be sure that the levels from the various program sources are reasonably equal and neither so large as to create an overload of the equalizer nor so low in level as to be submerged in noise.

When the equalizer is connected between the preamp and the power amp, the tape-monitor input is not lost. However, one loses the ability to bypass the equalizer unless it, itself, has a switch for that purpose.

Whenever you use an equalizer, beware of turning up all the controls. All you'll end up doing is creating a ragged frequency response—the response curve of an equalizer with all controls set for maximum boost or maximum cut looks like a series of waves—and you'll likely overload its output circuits and increase the distor-

tion. The best condition for use is with modest amounts of boost *and* cut so that the average program level at the output is more or less the same as that being fed in.

While virtually any equalizer can make virtually any system sound better, even the most exotic equalizer won't give a rotten speaker a flat response curve. The smoother the response of the speaker is to start with, the more perfect the final result will be, and the more impressed you're likely to be with the improvement.

Whether you opt for a simple five-band equalizer and use it as a "super" tone control, or go whole hog for a parametric equalizer and have it set up with professional equipment, the equalizer is one of high fidelity's more useful accessories. ▲

NOISE REDUCTION

(Continued from page 41)

which results in an unrealistic performance. They can use gain riding which means to increase the recording level during quiet passages (so the soft sounds are not buried in tape noise) and cut back on the recording level as a loud passage approaches—thus avoiding saturation. Finally, there is peak limiting which, as the name implies, is to use an electronic limiter to prevent loud signals from exceeding the capabilities of the tape recorder. As a home recordist, you may run into the same problems if you were to try and record a Sheffield direct-cut disc onto a cassette. Fortunately, the 2:1/1:2 compression and expansion of the dbx units allow you to squeeze much more sound on a tape

Thus far we have discussed getting rid of noise by using two-way processors. However, good and useful as these may be, they can do nothing to remove hiss from programs which already exist. In other words, if you are making a tape recording of, say, a poor FM broadcast, they can do nothing to clean it up—they just guarantee that your tape recording will be no worse than the original signal. Fortunately for those of us that already have discs or tapes with hiss, there are two "after the fact" single pass processors that do manage to correct existing problems.

First we have the DNF-1201A dynamic noise filter from Burwen Research. The DNF is meant to remove high frequency noise that is present in ordinary recordings. Basically, the DNF is a variable bandwidth noise gate (variable action filter) and its operation is determined by the volume of the signal being fed through it. A horizontal slide control on the

front panel acts as a threshold adjustment which the consumer uses according to the program being processed and the amount of unwanted noise in the music. Once it is properly set, any signal entering the DNF that falls above the threshold setting is left alone by the noise reduction circuitry, while any noise that falls below the setting is prevented from going any further in the audio system. Also on the front panel are three push-buttons labeled "Min," "Med" and "Max" which, in part, determine the frequencies at which the DNF will take effect. This unit is especially effective at "cleaning up" the sound from older 78 rpm recordings.

Another single pass noise "filter" on the market is the Phase Linear AUTOCORRELATOR. In the noise reduction mode, the Auto-C employs a series of electronic filters (called windows) that open and close on selected frequencies. When a signal entering the Auto-C is correlated (having predictable harmonics and waveforms) it is left alone by the windows—that is, the signal passes through with no alterations. However, if the circuitry senses uncorrelated random noise (hiss) the window(s) close and prevent passage of the signal. Although there is some necessary overlapping, each window acts upon a different frequency range, and can provide more accurate noise reduction than less effective noise reducers. With this series of frequency dependent windows a desirable low frequency signal (say, from a bass cello) can pass through while the high range hiss is blocked. An added benefit of the auto-correlator is its peak unlimiter and downward expander. The peak unlimiter acts on musical peaks

(sudden bursts of sound and musical transients) that are often compressed during the recording process. When the unit senses a very loud musical peak the gain of the unit is increased by 1.5 dB—while in medium level passages it is continuously variable and automatic. This action, coupled with

HFSBG UPDATE

A test report on the SAE 3100 power amplifier appeared in the September/October 1978 issue. Due to a typographical error, the distortion measurement was printed incorrectly. The frequency response of the SAE 3100 at 50 watts/8 ohms measured ± 0.1 dB from 20 to 20,000 Hz at a distortion no higher than 0.015% THD at any frequency (*not* 0.15% as printed). Our apologies for the error.

As we go to press, we have learned from SAE that they will offer a new product in January. The SAE 180 parametric equalizer will become available for \$250, the lowest price to date for a parametric equalizer. Two center frequency ranges are provided for each



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channel. In each range bandwidth is continuously variable and up to 16 dB boost or cut may be attained.

the downward expander (which makes soft sounds even softer) can provide an overall improvement of 17.5 dB.

As it is with all single pass systems, careful adjustment of the DNF and Auto-C is important. Too much noise reduction can adversely affect the high frequency sounds that are a desirable part of the music. As an example, consider the sound of a piccolo or the high notes of a piano—easily distin-

guishable as part of the music. But, sounds that have harmonics that are similar to random noise and hiss (such as brushed cymbals, snare drums and "fuzzy" synthesizer sounds) can be mistaken for noise if the units are not properly adjusted.

The future of audio is bright with the promise of none of the noise that plagues us now. Digital tape recording and pulse code modulated discs can

provide full dynamic range with no hiss. Unfortunately, although these types of equipment have been demonstrated (in prototype) it will be several years before they are commercially available at reasonable prices. Until they are, we can take comfort in the use of Dolby, dbx and single pass systems which are available to help with the goal of every audiophile—perfection in sound. ▲

SPOTLIGHT ON: GARRARD

(Continued from page 34)

remainder goes to a detector that tests the signal for characteristics which predominantly represent clicks and pops. If the detector senses a click or pop it sends a signal to a suppressor which arrives at the same time as the program itself. The suppression signal attenuates the noise pulse, and the signals leave the suppressor "popfree" to be amplified up to line level.

To accommodate the variations in output levels between pickups, and in some instances records, the Garrard MRM has a sensitivity control that allows the user to establish the "threshold" level for noise suppression. An LED indicator lamp illuminates when the suppressor is triggered, and serves as an aid to adjusting the sensitivity—just crank up the control until the LED blinks in step with the noise pulses.

A Large Package. The Garrard MRM, list priced at \$199.95, is housed in a cabinet 14½ in. wide x 11½ in. deep x 2½ in. high. Weight is 8.8 lbs. The front panel has a sensitivity control and switches for power and suppression in and out. LEDs indicate power on and the threshold level. Actually there's no reason for a package this large. The whole bit could have been compressed into a palm-size cube, but it's more than likely few would pay almost \$200 for a small box. Perhaps that's the

reason for the giant size packaging, which we found a bit of a pain

Measurements? There was no way we could relate our tests to Garrard's specs. Only Heaven knows what they were using for test equipment. For example, Garrard claims distortion less than 0.01% THD. The only thing we found at this level was noise. Our spectrum analyzer drew a blank all the way down to its noise floor of -80dB; if there's measurable distortion at typical recording levels we couldn't find it. Then there's output level. The brochure claims 8 volts for 2.5 volts in. There's no modern amplifier that could handle this level. Using our standard phono input test level of 3 mV at 1000 Hz, the Garrard MRM's output level was 0.2 volts—a typical and expected line level.

How it sounds. The one major difficulty with bucket brigade delay devices is that they generate a dynamic distortion for which there is presently no measurement technique. It's a very subtle loss of low frequency definition. The MRM has it. It takes some hard A-B'ing and some 15 minutes or so of listening to notice it, but it will be heard on the highest quality sound systems. For this reason we suggest its use only when required if the distortion is evident on your hi-fi installation.

Most of you will never hear it, or if noticed, won't be bothered.

Summary. If you're into restoring old recordings, or just want to restore enjoyable listening to old, poorly handled records, the Garrard Music Recovery Module is just the thing for you. It does what it is supposed to do exceptionally well. For additional information on the MRM, circle Number 70 on the Reader Service Card. ▲

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SIGNAL PROCESSORS

(Continued from page 32)

precise frequency between 200 and 7500 Hz. In Fig. 5 we have adjusted the *para's* tuning control to 800 Hz and progressively advanced the level control for boost and cut with the bandwidth set for *narrow*. This produces the four peak and null series nearest the center of the illustration. With the level controls at the extreme, we adjusted the bandwidth control midway, and then wideband to produce the broadening equalization pattern you see on the outer two traces.

Figure 6 illustrates what we can do using three *para* sections. First (A), we used a narrow bandwidth to notch out 100 Hz, as we might do when equal-

izing a low frequency resonance in a listening room, and we boosted the highs to 20,000 Hz using full boost, narrow bandwidth. Then (B) we added full boost at 1000 Hz with narrow bandwidth. Finally (C), we adjusted to provide full boost at 1000 Hz with *broad* bandwidth. Note how just the bandwidth variation at 1000 Hz created a completely different upper bass to lower highs response.

These are just a few examples of the versatility of the parametric equalizer. A four-section model, such as the SAE 2800 permits the most flexibility, particularly if you intend to use it to

(Continued on next page)

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tailor the sound of your source material while making your own recordings. As for equalizing a room, there is considerable argument whether a parametric or graphic equalizer is preferable. It all depends on personal preference.

SOUND PROBE

(Continued from page 26)

of completeness, clarity, and candor.

All this thoughtful engineering pays off in the kind of sound that—like good health—is hard to describe. It's always easier to tell the symptoms of illness—to pinpoint what's wrong. But just plain feeling good is hard to put in words. And this speaker just plain feels good—with all kinds of music. All the sound is there—top to bottom—and nicely spread out, too. Big symphony orchestras roll out with clarity and ease, and they stay that way even at top volume and at moments of musical climax. Heavy rock comes through without blur, and you can follow every strand in the brassy texture of jazz. Voices retain their true character and personality.

But we wouldn't be critics if we didn't have at least one beef: Treble projection from the rear tweeter is

That about covers the gamut of currently available signal processors. This article should serve you well as an introduction. Details on the major types of signal processors are to be found in features elsewhere in this issue. Happy hunting! ▲

naturally affected by speaker placement and the resultant reflections. This may cause either a trace of harshness (excessive upper midrange) or a slightly hollow sound (not enough midrange). But these variables—inherent in the basic concept of the speaker—are easily adjusted by altering the speaker distance from the rear wall, angling the speaker, or by adjustment of the tweeter level control on the separate equalizer.

Each speaker weighs in at 42 lbs and, with dimensions of 29½ inches high by 16 inches wide by 10½ inches deep is fairly compact for a floor-standing model. Nominal impedance is 8 ohms. The finish is an attractive walnut veneer blending nicely with a brown grille that drapes over the top front. The pair of speakers, including the equalizer, sells for \$675. ▲

LED INDICATORS

(Continued from page 38)

scene. Audio Pulse, Inc., for example, has a dozen of them in its Model One digital time delay system. Eight of them are green, with 0 dB—the maximum operating level, indicated by an amber light, and three red ones show overload conditions. ADS (Analog & Digital Systems) uses three groups of four LEDs in its Model ADS10 acoustic dimension synthesizer, described as "A complete third generation digital time delay system." One cluster indicates "stage" distances; one indicates the type of environment acoustics; and the third group is for peak level indications. Advent in its brand new "SoundSpace Control" uses eight LEDs in two layered banks of four to indicate operating levels for each stereo channel. A fourth company, Bozak, also uses LEDs, in this instance in the

Model 902, a time-delay with integrated amplifier. The display consists of LEDs arranged in two vertical bars, calibrated from 0 dB to minus 30 dB.

Record Players. Record-playing equipment has also come to capitalize on LEDs. A case in point is the Philips AF-877 all-electronic turntable that not only uses LEDs for various mode operations, but also features a series of nine LEDs to monitor platter speed and help the listener vary the pitch of the player.

Another case in point is Dual's new Model 731Q quartz-controlled direct drive turntable. Utilized in it is a two-range LED display covering 12 increments of pitch control over a five percent range. Readings can be obtained at low and high levels, for super-precise speed adjustments. ▲

CONCERT HALL AMBIENCE

(Continued from page 45)

seconds) and little reverberation, for the music is designed for the smaller room. Full-scale romantic music sounds best in a large hall, and a longer delay and a bit more reverb is appropriate; organ work designed for a live church can be helped by yet a longer delay

and a healthy bit of reverberation. Regardless of the type of music you like, the ambience simulator puts you in control of the apparent acoustic surroundings. If you want to hear a string quartet in a cavern, the simulator will satisfy your whim. ▲

Bose® presents the most exciting bookshelf speaker since the Model 301.

The new Model 301. With an improved tweeter that took three years to perfect. An innovative Dual Frequency Crossover™ network that delivers smoother midrange response. A unique tweeter protection circuit that virtually eliminates tweeter burnout. And a subtle exterior modification that makes the Model 301 more elegant than ever.

But even with changes, the Model 301 retains its conventional personality.

It is, after all, a Bose Direct/Reflecting® loud-speaker system. Which means it utilizes a carefully produced balance of reflected and direct sound to give you the spatial realism of a live performance. From nearly every location in your listening room, you hear accurate stereo balance. Accurate location of each instrument, each note. Clearly, precisely. And with a fullness and richness you may have thought

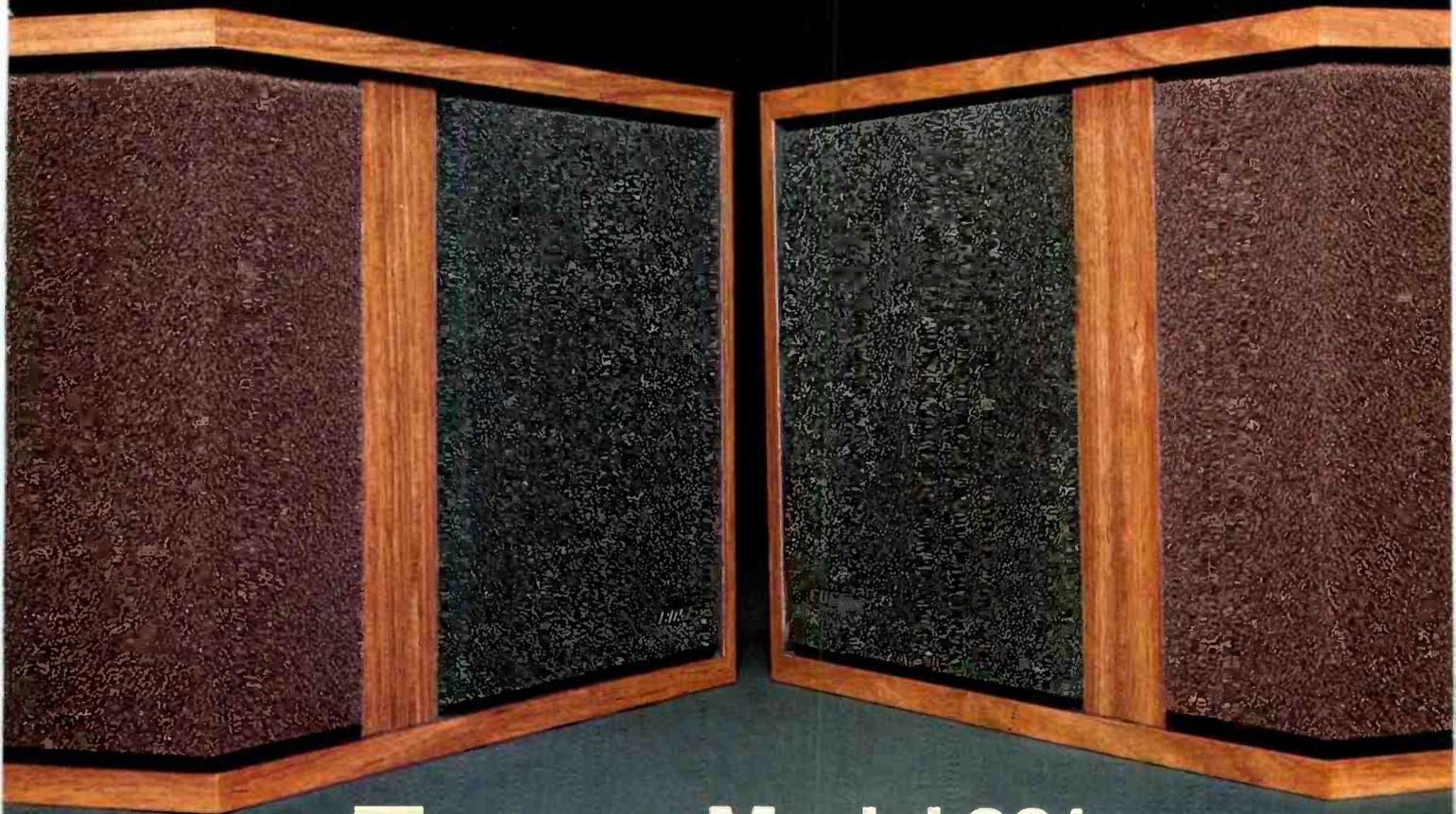
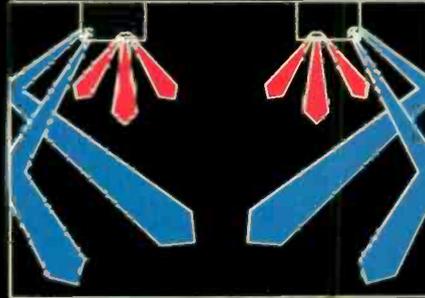
impossible from such a compact enclosure.

As a matter of fact, the Model 301 delivers a level of performance which simply astounds first-time listeners.

It could happen to you. Ask your Bose dealer to demonstrate the Model 301 against any bookshelf speaker, regardless of price.

Then ask him to demonstrate the Model 301 against even much larger speakers. In each case, you will hear an open, spacious sound that expands the confines of your listening room. Suddenly, you are in a larger, more open space, listening to music as if you were hearing it for the first time.

No other bookshelf speaker even approaches the spatial realism of the new Model 301. See your Bose dealer for a demonstration and hear what we mean.



The new Model 301.

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For complete technical information on the new Model 301 speaker system, write Bose, Dept. T, The Mountain, Framingham, MA 01701

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all transport functions and record from up to 20 feet.

For the same performance as the RS-1506 with the convenience of auto reverse, there's the RS-1700.

Compare specifications. Even with the best 2-track decks. TRACK SYSTEM: 4-track, 2-channel recording, playback and erase. 2-track, 2-channel playback 4-head system. FREQ. RESP.: 30-30,000Hz, ± 3 dB (-10dB rec. level) at 15ips. WOW & FLUTTER: $\leq 0.18\%$ WRMS at 15ips. S/N RATIO: 57dB (NAB weighted) at 15ips. SEPARATION: Greater than 50dB. RISE TIME: 0.7 secs. SPEED DEVIATION: $\pm 0.1\%$ with 1.0 or 1.5mil tape at 15ips. SPEED FLUCT.: 0.05% with 1.0 or 1.5mil tape at 15ips. PITCH CONTROL: $\pm 5\%$.

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