

367

hi-fi/stereo

BUYERS' GUIDE

THE SOUND SAVERS

ADD-ON COMPONENTS THAT PUT NEW LIFE IN YOUR HI-FI

TUNER TRYOUTS

WHAT TO LOOK FOR IN YOUR STEREO'S AM/FM

MULTI-TRACK TAPE RECORDING

PRO TECHNIQUES TO USE IN YOUR HOME STUDIO

MICRO AUDIO

GOOD THINGS DO COME IN SMALL PACKAGES



LABORATORY TEST REPORTS

TUNERS, RECEIVERS, PREAMPLIFIERS, AMPLIFIERS, EQUALIZERS AND CASSETTE DECKS.

75-P Pleasant St
Auburn, ME 04210

EDM02FPLP1380 EA-0 01 129NOV80*

FRED D. PLASANT ST
138 PLEASANT ST
AUBURN ME 04210



INVESTMENT LETTER



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

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

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

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

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

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

Seek out Discwasher® products at dealers worldwide who are interested in preserving your musical portfolio.

 discwasher, inc.
1407 N. Providence Rd.
Columbia, Missouri 65201

Why Yamaha speakers sound better than all the others. Even before you hear them.

To make a speaker that produces accurate sound is not simple. It requires painstaking attention to detail, precise craftsmanship, and advanced technology.

And that's where Yamaha comes in. We build all our speakers with the utmost precision in every detail.

As the premier examples of Yamaha loudspeaker craftsmanship, read what goes into the two speakers shown, the NS-690II and the NS-1000M. Then you'll understand why Yamaha loudspeakers sound better. Even before you hear them.

Precision Yamaha crafted cabinetry – (1) The walls on these, and all Yamaha speaker cabinets, are sturdily braced and crossbraced at every possible stress point. (2) The corner seam craftsmanship is so fine that it looks like the cabinet is made from one continuous piece of wood.

The back panels on these speakers are flush-mounted for maximum air volume within the cabinet. (3) Inside, a 3/4" felt lining "decouples" the cabinet from the drivers to achieve acoustic isolation of the woofer from the cabinet. (4) Thick glass-wool also aids in damping the woofer for maximum performance.

Lift one of these Yamaha speakers. It's uncommonly heavy and sturdy. (5) We even glue and screw the woofer cutout from the baffle to the inside rear panel for greater cabinet rigidity.

Now knock on the cabinet. It will sound as solid and substantial as it is.

Precision Yamaha Drivers – (6) The drivers are mounted on computer-cut baffle boards with exacting, critical tolerances to insure precision fit. All Yamaha speakers are acoustic suspension design, and this precise fit is critical for an airtight seal and optimum woofer recovery.

The drivers on these, and all Yamaha speakers, are flush-mounted on the baffle board to avoid unwanted diffraction of the sound waves. (7) This is especially important because all our tweeters and mid-high range drivers are the maximum-

dispersion dome type for the most natural reproduction of voice and instruments.

(8) We use chrome-plated machine screws (rather than wood screws) with two washers (regular and lock) to insure an unyielding mounting.

(9) The speaker frames shown are die cast rather than stamped. That's so they won't twist and alter the voice coil alignment during assembly and use.

Other Precision extras – All terminals are quick connect, screw-mounted assemblies.

(10) The wire leads are carefully soldered, not clipped.

All our speakers use full LRC crossover networks. These crossover networks are among the most advanced available.

Precision that stands alone – There's more. Much more. But, there is another fact of Yamaha loudspeaker construction that simply stands alone in the industry. Each component used in the two Yamaha speakers shown is manufactured by Yamaha. From the hefty die-cast speaker frames to the unique, ultra-low mass beryllium dome diaphragm.

That's a statement no other manufacturer can make.

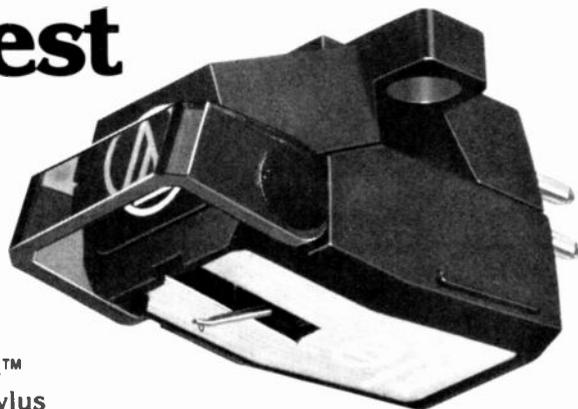
And therein lies Yamaha's story. If we put this much care and craftsmanship into the making of our components and cabinet structures, then imagine the care, precision and craftsmanship that go into the quality of the final sound. A sound built upon Yamaha's unique 98-year heritage as the world's largest and most meticulous manufacturer of musical instruments. From our most economical loudspeaker to our top-of-the-line models shown here, Yamaha retains the same attention to detail and craftsmanship.

Look before you listen. You'll be convinced that Yamaha loudspeakers sound better than the rest. Even before you turn them on. Then ask for a personal demonstration of these and

other Yamaha loudspeakers at your Yamaha Audio Specialty Dealer, listed in the Yellow Pages. Or write us: Yamaha, Audio Div., P.O. Box 6600, Buena Park, CA 90622.



At last a moving coil cartridge you can recommend to your best friend!



**New AT30E
Stereo Phono Cartridge
with Vector-Aligned™
Dual Moving MicroCoils™
and user-replaceable Stylus**

The subtle, yet unique characteristics of moving coil cartridges have had their admirers for years. A top-quality moving coil cartridge exhibits remarkable sonic clarity and transparency. This performance can be attributed to the very low mass, and low inductance of the tiny coils used to sense the stylus motion.

But until now, moving coil cartridge popularity has been limited by three major problems which seemed almost inherent to moving coil designs.

1) It seemed impossible to make a user-replaceable stylus assembly without compromising performance; 2) most moving coil cartridges exhibited relatively low tracking ability due to rather stiff cantilever mounting systems; and 3) output of the cartridge was below the level needed for commonly available amplifier inputs.

Introducing the new Audio-Technica AT30E and the end to all three problems! Our design approach is simple and direct. Rather than locate the coils in the cartridge body, they are integral with the stylus assembly. If the stylus becomes worn or damaged, the *entire* moving system, coils and all, is simply unplugged and replaced, just like a moving magnet cartridge. Large, gold-plated connectors insure loss-free connections so vital at the low voltages generated by a good moving coil cartridge. The result is easy field replacement with no penalty in terms of performance.

Careful research indicated that good tracking and moving coil design were indeed compatible. By controlling effective mass and utilizing a radial damping system similar to our famed Dual Magnet™ cartridges, we have achieved excellent tracking ability

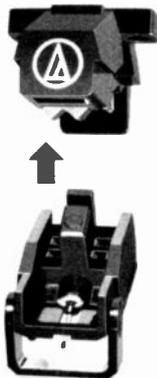
throughout the audio range. Compliance is individually controlled during manufacture of each assembly to optimize performance. This extra step, impossible with most other designs, coupled with our unique radial damping ring, insures excellent tracking of the high-energy modulation found in many of the top-quality recordings now available.

Each coil is located in the ideal geometric relationship to reproduce "its" side of the record groove. This Vector-Aligned™ design assures excellent stereo separation, minimum moving mass, and the highest possible efficiency. It's a design concept which is exclusive to Audio-Technica, and is a major contributor to the outstanding performance of the AT30E.

We can't take credit for solving the low output problem. The AT30E output is similar to many other fine moving coil cartridges. But an increasing number of amplifiers and receivers are featuring built-in "pre-amplifiers" or "head amplifiers" to accommodate moving coil cartridges directly. Thus the new systems buyer can make a cartridge choice based on sonic characteristics rather than on input compatibility. In addition, Audio-Technica offers the Model AT630 Transformer for matching to conventional amplifier inputs.

The new Audio-Technica AT30E Dual Moving Micro-Coil Stereo Phono Cartridge. With the introduction of this remarkable new design, every important barrier

to full enjoyment of the moving coil listening experience has been removed. Progress in sound reproduction from Audio-Technica... a leader in advanced technology.



audio-technica
INNOVATION □ PRECISION □ INTEGRITY

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hi-fi stereo

BUYERS' GUIDE®

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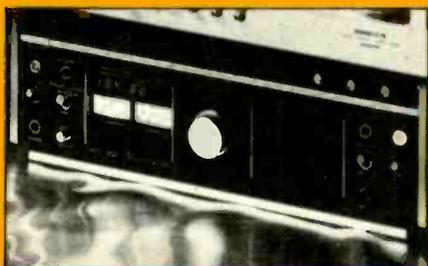
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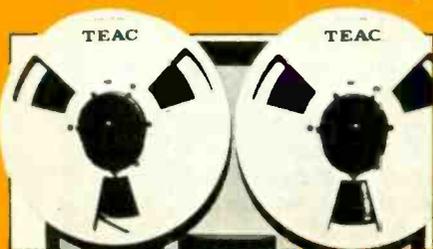
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Cover photo: Dave Niedo
Kennedy/Niedo Studio

For details on the cover, see page 67.



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



Clean look,
clean sound.

The Crown *Power Line One* amp and the *Straight Line One* pre-amp are designed for people who delight in accurate sound reproduction, whose joy is in listening and for whom simplicity of operation is important.

They are obviously easy to operate, yet all the basic controls you need for accurate reproduction and monitoring of fine quality sound are there.

Your greatest enjoyment will surely come from the unusual sonic accuracy of these units. Frequency response ± 0.1 dB, 20 Hz-20 KHz on both units.

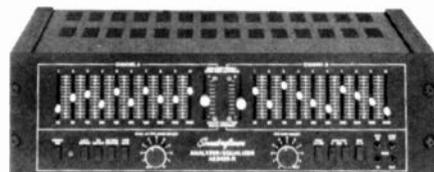
IM distortion below .001% on both. Signal to noise down a phenomenal 110 dB on the amp. Both units are acoustically as transparent as can be imagined.

Achieving that purity of sound and function wasn't simple. We've had years of experience in building state-of-the-art audio components, such as the world-famous DC-300A high-power amp and the newer DL2 digital logic pre-amplifier. We've learned a great deal about what can and cannot be done with cir-

Analyzer/Equalizer

Soundcraftsmen's AE2420 Equalizer/Analyzer is claimed to be a "revolutionary breakthrough" in enabling accurate analysis of a room's "imperfections," as well as compensating for system imperfections. A new concept is used to apply differential/comparator circuitry to equalization analysis. By sampling the complex waveshapes of a pink noise input signal on the one hand, and the speaker output signal on the other hand, the circuitry of the device converts the complex wave shapes to DC levels; these are then compared through the differen-

tial/comparator circuit to provide a readout of the exact differential between these two complex waves shapes.



Circle No. 107 On Reader Service Card

with an accuracy of 1/10th dB. Even if the pink noise input amplitude is variable across the spectrum, there is no effect on the analyzer's dB readings because the analyzer is actually looking at both the selected frequency spectrum signals simultaneously, without regard to amplitude. Any good quality low- or high-impedance microphone may be used, regardless of the mike's response curve. The calibrated curve supplied by the microphone manufacturer can be programmed into the obtained flat response curve through use of the "computer charts" the maker of this device provides. Price: \$499.

Deck With Unique Head

Yamaha's new "Natural Sound" TC-920B top-of-the-line stereo cassette deck is said to feature an exclusive "Pure Plasma Process" Sendust record/play head. The Plasma Process developed by the company is claimed to yield magnetic Sendust heads of 99.9% purity or better, to offer the following practical advantages: improved sensitivity and playback efficiency; very high maximum flux density, with large signal-current handling capacity; superior signal-to-noise ratio; very stable temperature characteristics; improved low frequency reproduction; less wear on both the head and the tape. Another unique feature is a *Sound Focus* switch that lets the listener control tonal quality during playback. One position provides optimum frequency response while the other gives priority to the signal's phase linearity at high frequen-



Circle No. 101 On Reader Service Card

cies, making reproduction, particularly vocals, seem more realistic. Other features include: a high-efficiency Double-Gap Ferrite erase head; smooth two-motor tape transport which ends reel drag; only 0.03% (WRMS) wow and flutter; three-position bias equalization; fine bias adjustment for different brands of tape; and a low-noise FET input to minimize low frequency noise



1718 W. Mishawaka Road, Elkhart, Indiana 46514

Innovation. High technology. American. That's Crown.

Circle No. 21 On Reader Service Card

Ohm's Law 9:

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

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



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

The Ohm I solves the problem. It can achieve



concert hall levels in your home effortlessly, with *no* sacrifice in bandwidth, linearity, or imaging abilities. While the Ohm I gets amazingly loud with as little as 10 watts input, it can handle 1000 watts comfortably.

It's the world's first *good and loud* loudspeaker.

Inside the Ohm I, you'll find everything we've learned about multi-driver dynamic loudspeaker design. It uses a total of five drivers, including a 12-inch, optimally-vented subwoofer with an incredible 72 ounce



magnet. Voice coils are cooled by magnetic fluid to increase power handling. The Ohm I's beautifully-finished, floor-standing enclosure is compact enough to fit gracefully into any home.

The new Ohm I's are already earning rave reviews from stereo critics. After listening to them, The



Complete Buyer's Guide to Stereo/Hifi Equipment says, "The volume level was approaching the threshold of pain, but the speakers were showing no sign of strain. The response, regardless of level, was smooth and free from annoying colorations. Too often a loud loudspeaker is deficient in many other areas. Fortunately, this is not the case with the Ohm I..."

According to **Hifi Stereo Buyer's Guide** (8/79), the new Ohm I has "...a combination of efficiency and power handling that, as far as we know, is unmatched." They continue: "(The Ohm I) is one of the finest speakers we've ever heard. There is nothing it couldn't do and do it superbly...it thundered out the lowest pipe-organ pedal notes in a way that made us feel we were in a great cathedral...When appropriate, the bass was

discreet. It was all there, without saying 'Here I am'.... The treble filled the room with a spacious sweetness that seemed...downright seductive...(The Ohm I) will bring out the best from any program material and will also do justice to the coming glories of digital recording... this is a speaker with a future - for the future."

For a listening experience you've never enjoyed before except at a live performance - visit your local Ohm dealer. Ask to hear the world's first good and loud loudspeaker: the new Ohm I.



For 16 complete reviews, and full specifications, please write us at: Ohm Acoustics Corp., 241 Taaffe Place, Brooklyn, N.Y. 11205.



We make loudspeakers correctly.

AUDIO SHOWCASE

and phase irregularities. Mode change in the TC-920B is fully electronic. A logic circuit in a highly integrated IC with solenoids has a built-in time delay to prevent tape/transport damage, permitting changes directly from one mode to another without going through "stop." A fast-response, fluorescent bar graph, peak meter monitors peak levels. Price: \$600.

Top-of-the-Line Receiver

Vector Research offers a top-of-the-line receiver, Model VRX-9000, that provides 80 watts per channel with total harmonic distortion of 0.08% at rated power and FM sensitivity (IHF) of 1.9 μ V. The unit features a digital-synthesizer tuner, preset memory for six FM and six AM stations, a three-second hold scan for both FM and AM stations, variable loudness control, low filter, tone defeat and tuner remote control capability. It also has power meters, a switchable meter range, a Dolby de-emphasis switch, mid-range control, tape copy switch and high

filter. Audio section specifications: frequency response at 1 watt, 10 to 50,000 Hz ± 0.5 dB; IM distortion at 8 ohms, 0.1%; damping factor (1000 Hz, 8 ohms), 50; input sensitivities, 2.5 mV phono, 150 mV aux, 150 mV tape 1 and 2. FM tuner section specifications: Mono and stereo frequency response,



Circle No. 108 On Reader Service Card

20 to 15,000 Hz ± 1 dB; distortion at 65 dBf and 1000 Hz, mono 0.08%, stereo 0.25%; capture ratio, 1.1 dB; alternate channel selectivity, 65 dB; spurious rejection, 72 dB; image rejection, 100 dB; IF rejection, 100 dB; AM suppression, 59 dB; stereo separation at 1000 Hz, 46 dB; carrier suppression, 65 dB; 50 dB quieting sensitivity, 19 dBf mono and 40 dBf stereo. Price of the VRX-9000 is \$750.

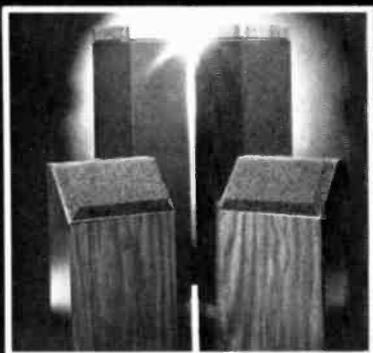
Audio Pulse Digital Time Delay is possibly the greatest advance in sound reproduction since stereo. A strong statement indeed, but we feel strongly about it. By means of time delay, the ambience of the live performance is returned to the music in a way not possible with ordinary stereo reproduction.

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

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

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

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



Audio Pulse

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

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Why Wait, Delay Now.



Circle No. 4 On Reader Service Card

Auto-Reverse Cassette Deck

Technics offers a new auto-reverse stereo cassette deck with four track SX head, memory auto-play, and two-color FL peak meters. The RS-M68 features a choice of three separate transport modes: *Cont* plays the tape endlessly until it is stopped manually; *Rev* plays or records one complete cycle of the tape and then stops automatically; *Non-rev* disengages the auto-reverse mechanism after one side is played. To play or record the other side, when the non-reverse mode is in use, just press the key for the opposite direction since there is no need to turn the cassette over. Outstanding features include: cue/review operation (which is rarely seen on auto-reverse units); FG servo DC motor and twin, dynamically-balanced flywheels; separate three-position bias and equalization selectors; a Dolby NR system with MPX filter; friction-coupled L/R input level



Circle No. 98 On Reader Service Card

controls; oil-damped soft loading and float-up ejection. Still other features are: large tape-direction indicators; memory on/off indicator lamp; timer standby switch; pause control; removable cassette compartment door; record indicator lamp; mic/line input selector; left and right channel mic input

At least not in the showroom. Chances are they've already heard them – or at least heard all about them. From a friend. From a consumer magazine. Or perhaps from an audiophile publication. When you've sold over 1/2 million, the word gets around.

What's made the EPI 100 such a classic?

The fact that for around \$110, they can give you EPI's amazing "Linear Sound." Sound that's remarkably accurate, uncolored and that's delivered to every part of the room. Because of their unique one-inch air-spring tweeter, you get nearly hemispherical dispersion with EPI 100's.

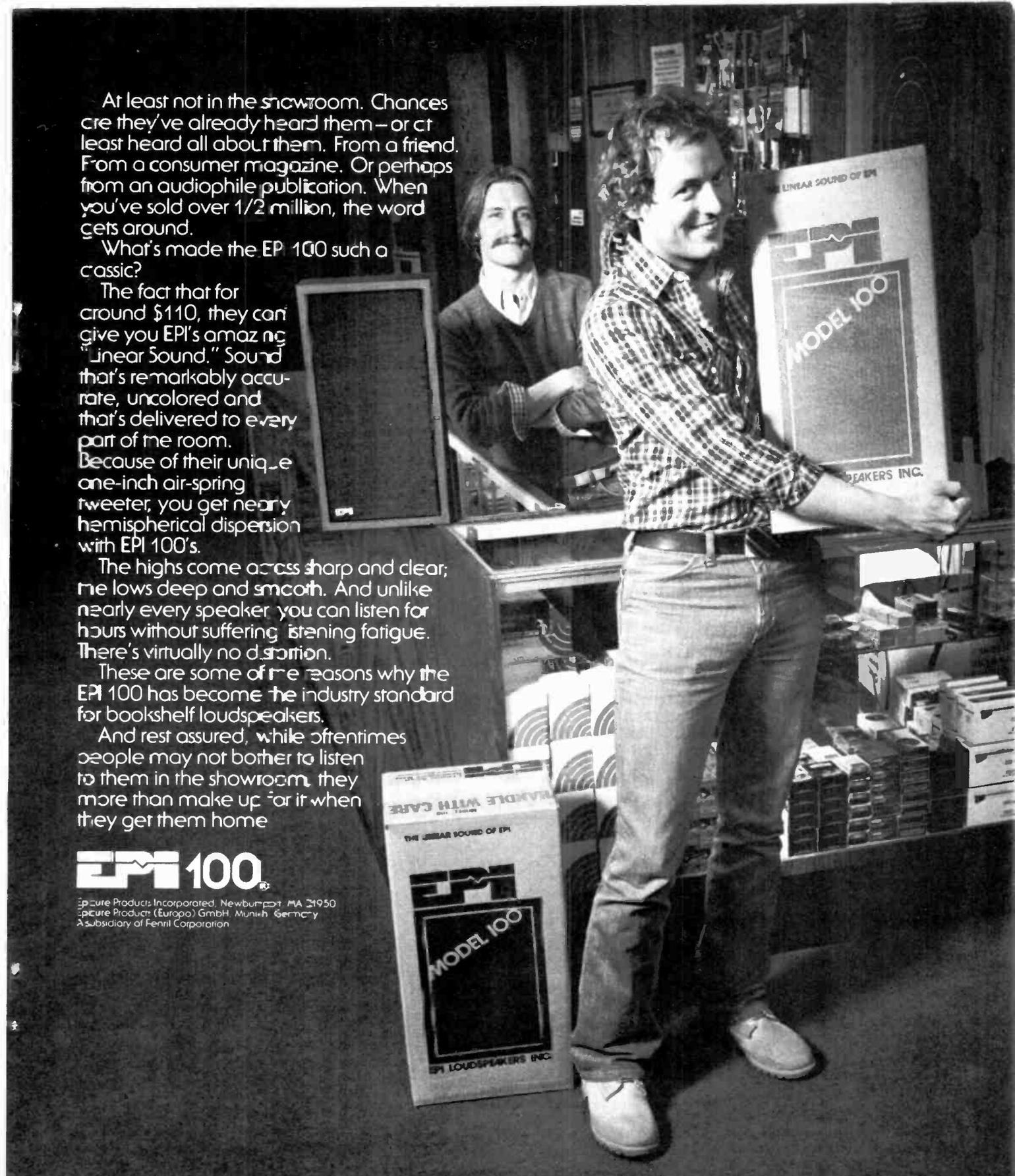
The highs come across sharp and clear; the lows deep and smooth. And unlike nearly every speaker you can listen for hours without suffering listening fatigue. There's virtually no distortion.

These are some of the reasons why the EPI 100 has become the industry standard for bookshelf loudspeakers.

And rest assured, while oftentimes people may not bother to listen to them in the showroom, they more than make up for it when they get them home.

EPI 100

Epiphone Products Incorporated, Newburyport, MA 01950
Epiphone Products (Europe) GmbH, Munich, Germany
A subsidiary of Fennell Corporation



**MOST PEOPLE WHO BUY EPI 100'S
DON'T EVEN ASK TO LISTEN TO THEM.**

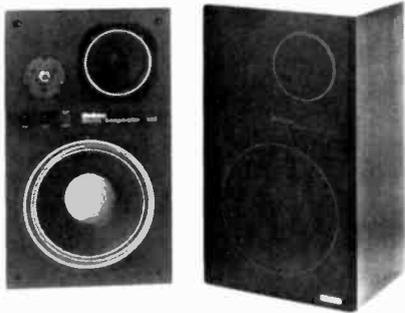
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AUDIO SHOWCASE

jacks; output level control (line and headphones); stereo headphone jack; stop/eject combination key and an illuminated tape compartment. \$550.

Three-Way Speaker System

Ultralinear believes that even the most serious music listener will appreciate the crystal clear, wide-band frequency reproduction of this efficient three-way



Circle No. 109 On Reader Service Card

speaker system. The specially-designed 12-inch long-excursion, low frequency driver features a large diameter high-temperature voice coil. The higher fre-

quencies cross over to a fully-enclosed 6-inch foam suspension midrange transducer and a 1-inch soft-dome, high-frequency radiator. Front mounted level controls for midrange and high frequencies allow precise adjustment of this air suspension system to match any room's acoustical properties. Power handling has been increased by 20 percent. The enclosure features "Flush Front" styling available in simulated walnut veneer finish. Grille choices include super-sheer black Transparaconic™ or brown double knit fabric. Price: \$299.95.

Professional Phono Cartridge Series

Shure's new line of phono cartridges is especially designed for broadcasting, recording, disco and other professional applications. Called the Shure SC39 Series, the cartridges emphasize resistance to stylus damage, even when subjected to the rigors of slip-cuing, back-cuing and the abuses of the stylus occasioned by "fast-paced" situations. Each SC39 cartridge has an internal support wire and special elastomer bearing that insures stable and accurate backcuing without groove jumping. There's also a lateral deflection assembly to guard against damage caused by side thrusts. Yet another feature is an exclusive lever-operated

locking guard that protects the stylus tip against drops, bumps, or accidental mishandling when not in use. In the playing position, when the guard is up, a V-shaped cutout on the control lever



Circle No. 93 On Reader Service Card

provides a highly visible cuing aid for precise groove setdown. Model SC39ED (photo) offers an essentially flat frequency response that compares favorably with top quality hi-fi cartridges, says Shure. It has a recommended tracking force of .75 to 1.50 grams, biradial (elliptical) stylus. Price \$80.

Metal-Capable Stereo Cassette Deck

Toshiba's PC-X40 stereo cassette deck is a fully featured unit with an AS (All-Sendust) record/playback head and ferrite erase head. It can play metal tapes. Also incorporated are: a digital IC controlled programmable multi-music quick sensor system able to program up to six different selections. There's also a skip/play function, two LED peak meters with changeable bar dot readout, auto-repeat functions, cue and review, and soft eject mechanism. Frequency response is put at 20



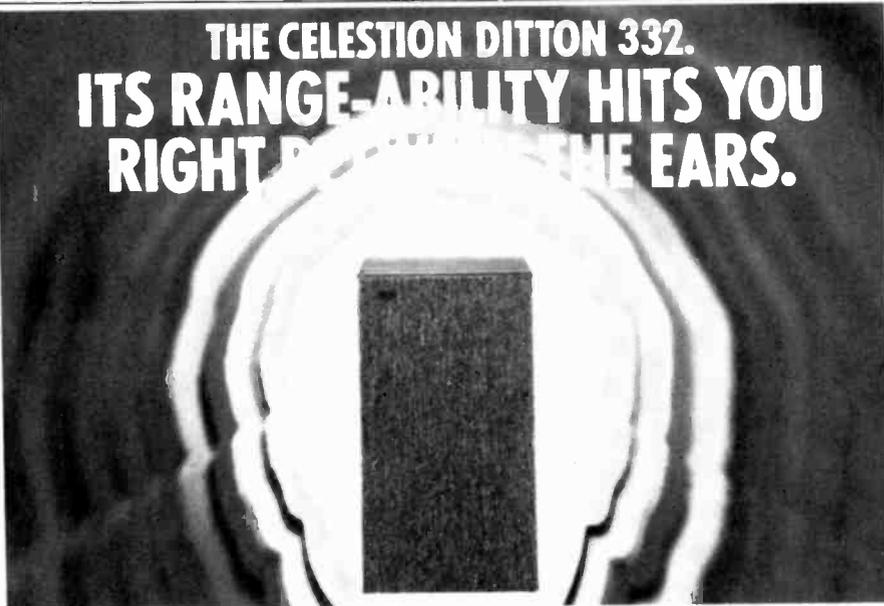
Circle No. 99 On Reader Service Card

to 18,000 Hz ± 3 dB at an input level of 20 dB. Wow and flutter is 0.05% WRMS. Signal-to-noise ratio with metal tape is 72 dB with Dolby on, 62 dB with Dolby off; with CrO₂ tape, 68 dB with Dolby on, and 58 dB with Dolby off. Price, including a new slim line cabinet, \$380.

In-dash Cassette AM/FM Stereo

"The quality of home stereo" is claimed for Tenna's deluxe in-dash auto reverse cassette AM/FM stereo unit, Model C-3039AR. The system comes with pre-amp output so that increased amplifier power can be achieved without distortion or complicated rewiring. Installation is said to be easy because of fully adjustable shafts and a universal nose size, short (4½ inch) chassis that makes it easy to fit in most cars including

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



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

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

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

Celestion manufactures each com-

Celestion Industries, Inc., Holliston, MA 01746 (617) 429-6706

Circle No. 29 On Reader Service Card

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

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

Range-ability. Finally, listening becomes an experience.

celestion
international 

Why we created our own total system.

We simply had to. Because no chain is stronger than its weakest link. And no music system is better than the distortion or noise coming from any of its components.

We wanted to make sure that when you choose one Revox you get all that it has to offer.

The total Revox system delivers virtually distortion-free music from every source and in any mode—music reproduction so true that it is unmatched by any other system available today.

All the components in the Revox system are designed to meet the professional quality standards that have been set by the Revox B77 open reel recorder with its ingenious logic control system. The B750 integrated amplifier, for example, is renowned for its fast transient response to all musical signals and for its low TIM. It is paired with the incredible B760 digital synthesizer FM tuner with the unusual capability of programming 15 stations which you can recall at the push of a button. The B790 direct drive, quartz controlled turntable reduces tracking distortion to an absolute minimum using a revolutionary new system called Linatrack.

For an unmatched musical experience, listen to our matched components at your franchised Revox dealer. Or write to us for details.



Revox
Audio-Rack



REVOX

STUDER REVOX America, Inc.
1819 Broadway, Nashville, TN 37203 615 329-9576 / In Canada: Studer Revox Canada, Ltd.

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Interface: C

Series II It sounds like music.

Interface: C Series II is the fulfillment of our six-year association with optimally vented speakers based on the theories of A.N. Thiele — speaker designs first introduced by Electro-Voice in 1973. The Interface: C offers you a unique combination of high efficiency and high power capacity — the only way to accurately reproduce the 120+ dB peak sound pressure levels found in some types of live music.

The SuperDome™ tweeter, an E-V exclusive, and the VMR™ vented midrange driver, the first to apply optimally vented design to mid frequencies, ensure your music is reproduced without the coloration normally found in other high-efficiency drivers. An honest 30 Hz low end totally eliminates the need for expensive subwoofer assemblies.

When you spend \$1,000 for a speaker system, get your money's worth. Audition the Interface: C Series II at your nearest Interface dealer. If you want a speaker that sounds like music, the Interface: C Series II is the one you'll buy.

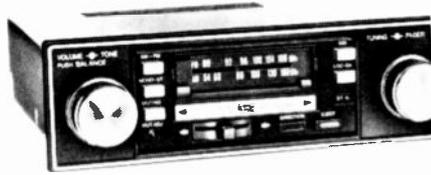
EV Electro-Voice®
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600 Cecil Street, Buchanan, Michigan 49107



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AUDIO SHOWCASE



Circle No. 110 On Reader Service Card

foreign models. The unit features adjustable FM muting, separate front to rear fader and balance controls, dial-in-the-door and selectable end-of-the-program eject or continuous play. It also has tape direction, mono/stereo, local/distance and AM/FM switches plus locking fast-forward and rewind controls. Specifications: stereo power, 10 watts RMS; 3 watts per channel minimum RMS at 4 ohms from 40 to 20,000 Hz with no more than 1% THD both channels driven; output impedance, 4 ohms; pre-amp output, 100 mV at 10 k ohms; Tape section specifications: wow and flutter, 0.25% WRMS; channel separation, 35 dB; crosstalk, 50 dB; frequency response, 40 to 12,000 Hz (3 dB); S/N ratio, 50 dB; rewind speed, 70 seconds for C-60 tape. FM section specifications: sensitivity, 3 μ V (max.), 5 μ V at 30 dB S/N; S/N ratio, better than 50 dB; stereo separation, 25 dB; frequency response, 70 to 12,000 Hz; IF rejection, 70 dB; image rejection, 50 dB. Price: \$199.95.

Digital Tuner With Memory

Described as "the first radical departure in tuner design in four decades," Sanyo's PLUS T55 tuner combines an electronically tuned front end and digitally programmable quartz crystal reference oscillator to provide "superb" audio performance. And there's another



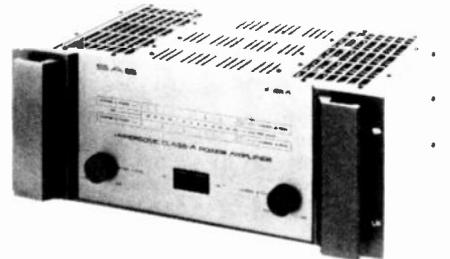
Circle No. 102 On Reader Service Card

unique benefit: it's impossible to mistune a station. As long as the station's frequency appears in the bright fluorescent digital display and the center tune indicator is lit, the receiver is perfectly tuned at the exact point of minimum noise and distortion. PLUS T55 has a passive four-pole LC filter that is double-tuned to reject not only the 19 kHz multiplex pilot tone, but also the 38 kHz multiplex subcarrier. Thus the high frequency subcarrier cannot interact with the bias frequency of tape decks. The band/mode selector lets you choose AM or either of two FM modes: auto, with automatic switching to stereo

mode in the presence of a multiplex signal; and mono, which suppresses stereo information in all signals, allowing noisy stereo signals to be heard with improved quality. FM specifications: frequency range, 88-108 MHz; usable sensitivity, 10.3 dBf (1.8 μ V); frequency response, 20 to 15,000 Hz +1/-2 dB; THD mono, 0.15% / 0.09% at 1 kHz; THD stereo, 0.2% / 0.1% at 1 kHz; AM suppression ratio, 60 dB; spurious response rejection (98 MHz), 80 dB; image rejection ratio, 70 dB; IF rejection ratio (98 MHz), 90 dB; muting threshold, 5V. \$349.95.

Hypersonic "Class A" Power Amp

Scientific Audio Electronics (SAE) introduces a premier product line called the X-series. The first items in this line are three Hypersonic "Class A" power amplifiers. The primary "foundation" for these new amplifiers is a balanced,



Circle No. 88 On Reader Service Card

fully-complementary design with mirror imaged amplifier sections for positive and negative waveforms. The hypersonic power stage, which uses an "extensive number" of output devices, has a combined power capability of over ten times the rated power output of the amplifier. The result: no VI limiting and a power bandwidth over five times greater than required for audio (hypersonic). The following three models each have the same THD (0.02%) and IM (0.02%) values: X-10A, 100 watts (\$800); X-15A, 150 watts (\$1100); X-25A (photo), 250 watts (\$1500).

In-Dash Cassette With Dolby

Pioneer's KP-8500 Supertuner in-dash car stereo and cassette deck with Dolby noise reduction for both tape and



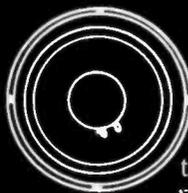
Circle No. 85 On Reader Service Card

FM was designed as the Dolby version of the firm's Supertuner cassette deck, the KP-8005. The new unit allows
(Continued on page 14)

JBL'S NEW L150: ITS BOTTOM PUTS IT ON TOP.

JBL's new L150 takes you deeper into the low frequencies of music without taking you deeper into your budget.

This short-tower, floor-standing loudspeaker system produces bass with depth, power and transparency that comes incredibly close to a live performance.



A completely new 12" driver was created for the L150. It has an innovative magnetic assembly, the result of years of research at JBL. It

uses a stiff, heavy cone that's been coated with an exclusive damping formulation for optimum mass and density.

And it has an unusually large 3" voice coil, which aids the L150's efficiency and its ability to respond to transients



(peaks, climaxes and sudden spurts) in music.

There's even more to the L150's bottom—a 12" passive radiator. It looks like a driver but it's not. We use it to replace a large volume of air and contribute to the production of true, deep bass. Bass without boom.

If you're impressed with the L150's lows, you'll be equally impressed with its highs and mids. Its powerful 1" high-frequency

dome radiator provides wide dispersion throughout its range. And a 5" midrange transducer handles high volume levels without distorting. The maximum power recommended is 300 watts per channel.

The L150's other attributes include typical JBL accuracy—the kind that recording professionals rely on. Maximum power/f at frequency response. High efficiency. And extraordinary time/phase accuracy.

Before you believe that you can't afford a floor system, listen to an L150. While its bottom is tops, its price isn't.

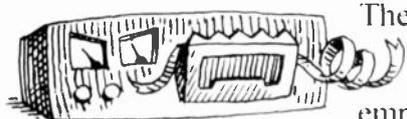
James B. Lansing Sound, Inc., 8500 Balboa Boulevard, Northridge, CA 91329.

JBL

**FIRST
WITH THE
PROS.**



Even the most enlightened consumer can get eaten alive in the hi-fi jungle.



There are probably few places where the phrase "caveat emptor"—let the buyer beware—is more applicable than in high fidelity.

The average consumer walks into a hi-fi store only to be confronted by a morass of receivers, turntables and tape decks, running the gamut from the unaffordable to the unpronounceable. And to make matters worse, the salesman seems to speak some bizarre dialect about megahertz and transient response.

At Sony, we sympathize with the plight of the music lover caught in this rather distressing situation. And to this end we offer some reassurance:

Since 1949, Sony has been at the very forefront of high fidelity. (In fact, our name is derived from the Latin word "sonus" for sound.)

And while the technology has changed, one thing hasn't: Since the beginning we've never put our name on anything that wasn't the best.

The V55 receiver: You don't need an engineering degree to understand what makes it superior.

Put as clearly as possible, the V55 was designed for people who are as interested in getting good value as they are good sound.

In terms of power, for example, the V55 offers ample wattage to fill almost any size living room with clean, clear sound. (55 watts per channel at 8 ohms from 20 to 20,000 hertz, with less than 0.03% total harmonic distortion.)

It has absolutely no audible distortion.

It features a Pulse Power Supply which is more efficient and stable than conventional power supplies at only a fraction of the size and weight.

And most importantly, it features a micro-processor-controlled, quartz-lock frequency-synthesized, digital tuning section that lets you preprogram up to eight

AM or FM stations for either push-button memory or automatic scan tuning.

All of which explains why if you pay a few dollars

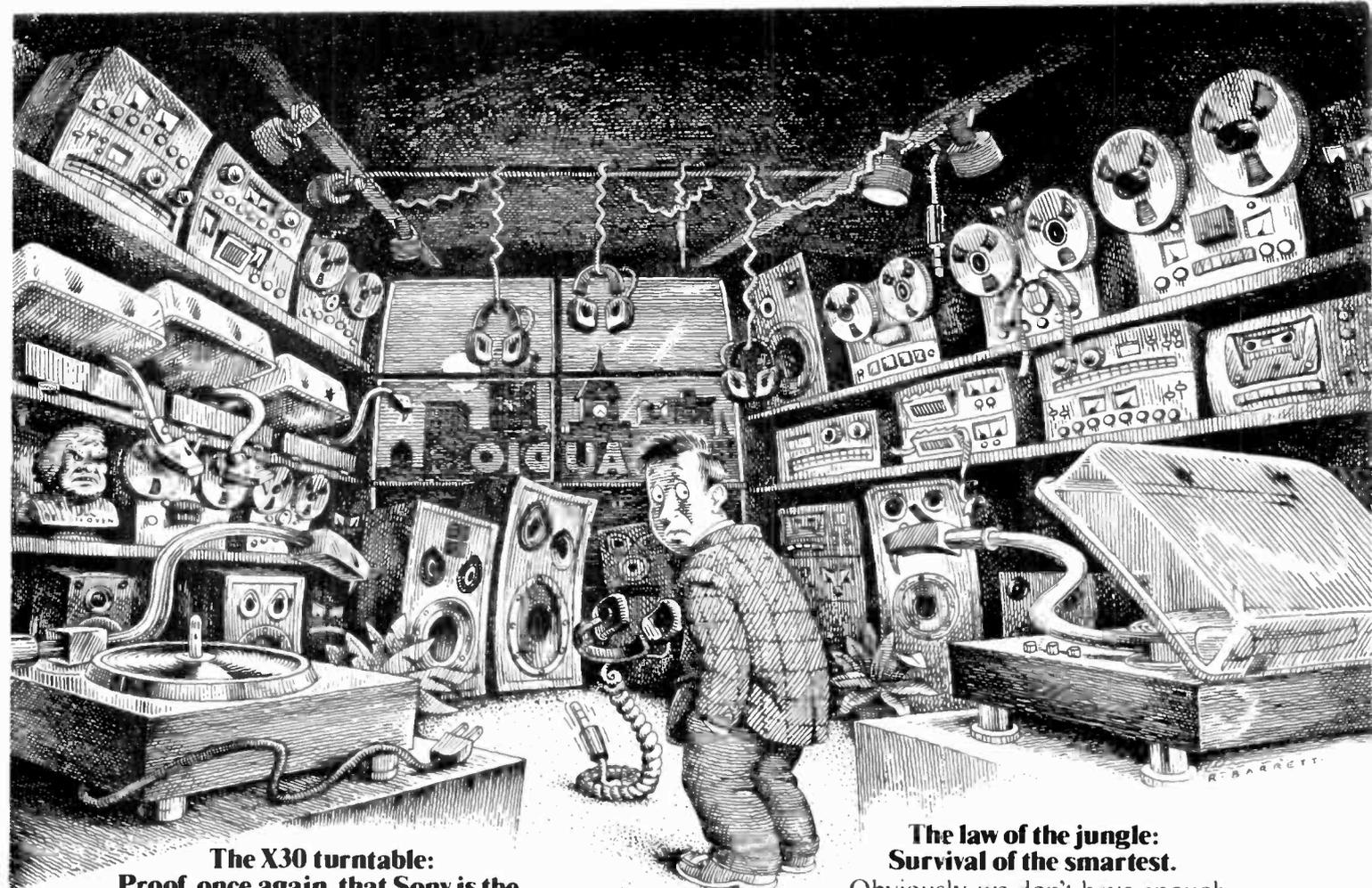
less for one of our competitor's receivers, it's probably because you're getting less receiver.



The new Sony micro components: small in everything but performance.



The V55 receiver: the latest from the company that founded the era of transistorized high fidelity.



**The X30 turntable:
Proof, once again, that Sony is the
real pioneer in high fidelity.**

Today, virtually all of the world's most expensive turntables feature "quartz lock." An electronic circuit that works like a quartz watch to ensure perfect turntable speed.

Now Sony has improved on this incredibly accurate system in the only way possible: by making it less expensive. But to buy the X30 on its price alone would be selling it short.

Like today's most expensive turntables, the X30 features a direct-drive motor that eliminates pulleys and unreliable belts. But unlike models built by Pioneer and Technics, our direct-drive motor is both brushless *and* slotless—which means it's more accurate.

Instead of using an inexpensive particle-board base like many of our competitors, the X30's base is made of a Sony patented "bulk molding compound" that reduces acoustic feedback.

And we've even made the X30's platter mat slightly concave—so if your records are a bit warped, they won't sound that way.

SSU-2070 speakers: Sony remains one of the only hi-fi companies to produce our own speaker cones, crossover units, and even the cabinets themselves.



The X30 direct-drive turntable: it even compensates for warped records.

**The law of the jungle:
Survival of the smartest.**

Obviously, we don't have enough space here to tell you the whole Sony hi-fi story.

Like the way our new micro components use Sony developed "pulse power supplies" that reduce distortion almost to the point of being unmeasurable.

Or the way our new SSU-2070 speaker system guarantees you'll hear every part of the music with distortion-reducing carbon-fiber speaker cones. And a computer-designed speaker arrangement that makes sure you hear the music exactly as it was recorded.

The point of all this, however, is that for over three decades Sony has built superior audio equipment. Extraordinary products whose reputation for quality, value and reliability is unsurpassed.

So even if you don't know watts from ohms, at least you'll be able to survive in the hi-fi jungle by knowing Sony.

For more information, or the name of your nearest Sony dealer, write us at Sony, P.O. Box CN-04050, Trenton, N.J. 08650.

SONY AUDIO

We've never put our name on anything that wasn't the best.

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AUDIO SHOWCASE

(Continued from page 10)

five-button pre-set pushbutton tuning for AM or FM stations, and also has automatic muting for FM stereo, local/distance switch, stereo/mono switch and locking fast forward and rewind. The unit automatically replays a tape after rewind and can activate any fully automatic power antenna. Controls include volume, tone and balance. Suggested retail price: \$279.95.

New Pickering Cartridge

Pickering offers the XSV/4000 phono cartridge to expand the Stereohedron series and to incorporate some of the best features of the "acclaimed" XSV/3000 to deliver totally new and improved performance. The new cartridge has the patented expanded contact area Stereohedron stylus tip for gentle treat-



Circle No. 111 On Reader Service Card

ment of the record groove. The mass of the Stereohedron stylus assembly is appreciably lighter than that of ordinary pickups, thus allowing an optimum frequency response from 10 to 36,000 Hz plus the ability to accurately track groove modulations at high velocities, according to Pickering. A low-mass, powerful, samarium cobalt magnet assures more accurate reproduction of sudden transient peaks. Tracking at 1 gram or less, the cartridge is considered ideal for the most critical of applications. The sound is said to be neutral, without added coloration. Hinged directly to the stylus assembly is Pickering's exclusive Dustamatic brush. Suggested retail price of the XSV/4000 is \$140.

Fully Automatic Turntable

Philips' model AF829 turntable is front operated, direct control, and fully automated. Direct control is a new system combining the advantages of measuring the actual speed at the turntable and the well-known advantages of belt drive, in combination with the subchassis principle used in earlier Philips turntables. The major achievement, according to Philips, is that it brings the specifications to the level of direct drive,



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but without the inherent problems of direct drive which requires extremely fine construction to avoid rumble, suppress microphony, and decrease sensitivity to shocks. Direct control begins rotating the motor at 33 or 45 RPM, as selected. The belt transfers the rotation to the turntable. The speed of the turntable is continuously sensed by the tachogenerator and converted into a voltage, the output of which is fed into the control unit where this voltage is compared to a reference voltage. The resulting difference voltage is used as a control signal to adjust motor speed. Thus in this system all external influences are compensated, including changes in tracking force, different record weights, use of a dust bug, changes in environmental temperatures and relative humidity, mains voltage, and frequency fluctuations. Wow and flutter is put at 0.03% WRMS. On this turntable, touch switches are located outside the dust cover, on the front of the turntable. A bar of 9 LEDs indicate speed accuracy in 0.5% increments. Price: under \$300.

Noise Reduction System

Nakamichi and Telefunken have joined forces to produce "Hi-Com II," a high-quality cassette noise reduction system that can be used as an "outboard processor" with any tape deck. However, the circuitry has been optimized for high-quality cassette decks. Hi-Com II is so-named because it processes the signal in two frequency bands. Both bands use a 2:1 compression/expansion ratio to achieve a 20 dB improvement in the cassette deck's dynamic range. The use of a relatively high ratio and the use of separate compressors (Telefunken's HighCom compressor IC) for the low and high frequencies results in virtual elimination



Circle No. 112 On Reader Service Card

of noise modulation (pumping), which plagues most simple compressor circuits particularly when applied to a medium with inherently limited range. The system is said to be especially free from coloration with transient signals, a vulnerable point with many other noise

reduction systems. Nakamichi recommends that the Hi-Com II be used with state-of-the-art equipment and the finest quality cassette tape. Suggested retail price: \$420.

Tuner With Opto-Lock Tuning

Optonica's Model ST-7405 slim-styled, ebony tuner features what the company calls Opto-Lock tuning, an exclusive feature said to optimize tuning ac-



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curacy by reducing haphazard tuning, poor reception and interference. Other features include digital frequency display, multipath monitor switch, IF band selector and indicator, pilot canceler, air-check calibrator, seven-element signal strength meter, seven-LED tuning meter, Opto-Lock tuning indicator, hi-blend switch, FM muting switch, mode switch and variable output terminal. Specifications: FM IHF sensitivity, 1.7 μ V; FM IHF selectivity, 35 dB/80 dB; FM THD, 0.1/0.2% (wide), 0.2/0.3% normal; FM signal-to-noise ratio, 75/70 dB (Mono/Stereo); FM frequency response, 30 to 15,000 Hz \pm 1.5 dB; stereo separation, 50/45 dB at 1 kHz. Price: \$400.

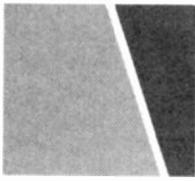
Satellite Speakers

Satellite-1 speakers were specifically engineered for use with Miller and Kreisel Sound's line of subwoofers, especially the M&K internally amplified servo-feedback subwoofer called the "Volkswoofer." The Satellite-1 retails for \$185 each, but the company says "greatest enthusiasm" has been for the \$795



Circle No. 104 On Reader Service Card

package called Satellite-Volkswoofer System. The Satellite 1 handles frequencies above 100 Hz and the subwoofer those below 100 Hz. The Satellite also operates separately as a compact, high-quality full-range speaker (Continued from page 67)



fact: professional studio technology comes to home hi-fi!



There is a new phono cartridge line that is the talk of the recording and broadcasting industries: the Shure SC39 Series. It is the first professionally optimized combination of true high fidelity performance, superb trackability, resistance to stylus damage under grueling conditions, and prolonged record life. These unique features make the SC39 ideal for high quality home applications as well.

if you transfer discs to tape

Use the cartridge developed for professional recording studios. The SC39 Series has a special strengthened internal stylus-support wire and elastomer bearing to improve stability when professional backcuing and slip-cuing techniques are employed.

In addition, the SC39 offers a unique stylus tip *not available on any other cartridge*: the MASAR™ tip, designed for playing even delicate lacquer masters, without objectionable noise buildup or "cue-burn" damage. It even helps when playing discs with high surface noise, or 45 rpm records made from reprocessed, substandard vinyl or polystyrene.

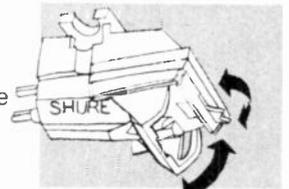


if youngsters have access to your hi-fi

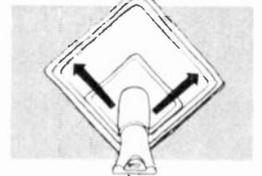


This cartridge also comes close to being "butterfinger-proof." Most stylus damage is caused either by dropping the cartridge or by pushing the stylus sideways against the edge of a record. To protect against this, the SC39 is equipped with two remarkable features. The first is the *Lever-Operated Stylus Guard*, which locks the stylus guard in safety position when not in use. With the flip of a thumb, the guard snaps up and the operating lever turns into a handy cuing aid.

In addition, the *SIDE-GUARD Stylus Deflector* protects the stylus shank from damage by withdrawing it safely into the cartridge body in response to sideways impacts.



Lever-Operated Stylus Guard



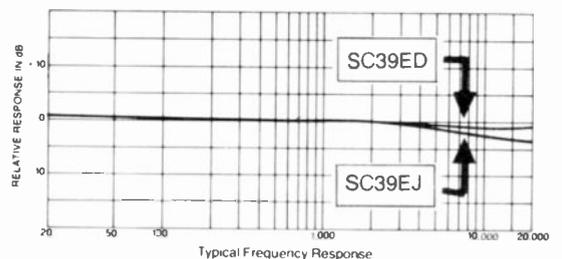
SIDE-GUARD Stylus Deflector

if you prefer professional response

The transparent sound of the SC39 Series is due to its optimized professional response which is virtually flat through the upper mid-range with a smooth and gentle rolloff at the highest frequencies. It is especially pleasant when used with loudspeakers that tend to exaggerate the high frequencies.

There are three models in the SC39 Series: SC39ED—Birradian (Elliptical) stylus for 3/4 to 1 1/2 gram tracking; SC39EJ—Birradian (Elliptical) stylus for 1 1/2 to 3 gram tracking; and SC39B—Spherical stylus for 1 1/2 to 3 gram tracking.

Send for brochure AL620



SC39 series professional phono cartridges... by



Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60204

In Canada, A. C. Simmonds & Sons Limited

Outside the U.S. or Canada, write to Shure Brothers Inc., Attn: Dept. J6 for information on your local Shure distributor

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

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"A Technological Masterpiece..."



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16

JAZZ



Lennie Tristano/by J.R. Taylor

If Lennie Tristano had never recorded a note of his music—even if he had never held a public performance—he would still be a significant figure in the history of jazz. Through most of his career, Tristano disseminated his style not to his audience, but to his student-musicians—some of whom became his colleagues—and to their students in turn. Turning most of his energies to teaching, Tristano became the first significant jazz pedagogue, an innovator not only in techniques of instruction, but also in the very act of training jazz musicians on general principles rather than the requirements of a specific performing situation.

Ironically, Tristano's course left him poorly represented in the LP catalog. Today, most of his records are out of print; but even if they were all available, Tristano would still have a sparser discography than his best-known students, saxophonists Lee Konitz and Warne Marsh.

Born in Chicago in 1919, Tristano lost his sight gradually during childhood, reaching total blindness before age ten. By then his studies on piano were already under way (he performed on saxophone and clarinet as well) and he turned professional at twelve. After studies at the American Conservatory of Music, he became influential among Chicago's younger white musicians, and this brought him to the notice of several Woody Her-

man bandmen, who encouraged his move to New York in 1946.

In the late 1940s Tristano formed a group that reflected his musical ideas. Its principals were Konitz and Marsh (both born in 1927 in Chicago and Los Angeles respectively) and guitarist Billy Bauer, a Herman veteran born in New York in 1915. Their opportunities for work were few, and by mid-1951 Tristano had decided to teach full-time. Konitz and Marsh taught too, but altoist Konitz kept his career going fairly steadily by working in a variety of situations, from Stan Kenton's band (1952-1954) to his own groups. Bauer became a recording-studio regular, while tenorist Marsh preferred non-musical work to music that involved artistic compromise.

Tristano would twice regroup with Konitz and Marsh, late in the 1950s and again in 1964. This last reunion ended with a break between Konitz and Tristano, and little was heard from the pianist thereafter. A 1965 European trip (his first) produced almost the last of his recordings and public appearances. At his death in December 1978, Tristano had not been

(Continued on page 69)

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

The new Sansui G-4700.



A double-digital receiver with all the right numbers.

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

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



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

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

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

and a better spurious rejection ratio (70dB).

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

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

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

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

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

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

SANSUI ELECTRONICS CORP.

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



Circle No. 8 On Reader Service Card

Introducing The Itsy Bitsy Mitsubishi.

Mitsubishi has put big audio performance into a series of precise little packages. Microcomponents.

Stereo components that are compact. But can hardly be called compacts.

They have the same high-performance characteristics as our regular size components. They have to. They're Mitsubishi.

The Micro FM tuner, for one. It's the teeniest tuner in the world. A mere 10⁵/₈" x 2³/₄" x 9³/₄" big. However, few tuners can measure up to its standards. It has, among other

things, a quartz-PLL synthesizer tuning system so sophisticated that it has absolutely no drift. Zilch.

We were no less frugal with features on our Micro Cassette Deck. It has an Automatic Spacing Pause System, Dual Capstan Drive, Separate 3-way Bias and Equalization Feather Touch Controls and of course, Dolby.[®] Yet measures only 10⁵/₈" x 5¹/₂" x 9⁵/₈"

For power, the Micro Amp is unbeatable at this size. The little "direct coupled" powerhouse puts out 70 watts per channel. Total harmonic distortion is only 0.01%. For 30 watts per channel, it's an infinitesimal 0.004%.

Our Micro Preamp is made to complement the

amp. And faithfully conduct any signal source that goes through it. It has a built-in moving-coil head amplifier. With a signal-to-noise ratio of 77dB even for 100 μ V input and 0.005% THD, it obviously does the job better than components twice its size.

Small wonder the final touch was to finish them with Champagne Gold face plates.

The new Mitsubishi microcomponents.

Now bigger isn't better. Only bigger.



Mitsubishi's Microcomponents. Micro FM Tuner, M-F01. Micro Cassette Deck, M-T01. Micro Amp, M-A01. Micro Preamp, M-P01. For more information write Melco Sales, Inc., Dept. 44, 3010 East Victoria Street, Compton, California 90221. Distributed by Superior Electronics Inc. in Canada. [®]Dolby is a trademark of Dolby Laboratories.

Circle No. 23 On Reader Service Card

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.

© Bartok: *Concerto for Orchestra*. Philadelphia Orch., cond. Eugene Ormandy, RCA Victor ARC1-3421.

According to the glowing liner notes on this disc, Eugene Ormandy, after listening to the playbacks during the recording sessions in April 1978, indicated there is "no comparison!" between the new digital process and recording techniques of the past. It is difficult to believe that Mr. Ormandy was



Unfortunate failure

listening to what we hear on this new LP, the first digital recording to be released by RCA. The digital Soundstream system is, of course, state of the art recording equipment, offering producers a wider dynamic range than ever possible before, with a total lack of hiss, background noise and distortion. But this system cannot do the impossible. It can only record what has been put into it. RCA's jacket notes state that 26 microphones were used for their Bartok sessions. One might expect something impressive sonically to come out of all this, but the end result is a recording that is decidedly inferior in

every way. Somewhere along the line the richness and beauty of The Philadelphia Orchestra have been totally lost. The orchestra's lush strings here are particularly thin and characterless, woodwinds are shallow, only brass and percussion conveyed with any degree of realism. Throughout there is a total lack of warmth, resonance and presence. Just about every other recording of Bartok's concerto currently available is preferable to this, particularly those by Bernstein, Boulez, Karajan, Kubelik, and particularly the budget-priced Fritz Reiner-Chicago Symphony version made more than two decades ago which still sounds infinitely superior to RCA's brand-new digital disaster. The fault on the new LP obviously is with the producer and engineering staff. RCA's technical problems with the Philadelphia Orchestra have always existed, ever since their first dismal recordings in 1968. Since that time they have improved, but never have they truly captured the resplendent sound of The Philadelphia Orchestra. This new Bartok LP is a major step backwards.

© Chopin: *Polonaise in A Flat, Op. 53; Berceuse in D Flat, Op. 57; Impromptu in A Flat, Op. 29; Ballade in A Flat, Op. 47 No. 3; Nocturne in C Minor, Op. 48 No. 1; Fantasia Impromptu Op. 66; Scherzo in B Flat Minor, Op. 31 No. 2; Waltz in C Sharp Minor, Op. 64 No. 2*. Earl Wild, pianist, Quintessence PMC 7131.

These are recent recordings, made in RCA's New York studios in September of 1978, here released for the first time. Wild created a sensation in New York with his Chopin recitals, yet on this recording much of his playing sounds quite mannered. In particular, the delicate "Waltz in C sharp Minor" is given a rather strange accent, with rubato far beyond any accepted norm. There are many moments of glistening filigree, particularly in the "Berceuse," but these generally athletic perform-



Below par performance

ances miss much of the introspective qualities of the more gentle pieces, while the more heroic works ("Polonaise in A Flat," "Scherzo in B Flat Minor") are rather rushed. Wild has made some spectacularly successful discs, notably many concerto recordings including all of Rachmaninoff's, and some remarkable Liszt interpretations. This new Chopin release falls considerably below Wild's usual performance standards.

© Mozart: *Violin Concerto No. 3 in G Major, K. 216; Violin Concerto No. 5 in A Major, K. 219*. Anne-Sophie Mutter, violinist; Berlin Philharmonic Orch., cond. Herbert von Karajan, Deutsche Grammophon 2531 049.

What an extraordinary opportunity for a young instrumentalist, to be invited by Karajan to appear with the

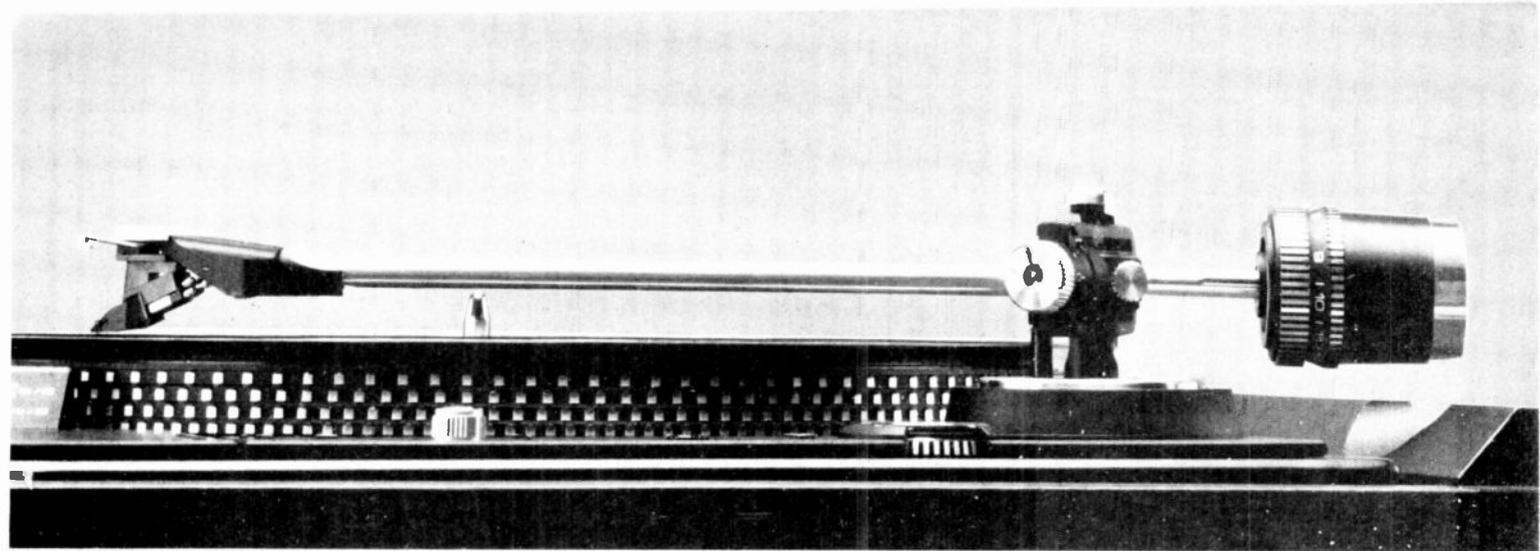


Prodigy on disc

Berlin Philharmonic when only fifteen years old! Mutter was born in 1963 and first studied the piano, soon thereafter switching to the violin, a year later winning her first prize on the instrument. Karajan heard her at the Lucerne Festival, which resulted in his invitation for her to perform with the Berlin Philharmonic in 1978, at which time she was enthusiastically acclaimed for her mature artistry. She is a lovely, poised and aristocratic young lady, and on this recording repeats the concerto she played for her remarkable debut with the Berlin Philharmonic, the *Concerto No. 3*, with the more familiar *Turkish* concerto on the reverse side. Mutter's playing is indeed eloquent, perfect in intonation and beautifully phrased. This is a most auspicious recording debut, which has been wonderfully captured by the DG engineers.

© Mussorgsky-Ravel: *Pictures at an Exhibition*. © Mussorgsky-Rimsky-Korsakov: *A Night on Bald Mountain*. Cleveland Orch., cond. Lorin Maazel, Telarc Digital 10042.

This is quite an astounding recording



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STEREO RECORDINGS

(Continued from page 20)

in many ways. The Soundstream digital recording process is capable of accurately reproducing the full dynamic range of a large orchestra, far more accurately than was possible with conventional recording methods. This is the first digital recording on Telarc of a major, large orchestra, and the engineers involved are to be commended for their expertise in capturing the rich sounds of the Cleveland Orchestra. The recording was made in Cleveland's Masonic temple in October 1978. This hall obviously is very satisfactory for recording purposes, although there might have been a touch more of reverberation to add more warmth to the strings. Otherwise, all is quite spectacular, and sonic buffs doubtless will play repeatedly the final movement of "Pictures," "The Great Gate of Kiev," with its resounding percussive, particularly the incredibly-reproduced tam-tam, that gets louder and louder at the climax. Both of Mussorgsky's scores are presented here in incredible orchestral detail, and this disc easily could become

the display LP of the year. Maazel already has recorded "Pictures" twice, for Angel and London Phase Four. He is hardly one of the more exciting conductors on the contemporary orchestral scene as illustrated by the somewhat prosaic performance on this LP. However, the Cleveland Orchestra plays like the great orchestra it is. Collectors seeking more interpretively from "Pictures" might look to competing versions by Leibowitz and the Royal Philharmonic on Quintessence, Giulini and the Chicago Symphony on Deutsche Grammophon or Muti and the Philadelphia Orchestra on Angel. It is understandable that direct-to-disc recordings would have a high price tag; there is a limit to the number of pressings that can be made because of the process. But this Telarc LP is digital, and the company can press as many copies as they wish. Because of this it would seem that the \$17.98 list price is rather excessive, although there is no question that it does sound superior to just about any other recording in my memory.

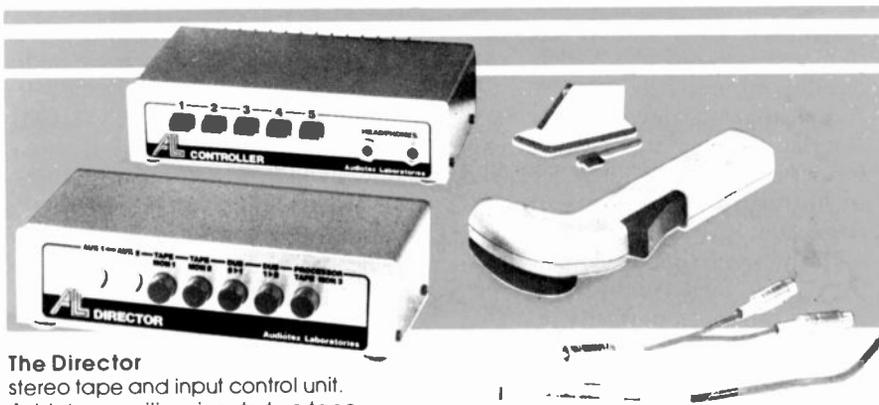
© Orff: *Carmina Burana*. Milada Subrtova, soprano; Teodor Srubar, tenor; Jaroslav Tomanek, baritone; Czech Philharmonic Orch. and Chorus, cond. Vaclav Smetacek, Quintessence PMC 7122.

This performance was recorded by Supraphon in 1961, available for some years on the Parliament label and is now restored to the catalog on this budget-priced Quintessence label. It is a worthy return, as this performance is extraordinarily effective in many ways. The Czech Philharmonic Orchestra is superb, and the chorus, particularly the male voices, quite outstanding. *Carmina Burana* is Orff's vivid setting of a group of poems written by Benedictine monks, with texts that are often more bawdy than you might think possible for men of the cloth. *Carmina Burana* is an audience pleaser, and for good reason. It is the first part of a trilogy that includes *Catulli Carmina* and *The Triumph of Aphrodite*, and easily surpasses the others in originality and freshness. Unfortunately, the three soloists on the Quintessence reissue are only adequate. They are enthusiastic enough but all suffer from that type of wobble typical of Slavic voices, and this might be too much of a distraction for some listeners. Even though this recording was made in 1961 the reproduction is very fine and well-balanced. The percussion, so important in this score, strongly punctuates the setting.

© Rachmaninoff: *Rhapsody on a Theme of Paganini, Op. 43*; © Dohnányi: *Variations on a Nursery Song, Op. 25*. Julius Katchen, pianist; London Philharmonic Orch., cond. Sir Adrian Boult, London STS 15406.

Julius Katchen was one of the most promising of the younger pianists on the international scene until his untimely death in 1969 at the age of forty-two. Some of his finest recordings, particularly of Brahms, still are in the catalog, and it is good to see this Rachmaninoff-Dohnányi coupling available once again. These are among the finest performances of both works, scintillating in their brilliance, yet sensitive to the score's more lyrical moments. The accompaniments are marvelous, and the quality of reproduction belies the fact that these are not new recordings. If you haven't heard the Dohnányi variations, you should investigate this inventive set of variations on the song "Ah, vous dirai-je, maman," in which the composer set: this simple familiar theme in treatments ranging from a Viennese waltz to a fugue. There is another superlative budget-priced performance of this score, on Quintessence, with Earl Wild accompanied by the New Philharmonia Orchestra conducted by the composer's son, Christoph von Dohnányi, coupled with Liszt's "Hungarian Fantasy" and "Mephisto Waltz." You could not go wrong with either recording. ▲

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Circle No. 9 On Reader Service Card

Opera

For Today

Nicolai Gedda

by Speight Jenkins

□ The name Nicolai Gedda, to anyone who loves opera, means taste and style. The Swedish tenor (whose mother was Russian and so gave him a double national heritage at home) has been known on the international scene since 1953, and this fall has another new production at the Metropolitan Opera, the exacting role of Belmonte in Mozart's *Entführung aus dem Serail*. Some tenors are known for their sensual sound while others for their ringing high notes. Gedda has built his career on being able to handle high notes as easily as they exist and on his ability to sing idiomatically in as many languages as there are operas to fill them. Also rare with Gedda is his effective and easy mezza voice—the soft kind of singing vital in bel canto operas and spectacular in more dramatic works. Gedda can file down the size of his voice

and seem to float it on a light column of air, moving high into the vocal stratosphere without ever going into falsetto. Even at his present age of 54, the tenor can sing with brilliance and subtlety, showing less age in live performance than in some of his more recent records.

Gedda's voice began as a very light tenor—a true *leggiero*—and his first fame came from an opera of Adam's, *Le Postillon de Longjumeau*. The work is not a great one, but it has one aria in it that is tantalizing for any tenor. Again and again the tenor must vault from the staff up to high C, ending with a true, full-voiced high D. Gedda did this easily in Paris at the Opera in 1953, and he was launched. I remember well hearing him for the first time there in a very unusual opera, Weber's *Oberon*, in which he played the fairy king with brilliance and the easiest, high-flying voice I had ever heard. In 1957 he made his debut at the Metropolitan Opera in *Faust*, and his brilliant lyric tenor was precisely right for the part. Gedda had a wide range, a youthful sound and a sureness of production rare in any singer, let alone a tenor.

Though Swedish and Russian are his two native languages, his facility in French, German, Italian and English is as perfect as a native's. This statement has been made in the past of other singers and some could fault it. But with Gedda the clarity of words he sings in our own language gives one



Nicolai Gedda portrayed Lenski in Tchaikovsky's *Eugene Onegin* at the Metropolitan Opera House.

an idea of what he can do in the others. And it has been the same since his beginnings in the U.S. In his first Metropolitan Opera season he sang Anatol in the world premiere of Samuel Barber's *Vanessa*, and many pointed out that his English diction was the clearest though he was the only non-American in the cast.

What Gedda lacks is the rich, sensual quality of so many Italianate tenors, and he does not really have the typical Italian vocal production that can be heard in the work, say, of Luciano Pavarotti. This has not stopped him from taking on and recording a world of Italian roles, but out of the bel canto repertory, despite his grasp of

the style, he has not proved as satisfying to audiences as those tenors with a richer voice. This is said with some hesitation for two reasons: Gedda can sometimes surprise you and sing a Puccini or Verdi role with the ardor and passion of the Italian tenor, and further, it is not at all clear that audiences are quite as finicky about the special kind of voice for certain parts as are critics.

In all repertories, Gedda has had a distinguished career at the Metropolitan Opera. In the 22 seasons as a first tenor at the house he has sung 28 roles over 250 times. As of a few years ago his most performed role was one he hardly sings now at all: Don Ottavio in *Don Giovanni*. Included in the list of widely heard roles are his Des Grieux in Massenet's *Manon* (denied us since 1964 because the Met has not performed the opera), Hoffmann in

(Continued on page 68)



In a scene from Smetana's *The Bartered Bride*, Gedda plays Jenik opposite Teresa Stratas' Marenka.



The role of Ernesto in *Don Pasquale* by Donizetti was one of Gedda's most successful accomplishments.

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OA-3A



OA-7



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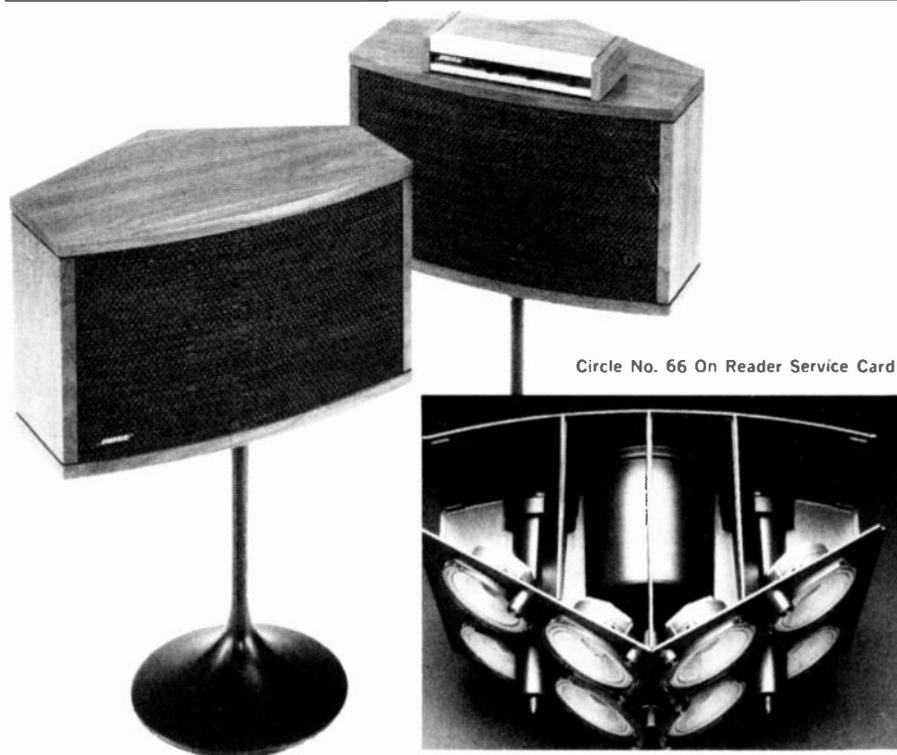
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SOUND PROBE SOUND PROBE SOUND PROBE

Almost everyone agrees that the only meaningful way to judge loudspeakers is by ear. So it's too bad we can't actually invite you to come and listen with us. But by giving you an account of our subjective impressions along with a description of the basic design principles of the speakers we review, we hope to enable you to form an idea of what these speakers are like.

by HANS FANTL and CHRISTOPHER CURRY, EAF



Circle No. 66 On Reader Service Card

Bose 901 Series IV

We scratched our collective heads when the Bose speakers arrived. They look like no other speakers and they sound like no other speakers. How on earth were we going to describe them?

Maybe the best way to characterize the Bose 901 is to call it a collection of maverick ideas that seem far-out at first glance. But when you put them all together, they work out splendidly.

This radically unorthodox speaker is the brainchild of Dr. Amar Bose, a professor of electrical engineering at the Massachusetts Institute of Technology, a top-rank researcher with a flair for thinking of things from the ground up. So Dr. Bose began by throwing away most established notions about loudspeakers. In fact, he went all the way back to the original sound, making an analytic study of sound propagation in the concert hall. He found that most of the sound heard at a live performance does not reach the listener directly. As the musicians play on-stage, only

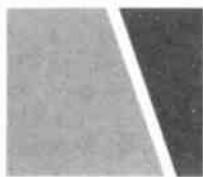


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KEF-101

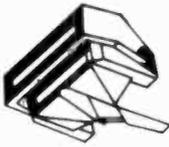
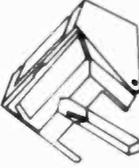
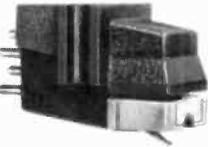
The recent appearance of mini-components is good news for musical dwellers in cramped quarters. By using miniaturization methods developed for space electronics and computers, the minis happily reverse the trend toward needless bulk in audio equipment. But these methods apply chiefly to purely electronic components, such as amplifiers, tuners, and receivers. The effort to shrink size without shrinking performance has not been equally successful in the area of loudspeakers, and many of the mini-speakers that have recently been sounding off in the market were not entirely satisfactory. Granted, mini-speakers by reputable manufacturers usually have clear, undistorted sound, and the net result is by no means unpleasant. But some of them seem notably weak in bass, which is not surprising, considering their size.

One way of mitigating this inherent deficiency of small speakers is to make



fact: a Genuine Shure upgrade stylus is unquestionably the biggest bargain in hi-fi

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 <p>M70 SERIES</p>	<p>N72EJ Biradial (Elliptical) stylus N72B Spherical stylus</p> 	<p>Improved trackability, especially at high frequencies, due to a new, redesigned low-mass N72 stylus assembly.</p>
<p>ANY M91, M92, M93</p>	<p>N91ED* stylus</p>	<p>Much improved trackability due to the lower effective tip mass of the nude Biradial (Elliptical) stylus tip. Less tracing distortion compared with a Spherical stylus tip.</p>
<p>ANY M71, M73, M75</p>	<p>N75 TYPE 2* Series styli</p>	<p>Improved trackability at higher frequencies due to a stylus assembly with a lower effective tip mass.</p>
<p>ANY M44 Series</p>	<p>N55E* stylus</p>	<p>Lower tracking force with a Biradial (Elliptical) stylus, lower distortion, lower effective tip mass.</p>
<p>M3D, M7D</p>	<p>N21D* stylus</p>	<p>Improved performance at lower tracking forces.</p>

* Before purchasing any replacement stylus be certain your turntable is compatible with the tracking force of the stylus you select.

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SOUND BOSE SOUND PROBE SOUND PROBE

(Continued from page 26)



Circle No. 66 On Reader Service Card

about 20 percent of their sonic output travels straight out toward the audience. The remaining 80 percent reach the ear by way of wall reflections, somewhat like a carom shot bouncing off the edge of the pool table before hitting the pocket. Dr. Bose therefore resolved to design a speaker that would duplicate this pattern.

The Bose 901 radiates most of its sound *away* from the listener toward the rear and the sides of the room. Where the rearward and sideways sound hits the walls, it reflects as from a mirror. This produces an odd effect. When you look in a mirror, your reflection appears not in the mirror plane but *behind* the mirror. Likewise, the sound reflections seem to be coming from *behind* the walls. This creates the impression of sitting in a large concert hall even when you are listening in a small room. To some degree, this is true of most multi-directional speakers using reflected sound. But in sheer spaciousness—giving a sense of sonic enlargement to the acoustical environment—the Bose is without parallel.

Description:

This speaker is unique in other ways, too. There are no woofers and tweeters. The sound is generated by a total of nine identical four-inch cone speakers,

each separately chambered in an odd-angled enclosure, and each pouring out full-range sound. A special electronic equalizer, connected as an outboard device, creates the desired response curve by shaping the amplifier output to the requirements of the speaker.

John Wawzonek, a Bose engineer, explains it this way: "Most speaker designers try to get flat response by stretching the capabilities of the speaker materials. We think it's easier to compensate electronically for the mechanical properties of the speaker. We push the signal in those parts of the frequency spectrum where the speaker is naturally weak, and we weaken the signal where the speaker is naturally efficient."

Bose uses a computer to match the nine drivers in each speaker. A test signal sweeps each driver through the entire frequency range from 20 to 20,000 Hz, and the computer "listens" through a calibrated microphone to check the speaker response. "This automated analysis," says Wawzonek assures that every element in the array is compatible with the others so as to produce peak-free overall response."

Another unusual feature of the 901 Series IV are two nozzles projecting
(Continued on page 67)

sure that they have extremely smooth response above the cutoff region. The human ear has the ability to inwardly reconstruct at least some of the missing bass as long as the upper frequencies are presented in their exact relative proportion. Nobody quite understands why this is so. Intensive investigation of this phenomenon at the Harvard Psychoacoustic Laboratory has yielded no clear answer; but apparently the human ear "synthesizes" the missing bass from the structure of the upper harmonics which are reproducible even by a very small speaker.

The net effect of this illusory bass is not quite the same as that of genuine bass. It lacks the sense of depth and weight. But if the response of a speaker is truly linear from the mid-bass region upward, the listener gains some feeling for the bass that isn't there.

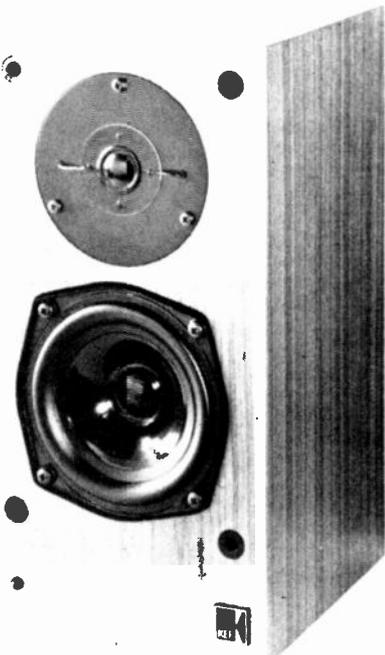
Description:

This lengthy preamble is necessary to explain the sound of the KEF-101, which is unquestionably one of the very best little speakers ever to come to our attention. Its British designers have taken uncommon pains to assure its uncommon quality. For one thing, every one of its elements is computer-matched. As in the case of the Bose speakers, discussed above, the response curves of

all drivers are analyzed by computers to assure a smooth matching of woofer and tweeter without any discontinuities of response in the crossover range, and matching of speaker pairs to assure identical sound projection from left and right. Not only the drivers are computer-matched; every circuit element in the crossover networks is also subjected to computer analysis so that tight tolerances are maintained and the two speakers in a pair are absolutely alike.

When you measure the KEF-101 in the lab, you'll find its response astonishingly linear: within 2 db from 90 Hz to 30 kHz. It is this linearity which accounts for the smoothness of sound as well as for the psychoacoustic effect previously described: the illusion of bass not actually reproduced. Of course, the speaker does in fact reach below 90 Hz, even though its response below that point is no longer linear. Its tight acoustic suspension allows it to accept bass boost from the amplifier and receiver without becoming boomy, and in this manner considerable output can still be obtained in the region around 45 Hz—not at all bad for a little box measuring a mere 12¼ inches high, 6 inches wide and 6½ inches deep.

One of the most astonishing aspects
(Continued on page 68)



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hi fi stereo
BUYERS GUIDE
JAN/FEB 1980

Innovations in TUNER TECHNOLOGY

by William S. Gordon

If we're to believe statistics, more time is spent listening to FM than to any other program source. Before you discount that statement completely, tote up the hours you spend listening to radio and compare the figure with the number of hours you spend listening to discs or tapes. When I did, the results were surprising. That tuner is on more than I thought. Sure, I may not be

listening to it *seriously* for all that time—like right now when I'm writing—but I *am* listening, and when the sound is distorted or garbled, I react immediately and with annoyance.

Fortunately, tuners have gotten pretty good. Top models are actually better than the equipment used at most broadcast stations! They are able to handle the full band transmitted (30



For those who like a traditional dial display but with push-button tuning, Kenwood's KT-413 may be the answer. This AM/FM tuner is said to have a sensitivity of 1.9 microvolts and a signal-to-noise ratio of 72 dB in stereo and 77 dB Mono. The distortion is .15%. Circle number 75 on the Reader Service Card. Price: \$250.



Onkyo's T-4090 features quartz-locked tuning with a large flywheel tuning knob. It has front-panel controls for de-emphasis, output level, mute lock and a noise filter among others. LEDs show station lock and signal strength. Circle No. 80. \$339.95.

TUNER TECHNOLOGY

Hz to 15,000 Hz) uniformly and with admirably low distortion. And, stereo separation actually exceeds that of most program sources. (A phono cartridge is lucky to achieve a 30-dB separation figure, but such an achievement is now duck soup for a tuner.) Sensitivity, once a criterion that separated the men from the boys, now closely approaches the theoretical limit on many tuners.

Real-World Performance. But a tuner attains its specifications only if it is "tuned" precisely. If you're a little off the target, distortion increases precipitously, sensitivity diminishes, separation goes to pot, and the noise level increases. And sometimes, you don't know that you're slightly mistuned until a sudden crescendo elicits a raspy choke at its peak. Recent tuner advances seem to be devoted more to improving performance in the "real world" than on the test bench, and that's all to the good.

Many design techniques and features that once were available *only* in top-of-the-line models are now quite commonplace. Chalk that inflation-fighter up to the economies of mass production and the availability of inexpensive integrated circuits that combine a slew

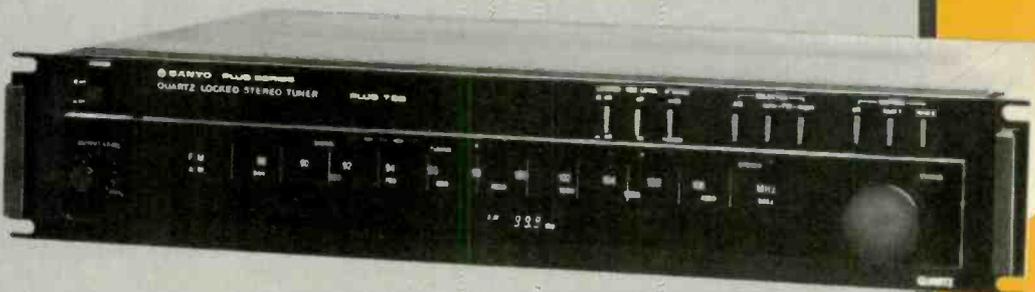
of circuitry in a single chip. A prime example is the phase-locked-loop (PLL) multiplex decoder. Most tuners now feature this type of circuitry—one that improves stereo separation especially near the ends of the audio band. But before the IC was developed, a phase-locked loop was impossibly complicated to implement in a reasonably priced tuner.

Along the tuning line, many FM sets have some sort of "lock" system. (Don't confuse this with a phase-locked-loop MPX decoder.) Once you've dialed in close to the station, the tuner takes over and pulls in the rest of the way. Modern automatic tuning systems are far better than the old AFC (automatic frequency control) that frequently produced distorted audio and would "pull" towards the stronger of two adjacent stations. The new systems compare the IF frequency with that of a quartz-locked oscillator and make the adjustment accordingly. Essentially, the tuner attains the stability and approaches the accuracy of the quartz reference, and that is mighty good. And, it needn't cost you a fortune either. To put over the "stability" idea, many such tuners push the word "quartz" (or some variant thereof) in the promotion. We're all supposed

Sansui's new TU-X1 is an impressive looking machine that has separate AM and FM controls and metering. On FM the signal strength meter can be used as sensitive multipath-distortion meter. Both IF amplifiers can be used in the narrow or wide modes. Circle No. 89. \$980.



Sanyo's Plus T35 is a quartz-locked AM/FM tuner with a digital channel indicator and an analog reference dial. It also has a variable bandwidth IF amplifier, switchable de-emphasis, two-level muting and a five LED signal strength meter. Sensitivity is 1.8 μ V. Circle 102. \$299.95.



Mitsubishi's top-of-the-line DA-F20 FM-only tuner has quartz-PLL tuning for low drift. The stereo signal-to-noise ratio is 75 dB wide-band, total harmonic distortion 0.08% wide band. Circle 78 for more information. \$430.



to know that quartz implies accuracy.

Synthesized Tuning. Although "quartz-locked" tuning assures that you're very close to the money, theoretically, it's not perfect. The tuner must always be *slightly* off the mark, for it is this "error" that actually does the tuning. (Practically speaking, this needn't concern you for the "error" is miniscule—much less than you'd achieve by hand tuning unless you're incredibly lucky.) To eliminate this last vestige of inaccuracy, we have "digitally synthesized" tuners. These are a good deal more complex (and expensive) than the quartz-locked variety.

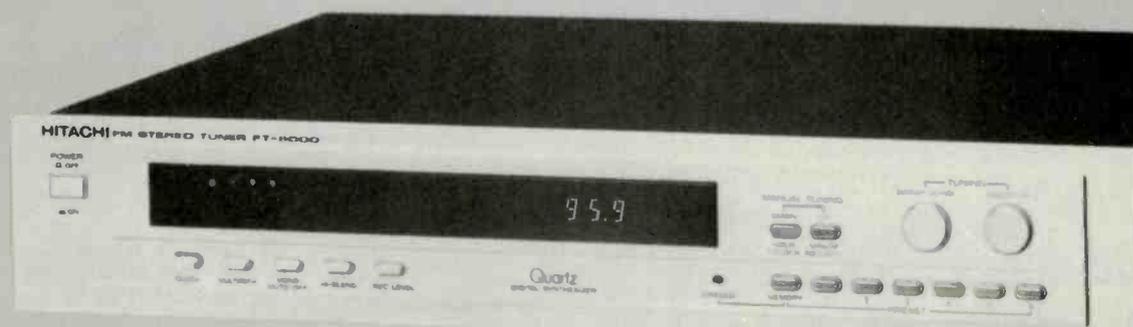
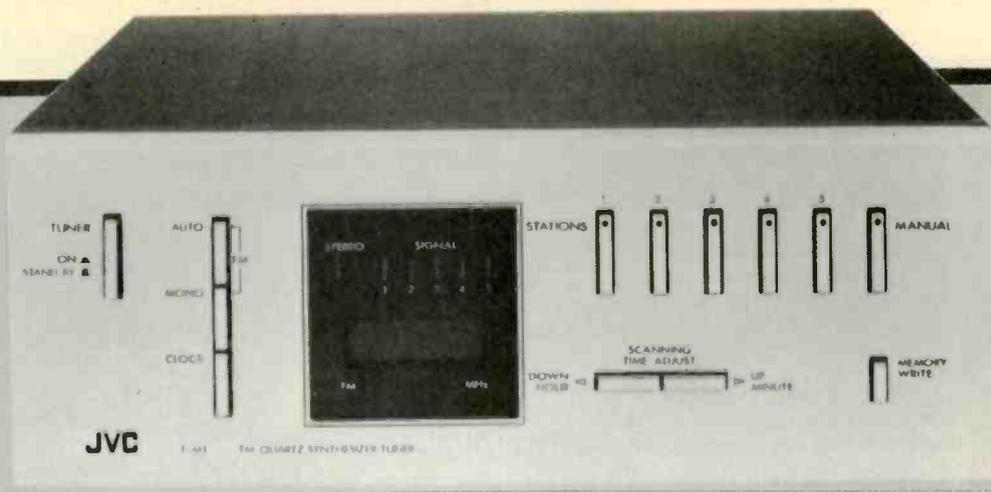
A quartz crystal forms the heart of a synthesized tuner too, but it's used in a different way. Rather than being a *reference* to which the signal frequency is compared, the crystal generates the local-oscillator signal for *every* conceivable station and (usually) *only* for those stations. There is no comparison and correction; in a sense, the tuner is pre-programmed to line up only with stations that are at the designated FM frequencies. In this country,

FM stations are spaced at 200-kHz intervals, so only those channels need be tuned. (In other parts of the world, FM channels are spaced differently, so some synthesized tuners provide for channels in 50-kHz increments.)

Tuning a synthesized tuner really comes down to switching in the right oscillator frequency. It can be done via pushbuttons, programming "cards," by knob, or in many other conceivable ways. The ability to "preset" a number of your favorite stations and switch between them instantly is thus easy to accomplish, and most synthesized tuners afford this facility. Usually too, the station frequency is displayed on a digital readout. Although it's not needed, a conventional slide-rule dial may be used as well. The digital display takes some time to "update," and, when you are spinning rapidly through the band, the old slide-rule dial is actually a more convenient rough indicator of where you are.

Be aware that a digital display by itself does not mean that the tuner has a "digitally synthesized" oscillator. Some designs use a conventionally-tuned oscillator and have a built-in "frequency counter" to indicate the frequency

JVC's T-M1 micro, synthesized tuner is only 9 in. wide but it has plenty of features. Its digitally synthesized tuning is precise, and set manually or with 5 programmable presets. The digital display is also a clock. Circle 74 for more information. \$499.95.



TUNER TECHNOLOGY

Hitachi's FT-8000 quartz-digital synthesized FM tuner has a digital display, six programmable preset stations and built-in clock. Signal-to-noise ratio is 72 dB mono, 68 dB stereo. Circle Number 72. At \$459.95.

of the station that is being tuned. Although such a display is a more accurate indicator of which station you're receiving than a slide-rule dial, it does not assure that you are properly tuned to that station.

Preset Tuning. The inclusion of "presets" may indicate digital synthesis, but you can't count on that fact either; some tuners use "varactors" to provide the preset ability. A varactor is a voltage-controlled capacitor; by changing the DC voltage across the device, its capacitance changes and accomplishes the same purpose as a conventional mechanically-driven "tuning capacitor." Thus, tuning can be achieved by strictly electronic means which simplifies implementation of the preset feature. Actually, varactors are used in a synthesized tuner too, but not to adjust the oscillator frequency. They are used to replace the mechanical tuning-capacitor sections that adjust the RF amplifiers. Varactors are no better than a mechanical tuning capacitor; in fact, in some respects the mechanical jobbies beat them hands down. However, they are a very convenient means of achieving electronic tuning. At least one tuner we know of uses a servomotor-driven mechanical tuning capacitor to

achieve presets without the theoretical limitations of varactors.

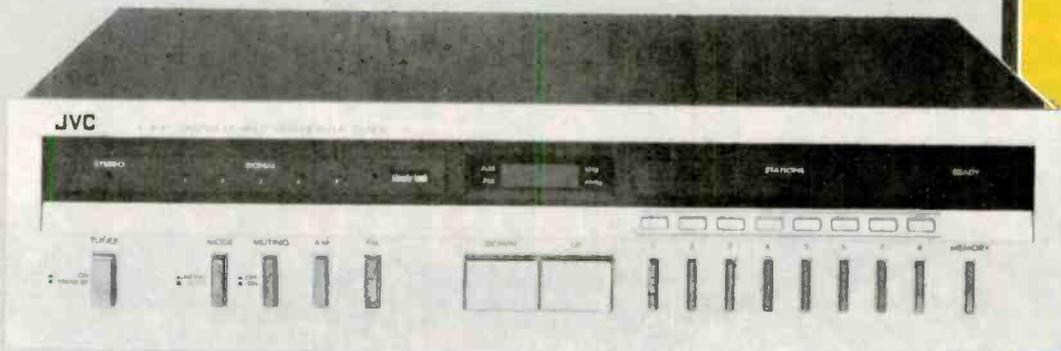
Meters. Tuning accuracy is the *sine qua non* of FM reception, and, most tuners and receivers have some form of tuning "aid"—meters, LEDs, or whatever. Traditionally, the better tuners have been equipped with two meters, one indicating signal strength, the other showing when you are tuned precisely to the center of the channel. The recent trend is to replace these meters with LED displays. A three-LED configuration does a pretty good job of replacing the center-of-channel meter; one LED indicates when you're tuned too low, another when you're tuned above the station. The center one tells you when you're on the money. Combined with some sort of "lock," such a display is all you need as a tuning aid.

LED signal-strength indicators frequently leave something to be desired. Usually they consist of a five-light array, and the greater the number of LEDs that are illuminated, the stronger the signal is. If you're using the array to serve as a guide in orienting an antenna for strongest reception, you may find it inadequate. The "steps" between successive LEDs

Aiwa has an FM digital tuner with analog and digital displays, model AT-9700 U. Has variable output level for taping. Please circle number 103. \$520.



JVC's T-40P synthesized AM/FM tuner has digital channel display, 8 programmable preset stations. Circle 74 for more information. \$369.95.



With 15 touch-select channels the ReVox B760 is great for the audiophile who likes convenience. It has noise reduction circuitry. Separate signal strength, center channel meters. Circle No. 86. \$1,649.



may be so large that you don't get any different indication even when rotating the antenna through a substantial angle. Of course, some meters are more sensitive than others in this regard.

Especially in an urban environment, the antenna orientation for best reception may *not* coincide with that for *strongest* reception. Frequently, it is more important to rotate your antenna for minimum *multipath* pickup than merely to pick up as much signal as possible. Some tuners are equipped with multipath-reception indicators. One of the meters may double up for this function—usually it's the signal-strength meter. When in the multipath-indication mode, you rotate the antenna for *minimum* indication—or the tuner may present the distorted multipath signal aurally through one of the speakers. Obviously, you turn the antenna for minimum garbage. Some tuners have output jacks that connect with an external oscilloscope display that shows multipath; at least one, has a built-in oscilloscope display. Some form of multipath indication is especially helpful in and near a city, although this

author hasn't found the meter-type particularly effective.

While on the subject of meters, some tuners feature a modulation or "deviation" meter that displays the percentage of modulation being used at the station. Usually, the signal-strength meter doubles up for this job. Since stations are not supposed to exceed a modulation level of 100%, such a meter may serve as an aid in setting the recording level when taping off the air. Presumably, when the meter is hitting 100% on peaks, your tape-recording level meter should be peaking to 0 or slightly above. Other than serving that purpose (and amusing the inveterate meter-watcher), we're not sure to what practical use such a meter can be put to in the home.

Dolby FM. Many tuners now feature a "record-level check"—a built-in oscillator that puts out a test tone at a level corresponding to some fixed percentage of modulation. Usually 50% modulation is the benchmark since this is the "Dolby-FM Level," and the tone can be used to calibrate a Dolby decoder even when the station does not transmit a Dolby-calibration tone. (Check the tuner manual, however, *(Continued on page 74)*)

An Introduction to...

MULTI-TRACK

Mix professional-quality recordings in your own studio

by Larry Blakely

No longer is the amateur recordist considered to be a slightly-fanatical individual with too much money to spend on a basement full of electronics and acoustic insulation. All across the country there are thousands of audiophiles and musicians who are turning out increasingly sophisticated recordings on comparatively inexpensive equipment. Using techniques similar to those used in professional studios these amateur recordists are producing high-quality tapes, many of which have been produced as commercial record albums.

The most useful technique used in both professional and amateur studios is multi-track tape recording. Understanding how it works and how it can be used is vital to anyone considering setting up a home studio.

How it Started. Multi-track recording was developed by the recording industry to overcome the difficulty of making a perfect "real time" recording. Real time means that a group will perform and the recordist must record everything in one pass. If any performer makes a mistake you just have to live with it. If circumstances allow, you can re-record the entire selection and hope the performer doesn't make the same mistake or a worse one. If the recordist is really skilled, he may be able to re-record only the section of the performance where the mistake was made and splice it into the original tape recording with a razor blade or scissors. Whatever the circumstance, you must still record all the performers at one time and live with what you get. If one person makes a mistake or the recordist goofs, everyone goes back to square one.

The professional recording industry faced the same problems with tape recording until the 1950's. They were



The TEAC model 2A is a six-input, four-output mixer. Each input has switchable mic/line level inputs, ± 12 dB bass and treble controls, color-coded output selection switches, and slide fader. The unit shown includes the MB-20 meter bridge which monitors the input level sensitivity and the level of the output signal. The mixer has a master output level control and a pan control that lets you move the image from left to right. Model 2A sells for \$475 and MB-20 for \$250. Circle 121.

RECORDING

A four-track recorder is the key to getting started in semi-pro recording. The A-3440 by TEAC features a three-motor drive, erase, record/synch and playback heads, and separate VU meters for each track. Frequency response at 15 ips is from 25 Hz to 24kHz \pm 3 dB. \$1600. Circle 121.

recording in mono and stereo during this time much the same way. If Nat King Cole was recording with a full orchestra and made a mistake, the entire selection would have to be re-recorded. If any performer's playing or singing was marginal in a given musical selection, the producers would have to determine if they felt everyone could do a better job if the entire selection were to be recorded again. Sometimes only portions of a selection would be re-recorded and spliced into the original recording. This was the typical recording process in the professional recording industry throughout most of the 1950's.

During this same time period a musician by the name of Les Paul, of "Les Paul and Mary Ford" fame, had an idea that was to later change the face of the entire recording industry. He conceived a process whereby, certain portions of the music could be recorded during one session and other musical parts could be added at a later time in other recording sessions utilizing different channels (tracks) on the same tape. For example, the orchestra could be recorded on two tape tracks and the vocalist could be recorded on a third track. If during a recording session (with orchestra and vocalist performing, there was a good performance by the orchestra and the vocal was unacceptable the vocal part could be re-recorded at a later time.

During this re-recording process the vocalist would listen to the orchestra recording (tracks) on headphones while singing the new vocal part into a microphone. The new vocal recording would again be recorded on the third track (erasing the original vocal recording). This process just described is three track multi-track tape recording.

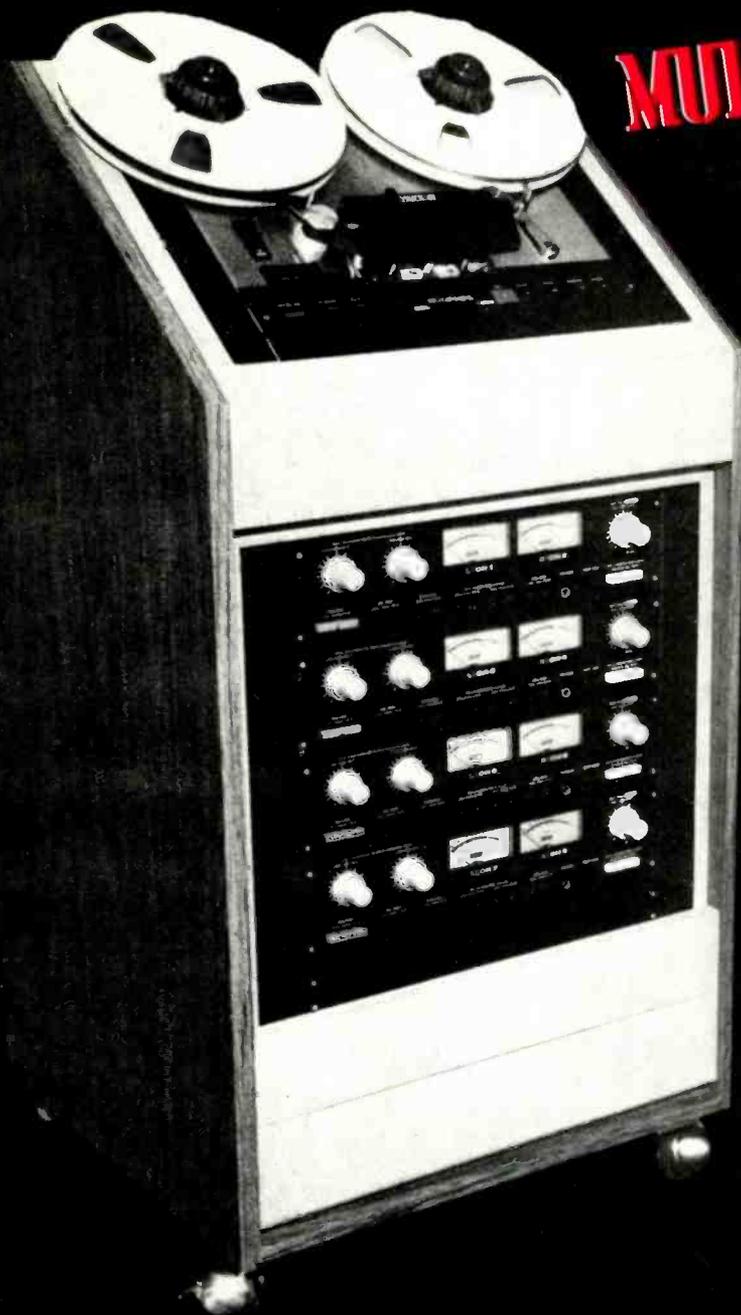
You may ask, why can't I do this with my reel-to-reel tape recorder? Well, there is one big drawback. Let us analyze it!! Regular tape recorders utilize three tape heads,

an erase head, record head, and a playback head (Figure 1).

In the example given previously, if the vocalist were listening to the recorded orchestra tape tracks (Track 1 and Track 2) they would be played from the playback head. If the vocalist were recording a new vocal track (Track 3) it would be recorded on tape by the record head. Since the playback head is located some distance from the record head, there is a time difference (lag) between the signals of the record head and the playback head. If a recording were made by this procedure the vocalist



MULTI-TRACK RECORDING



would be out of time (synchronization) with the orchestra tracks.

Sync. Les Paul's idea was a method where additional parts could be recorded on the same tape (by using additional tape tracks) and still remain in synchronization. Ampex Corporation reduced this idea of Mr. Paul's to practice. The answer looks simple on the surface. You simply use the record heads for playback (Figure 2). If Tracks 1 & 2 are being played back from the record head while Track 3 is being recorded on the record head all tracks will remain in synchronization (sync). Ampex developed this idea and named this feature Sel-Sync™. Today other

The Otari MX-2050-B is a professional quality half-inch, eight-track recorder that comes in two sections. The transport section has all the tape heads and drive components while the electronics are in the other section. Sells for \$4695 plus \$350 for the wood console. Circle number 122.

manufacturers have this same feature, and since the term Sel-Sync is trademarked by Ampex other companies commonly refer to it simply as "sync." The definition of a multi-track tape recorder is a tape recorder that has two or more tracks (channels) with a Sync feature. It can now be seen why the standard tape recorder will not perform this so called multi-track function.

Three track tape recorders with Sync were common in professional recording studios in the late 1950's and early 1960's. Musicians and record producers alike found the multi-track recording process a useful and creative tool. In the middle 1960's professional four-track tape recorders became available. Rock and Roll was coming into full swing by this time and pop recording artists and their record producers saw even greater potential for multi-track recording. It was at this time that multi-track tape recording came into its own.

How It's Used. When making rock and roll recordings with four-track multi-track tape recorders, the bass and drums could be recorded on Track 1, the guitars, piano or organ could be on Track 2, the lead vocal could be on Track 3, and the background vocals on Track 4. However, the recording process would usually start by recording what is commonly referred to as a "bed" or "instrumental bed." This bed is typically the bass, drums, and rhythm instruments (guitars, piano, or organ). As mentioned earlier these instruments for the bed would typically be placed on Tracks 1 and 2. The musicians have the ability to record and re-record this "bed" until they are pleased with the musical performance as well as the sound of the recording on those tracks. When a satisfactory instrumental bed was obtained they listened to these recorded tracks on headphones and sang the lead and background vocals which were recorded on the open (un-recorded) Tracks 3 and 4. This procedure of listening to recorded tape tracks and recording additional tracks is called "overdubbing." I have just explained the basics of four-track (multi-track) tape recording. There are many other variations of different instruments and vocals on different tracks as well as additional procedures.

When one has recorded all of the tracks on a multi-track tape recorder the tracks are said to be "full." Now the "mix-down" process begins. The multi-track tape is played and the signals from all of the channels are routed to a

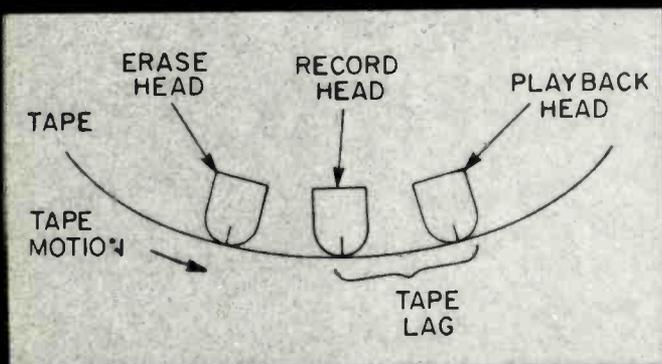


Figure 1. When a conventional recorder is played back, the playback head is not aligned with the record head. If you record one track while listening to another, the new track will lag the old.

mixing console. Signals from the four-track (multi-track) tape will now be recorded on to a stereo tape which will be called the "stereo master tape" or "two-track master tape."

During the mixing process each track of the multi-track tape can be played left center, or right (or even degrees in between) in the stereo perspective, when making the stereo master tape. Also at this time special signal conditioning or processing can be done such as equalization, echo reverberation, etc. There are a large number of special effects that can be added during the mixdown process with the use of signal processing.

The use of four-track (multi-track) tape recording was very popular in the professional recording industry by the mid 1960's. By this time the artists and record producers found that they needed more tracks on their tape recorders. In approximately 1967 the eight-track (multi-track) tape recorder was introduced to the industry. This allowed even greater versatility since the instruments could now be broken into smaller groups or more available tape tracks.

With this additional flexibility the recording procedure became a process of "cut and paste." Recording was done in building blocks. The instrumental bed could be recorded and re-recorded until everyone was pleased. In another session, brass instruments could be added on open tracks. In yet another session the strings could be added. The vocals could then be added at yet another time. In each of these overdubbing sessions, all attention would be placed upon the tracks that were being recorded at that time. This allows greater perfection to be obtained from each recorded track. One can now see that the multi-track recording process is very complex. Because of this complexity and the cut and paste methods, the music sometimes becomes more mechanical in nature and lacks the spontaneity that can often happen when musicians are all playing together at the same time.

From 1967 forward the professional recording industry entered the "Great Track Race." In late 1968 the 16-track tape recorder was introduced, and in early 1970 the 24-track tape recorder came along. Today there are studios that have the ability to sync two 16-track tape recorders together to have 32 tracks to record on. Other studios have two 24-track tape recorders in synchronization. There is talk now of a 32-track tape recorder that uses 3-inch tape. Aside from the recording industry's love for tracks, the multi-track recording process is indeed a valuable tool. It will provide both musician, and recordist a creative tool with flexibility as well as a creative ability that could not be obtained from conventional tape recording methods.

The preceding information should have greatly increased your knowledge of the multi-track tape recording process. We have only touched this subject in its most basic form.

Now, how does all of this relate to the average audiophile? For many audiophiles this is just a little extra knowledge and none of it will apply to their particular needs. Those who do live recording or wish to in the future may find that multi-track will be the perfect answer to their needs. On-location recording can be made with a four-track

(multi-track) tape recorder. Solo instruments or vocal solos can now have their own track. If mistakes are made in the solo parts these tracks could be re-recorded at a later time.

Professional studio multi-track tape recorders are very expensive and will cost from \$8,000 to \$50,000. However, in the last few years some companies have introduced economy multi-track tape recorders that are well within the financial grasp of most audiophiles and musicians. These economy recorders will range in price from \$1,500

(Continued on page 73)

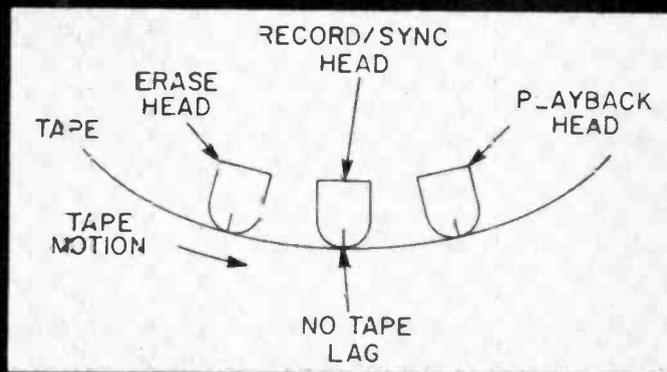
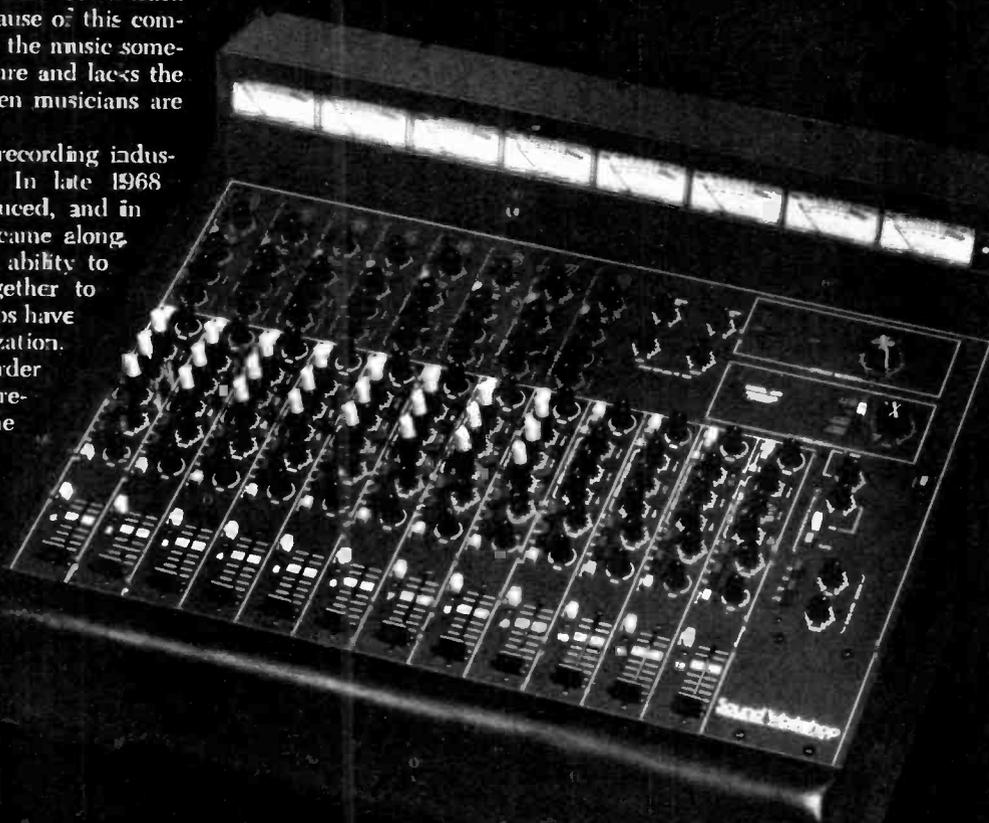


Figure 2. On a multitrack recorder the record head is used as a playback head so that the monitored track is synchronized with the track that is being recorded on. This is called sync.



The Sound Workshop 1280B-8EQ is a semi-pro recording console with 12 inputs and 8 outputs. Each of the inputs has three-band equalization, 35 dB trim control, full panning, straight-line fader, 26 dB mic pad and many other features too numerous to mention. The unit sells for \$4,100. Circle 123.

popdises

A review of the latest popular music releases

by KEN IRSAV

Herman Brood: "Herman Brood & His Wild Romance." Ariola. \$7.98.

Now that the New Wavers have made their point on numerous albums that are about as commercial and appealing as the Ford Edsel, a new, more palatable incarnation of basic, effervescent rock is coming to the fore. This album certainly moves, but with more attention to disciplined arrangements and musical technique.

Debby Boone: "Debby Boone." Warner Bros. \$7.98.

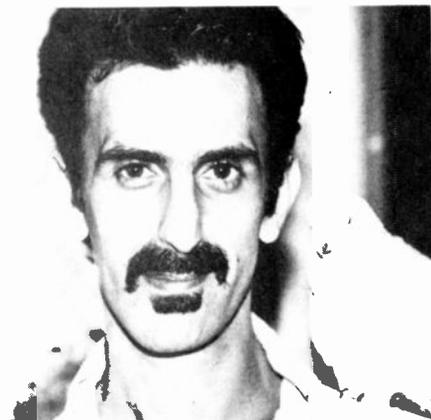
At the risk of sounding uncool, I must admit to a case of goosebumps as I listened to the marvelous voice, beautiful tone and superb control of Debby Boone. Producer Brooks Arthur has resisted the temptation to drown



Debby in strings and other angelic apparitions, keeping the arrangements clean and uncluttered. "I'll Never Say Goodbye" places her in the Streisand class.

Frank Zappa: "Joe's Garage—Act I." Zappa. \$7.98.

This funny futuristic fantasy (complete with libretto) about the government's abolition of music is done in the usual non-air playable Zappa style. There's no doubt that Zappa is an acquired taste. Those who've acquired it



tell me this is a superior album. The jazz/rock instrumental segues are certainly top drawer.

Led Zeppelin: "In Through the Out Door." Swan Song. \$8.98.

The masters of heavy metal come crashing back into the recording scene in their first new album since 1976. But there's no need for aspirin. The group offers a surprisingly diverse set of songs of many genres. Country/rock is represented in "Hot Dog" and if you've been aching for some good calypso there's "Fool In The Rain." A ten-minute extravaganza into ethereal, cosmic rock called "Carouselambra" is an instrumental tour de force. In the midst of all this diversity, the boys have found room for more of their famous heavy metal riffs.

Bob Dylan: "Slow Train Coming." Columbia. \$8.98.

Vastly superior technically to his last studio album, "Street Legal," this set has more stereo separation and a better instrumental mix than just about any of Dylan's past releases. Guitarist Mark Knopfler and drummer Pick



Withers, both of Dire Straits, bring their super-successful pop-blues sound to Dylan's always thought-provoking lyrics. ▲



Equalizers, time delays, dynamic range enhancers, reverbs, noise reducers, cushion woofers, timers and much, much more

by FRED PETRAS

One reason that music lovers buy component high fidelity systems is that such systems are supposed to offer more in the way of capability and flexibility than a modular "compact" or console stereo.

Some hi-fi system owners find that after a certain period of time they're not totally happy with their systems. Something seems to be missing. Perhaps a greater degree of flexibility, perhaps another sonic dimension, perhaps the opportunity to fine-tune the sound to suit personal tastes.

The cure for such malaise need not involve discarding your old system and starting over again from scratch. Sometimes all you need do is add on a single performance booster such as the ones described below.

One of the most effective, fascinating and creative ways to enhance a worthy component system is with an equalizer. While they've been around as a consumer product since 1969 (JVC Model 5011 equalizer/preamp), it's surprising how many audio buffs and music lovers don't own one. A key reason is that only a relatively small number of companies make them; another is that they have not been widely promoted—both of which add up to a wide lack of awareness. A third is that where an awareness of equalizers does exist, it is accompanied by avoidance based on the idea that they are too complicated and "sticky" to operate. Yet another is that "name-brand" equalizers have been somewhat expensive. But you no longer need dig deep into your money bag; as of now you can buy one for as little as \$90 (Superex brand).

Essentially, an equalizer is a device which, in the words of major proponent/producer BSR/ADC, gives music lovers and audio buffs "absolute control... lets them alter everything they can hear..." The following are some of the many important uses for an equalizer: Compensating for room size, shape and furnishings, and placement of audio equipment within the room. Eliminating background noise on records, hiss on tapes. Compensating for frequency imbalances in speakers and phono cartridges. Changing the instrumental or frequency balance of poorly engineered phono or tape recordings. Creating special sound effects. "Re-creating" the sound of ancient 78 RPM records and old radio show recordings. Improving the sound of broadcasts from stations that tamper with the sound spectrum (by their rolling off the high end, the low end, or both). Improving prerecorded tapes by equalizing them in playback and re-recording them.

All of the above boils down to this: you can *actively* take part in and control the music creation/reproduction process—rather than *passively* accept what comes out of your component rig's speaker systems.

With a few exceptions, equalizers look like most audio components and fit nicely into a component setup. Contrary to an erroneous "mystique" that has built up around them over the years, they are *not* hard to connect or operate. Once you study the operation manual and do a

EXPAND YOUR COMPONENT SYSTEM

The ATD-1 time delay, from Nikko, enables the user to recreate the ambience of just about any room with two or four speakers. With two speakers the delay is simulated and mixed back in to the amp. Price: \$450. Circle number 79.



EXPAND YOUR SYSTEM

bit of experimenting, you'll find that they are actually easy to operate.

Many buffs/music lovers start off with a five-band graphic equalizer, experiment with it, and learn how valuable it is in enhancing their listening pleasure. They later buy a full-range model, offering sound control or alteration of 10 or 12 bands of sound frequencies. Sophisticated Super Buffs go a step further, opting for parametric or paragraptic models that provide an even wider range and precision of frequency control. The most common range of alteration capability is plus or minus 12 decibels. A few models offer boost/cut of up to 16 dB.

About 25 audio component companies import or manufacture equalizers for consumer (as opposed to professional/industrial) use. Their equipment ranges from \$70 to beyond \$1,000. To delineate all their products would be beyond the scope of this article. Instead, we'll briefly discuss and describe a batch of recently introduced models.

Breaking the old high price barrier in major brand name equalizers is Superex, key manufacturer of stereo headphones. The company entered the equalizer field with the Gem-1, priced at \$89.95. The Gem-1 is a wedge-shaped five-band graphic model covering the 60, 240, 1,000, 3,500 and 10,000 Hz ranges, for 12 dB of boost/cut. It comes with an "EQ-Card" system for permanently tabulating many equalization combinations of records and tapes.

Audio Control's redesigned Model 520 is one of the few equalizers that use rotary controls instead of sliding "pots" (potentiometers). It covers a five-band range from 36 Hz to 15.5 kHz in a plus/minus 12 dB gain range.

Rotel's most recent equalizer is the seven-band RE-700 at \$180. It offers 12 dB of boost/cut from 40 Hz to 15 kHz. Another entrant at \$180 is Technics Model SH-8010, operating from 100 Hz to 10 kHz in five increments continuously variable in gain from plus 12 to minus 12 decibels.

Sansui's SE-5, an eight-band combined-channel model priced at \$200, sports an output gain control. Range, 80 to 10,000 Hz, plus/minus 12 dB gain. It comes in black finish cabinet with "pro" rack-mounting handles. Another black-finished model at \$200 is Nikko's EQ-Two, a low-silhouette six-band model operating from 60 to 12,000 Hz, plus/minus 12 dB gain range.

Audio Control's Model C-22, priced at \$250, is said to be the first 10-band equalizer on the American hi-fi market to feature an 18 dB-per-octave subsonic filter and special bass summing circuits. It offers 15 dB attenuation from 32 Hz to 15.5 kHz. It comes in a black cabinet with rack-mounting handles.

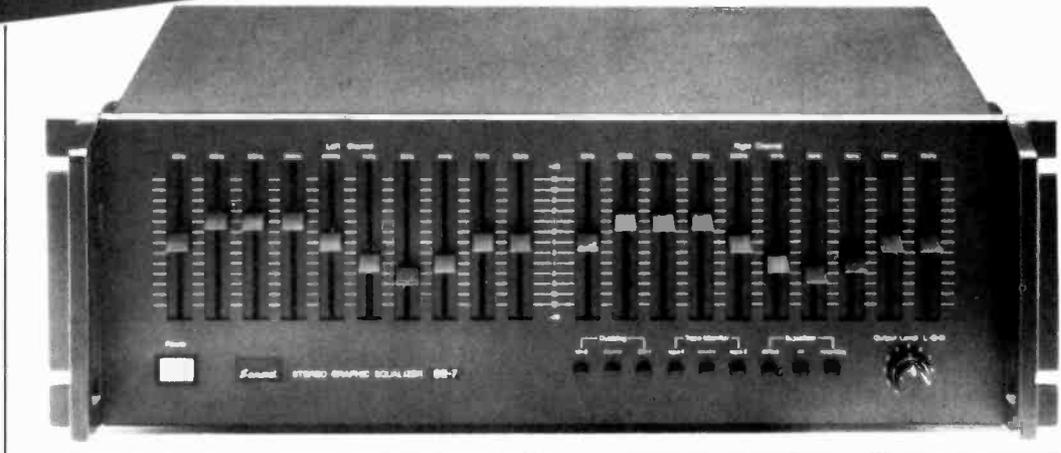
Sansui's second recent entrant is the SE-7, a 10-band model tagged at \$300 featuring an output gain control, and jacks and switching for dubbing and monitoring with two separate tape decks. Frequency adjustments of plus/minus 12 dB are possible from 32 Hz to 16 kHz. It is finished in black and has rack-mount handles.

Twelve bands of frequency control in a plus/minus 10 dB gain range are offered in the U.S. Pioneer SC-9800, priced at \$395. It features an LED at the tip of each of the 12 level controls for each channel, to provide the user a visual indication of his equalization setting from across the listening room—even in the dark. Frequency range is 16 Hz to 32 kHz. The unit also has line attenuators (minus 3 and 6 dB) for professional use with a light to

The ADC Sound Shaper Three is a paragraptic equalizer ± 12 dB control over 12 center frequencies, each of which can be increased or decreased in frequency by about 20 percent. This allows full boost or attenuation at specific frequencies. Price: \$500. Circle number 61.



Sansui's SE-7 is a straight-forward 10-band graphic equalizer with ± 12 dB control over each of the bands. With the controls flat the frequency response is $+0/-1$ dB from 10 to 100 kHz. It allows the user to compensate for system short-comings. Price: \$300. Circle number 89.



indicate overload conditions, and tape monitor receptacles.

BSR calls its ADC-brand "Sound Shaper Three" a *paragraphic* frequency equalizer. It is said to offer "the advantages of both graphic and parametric equalizers—without their inherent limitations." Which in this instance means that the unit solves sound problems more precisely by offering 12 primary slide-pot frequency controls, and 24 ancillary control positions, per channel—in effect, 36 frequency ranges. Two-position flip switches below the frequency control sliders allow any given frequency to be raised or lowered by nearly 20 percent. The Sound Shaper 3 has two LED signal level meters for easy monitoring and balancing of both left and right stereo channels. Used with optional accessories—the SLM-300 sound level meter, R-2300 one-third octave pink noise record, and 20-foot extension cable, you can obtain actual sound pressure readings on the sound level meter. The equalizer goes for \$500; the sound level meter/pink noise record package for \$70.

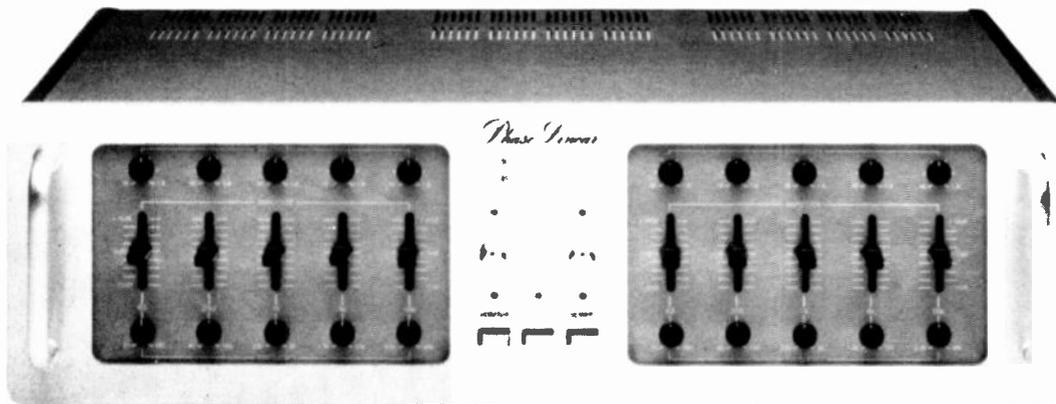
Phase Linear's new Model 1100 is a parametric equalizer priced at \$600. It offers not only cut or boost (plus/minus 12 dB), but also adjustment of bandwidth (0.18 octaves to 1.8 octaves) and center frequency. Its five center frequencies are 63, 250, 1,000, 4,000 and 16,000 Hz, continuously variable in a range of 9:1, with center detent. It has a gain of plus 6 dB maximum with separate overall level controls, and overload indicators.

Audio Control, in its Model C-101, priced at \$550, offers a built-in real time spectrum analyzer. This enables the listener to actually see music broken down into 10 separate frequency bands and watch the effect of equalizer controls and visualize what his stereo system is doing. The spectrum analyzer display features 92 LEDs. The unit also has a built-in pink noise generator, which is used with a calibrated microphone for room acoustic analysis, tape bias and speaker adjustments. Also featured is an 18 dB-per-octave subsonic filter, along with a rumble-reducing circuit for reduction of rumble, phase and intermodulation distortion below 200 Hz. The EQ range is plus/minus 15 dB. Available in rack mount form.

JVC also offers a built-in spectrum analyzer display and pink noise generator in its deluxe SEA-80 equalizer, listed at \$600. This 10-band model displays the dB level of each on 10 bright fluorescent bars. An eleventh bar charts over-all volume. Each display bar is designed to rise rapidly and fall slowly, for further visual representation of what your ears are hearing. The fluorescent spectrum analyzer display covers the frequency range from 32 Hz to 16kHz over the range from 0 dB to 26 dB. The SEA-80 can reduce distortion by lowering high frequency levels during recording. Raising these levels during playback provides high frequency content without distortion.

Another satisfying way to raise the performance and pleasure levels of your hi-fi system is with "ambience enhancers." These come in a variety of forms, ranging from mechanical reverberation units on up to complex electronic time-delay systems requiring a second amplifier and second pair of speaker systems. The equipment, in effect, enables you to change the apparent character of the listening room. You can "convert" your listening room into a concert hall, a stadium, an intimate close-in cocktail lounge—

The JVC SEA-80 stereo graphic equalizer has 10, ± 12 dB frequency bands and a bar-graph spectrum analyzer that lets you 'see' the unit's output. Bar graph display indicates signal level in one-dB increments. It also has a built-in pink noise generator. Price: \$600. Circle number 74.



The Phase Linear 1100 Series II is five-band parametric equalizer with center frequencies of 63, 250, 1,000, 4,000 and 16,000 Hz that are adjustable to provide full coverage. The range of each band overlaps onto the next one. Bandwidth varies from .18 to 1.8 octaves. \$600. Circle 124.

EXPAND YOUR SYSTEM

virtually any acoustic environment, in a matter of seconds, by adjusting a few controls.

The simplest and least expensive of recent offerings of this kind is U.S. Pioneer's SR-303 reverb amplifier, with a list price of \$195. It's an all-electronic reverberation/time delay device using "bucket-brigade" circuitry that breaks an analog signal into segments and passes each segment through a sequence of storage bits. This shifting through the sequence causes a time delay, the length of which is determined by how fast the shifting occurs. The speed control is located on the front panel, labeled "time delay." A portion of the delayed signal is re-entered into the delay line again, mixed in with the undelayed signal. This produces a smooth, longer lasting ambience. The amount of the delayed signal to be re-entered is determined by the reverberation time control. Reverberation effect indication is seen as rings of green in a special display. Pioneer describes effects achievable as "from a subtle, silky concert hall sound to that of a mirrored room."

Nikko's ATD-1 time delay synthesizer priced at \$450 can be used in an existing stereo system with the delayed signal mixed with the original signal in the main amp and speakers, or with an extra amp and second pair of speakers as a four-channel ensemble. Three pushbuttons adjust to create the acoustics of small, medium and large halls. Three more are used to compensate for the acoustical character of the hall relative to furnishings, and characteristics of walls, floor and ceiling. Five pushbuttons control the degree of reverberation in steps of up to two seconds. A stage/distance control changes front/rear balance.

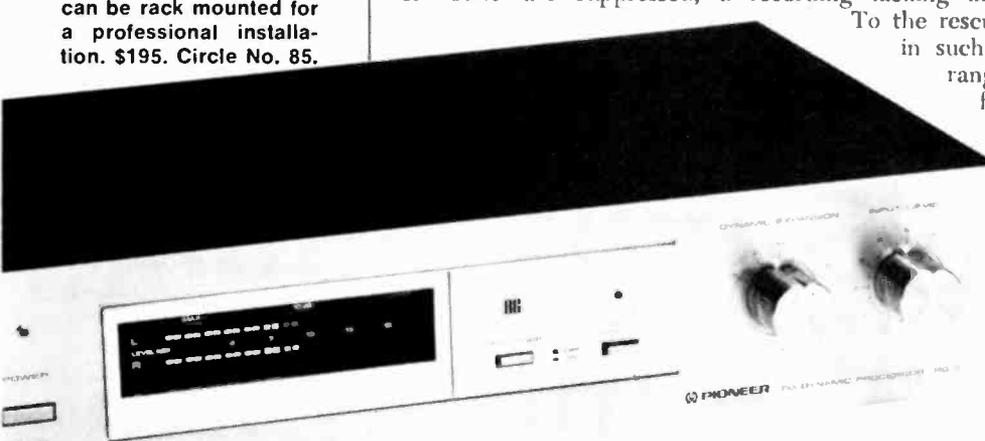
ADS—Analog & Digital Systems—recently introduced a derivative of its total-ensemble ADS 10 time delay system in the form of the Model 10 01, a lower priced (\$675 versus \$995) set for those who already own the required second amplifier and second set of speakers. It is a third-generation time delay system employing a proprietary audio-to-digital encoder/decoder system with delays of up to 1.6 seconds. ADS says the system "allows you to select the hall size and ambience and offers controls for stage depth and listener's seating distance from the proscenium. When used with electronic or disco music, the full bandwidth of the delayed rear channel output offers complete delayed 'surround sound.'"

Every audio buff/music lover knows there's a big difference between the sound of "live" music and recorded music. Live music has a wide dynamic range—louder "lounds," softer "softs." In the recording process—no matter how excellent, the dynamic range of the music must be compressed, to no more than the range of the of the recording medium, record or tape. The end result is a recording whose quiet passages are not as quiet as they should be, whose loud bursts of sound are suppressed, a recording lacking in realism, transparency and depth.

To the rescue: a dynamic range expander. The latest in such devices is U.S. Pioneer's RG-2 dynamic range expander, priced at \$195. It can add from four to 16 decibels (in 3 dB steps) to the range of your records and tapes with no negative effect on the frequency response, noise, or distortion levels. Quiet sounds became quieter, including noise levels. Loud percussive sounds or deep bass are boosted back to live levels. At the same time the RG-2 reduces inherent noise content, to improve the signal/noise ratio

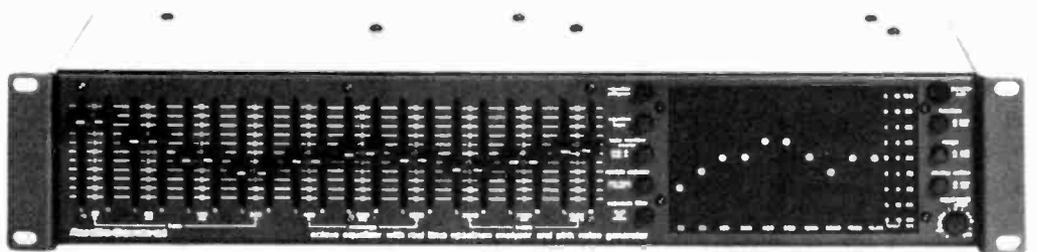
(Continued from page 70)

The Pioneer RG-2 is a dynamic range expander and noise reduction unit that boosts dynamic range by up to 16 dB (10 dB boost and 6 dB noise reduction). A Fluorescent meter keeps track of the output. This unit can be rack mounted for a professional installation. \$195. Circle No. 85.



Sanyo's Plus E55 computerized component timer will turn your hi-fi equipment on or off at any preset time. It can also control your house lights. \$250. Circle 102.

Audio Control's Spectrum Analyzer/Equalizer combines a ten-band equalizer, a 99-LED analyzer and pink-noise generator. \$550. Circle 118 for more information.



Explore the high-performance world of micro-fi

by William S. Gordon

SIZING UP

They may be small and, to some people, rather plain looking, but the current generation of "micro" components pack plenty of audio punch and have all the right numbers. A year after their introduction, the fate of micro components is still to be decided. Initially only two of the Japanese giants—Technics and Mitsubishi—tried out their miniature components this side of the International Date Line. The other big names kept their tiny tots in the wings, waiting to see how their more adventurous siblings would fare. Evidently, they are doing pretty well for at least three more of the brethren have joined them in this country—Aiwa, JVC, and Toshiba.

Micro components existed in Japan well before they were shipped over here, and visitors had no trouble finding lots of them along Tokyo's "Radio Row" more than a year ago. But, what appeals to Japanese tastes may not jibe with American predilections. Thus, the caution exhibited by many Japanese electronics houses can be well appreciated. After all, would the American audiophile pay as much (or more) for smaller, more subtly styled gear? Is there a market for understated styling?

For certain, not all micro components are budget busters, and those that command premium prices, by and large, are char-



acterized by state-of-the-art technology and specifications that would cost as much or more had they been in conventional-size packages. With certain types of components, size has nothing to do with performance.

Micro Tuners. Take JVC's T-M1 tuner for example. It may be only 9 by 3 $\frac{1}{4}$ inches and weigh in at less than 8 $\frac{1}{4}$ pounds, but it offers some pretty advanced innards. It's a digitally-synthesized design, so its tuning precision is beyond reproach. There's no need for a "tuning" meter, for it simply can't be mistuned. No need for a large slide-rule dial—a digital readout is more accurate. (The display also doubles as a clock!)

Five station frequencies can be preset into its digital memory, so you can hop from one to another at the press of a button. For manual tuning, just press either the *Up* or *Down* button, and the T-M1 scans the band automatically—not only convenient, but it saves the size and bulk of a conventional tuning knob. Specs are on a par with other first-line tuners—10.3-dBf IHF sensitivity, 75-dB mono S/N, 0.08% distortion, etc. A new PTL (phase-tracking-loop) multiplex decoder yields a 50-dB midband separation figure with 0.12% distortion.

Toshiba's F15 also uses the digital-synthesis principle and offers 10 presets. It features the

MICRO COMPONENTS COMPONENTS COMPONENTS COMPONENTS

MICRO COMPONENTS

same idea in pushbutton scanning with digital readout, drops the clock feature but adds a "record-calibration" tone. Aiwa's SA-R22U is a bit more conventional as far as tuning goes—regular knob type but with digital display and AM as well as FM reception. Mitsubishi's M-F01 manages to squeeze in a conventional knob-and-slide-rule-dial tuning mechanism with quartz lock, record-level check, and outputs for an oscilloscope multipath display. Technics ST-C01 takes a similar route—knob and slide-rule dial—with servo lock and AM as well as FM capability.

Amps and Preamps. In preamps, there's Technics SU-C01. Not only does it have the normal bass, treble, volume and balance controls, but a high filter, subsonic filter, and loudness contour as well. And, there's a built-in moving-coil head preamp. Most full-size preamps don't have that!

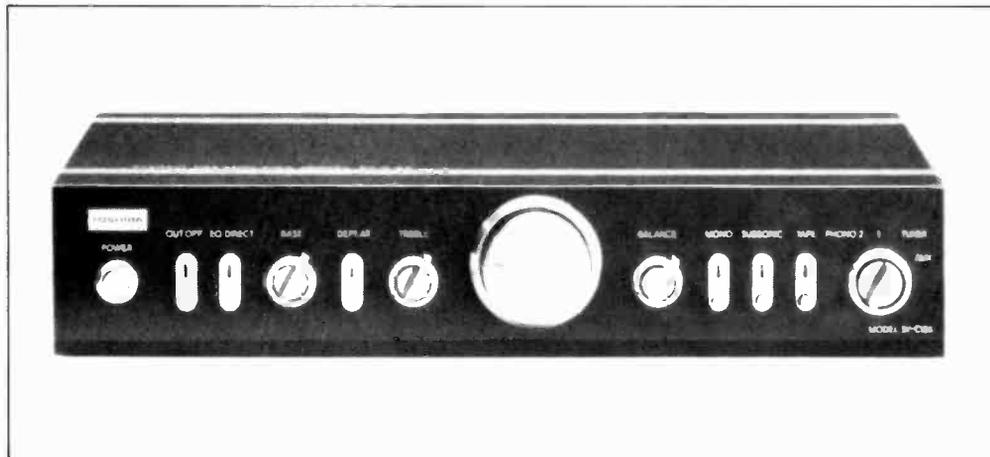
Mitsubishi's M-P01 also has a moving coil head amp and pushbutton selection of the tone-control action you desire. Two-way tape dubbing is also possible with the M-P01. Toshiba's C15 features an overload-proof phono front end and LED indication of switch settings. Aiwa's SA-C22U offers most of the conventional preamp functions in more or less the conventional way—but it's smaller in size.

Most micro-component lines are "separates" all the way—tuner, preamp and power amp. JVC is the exception in offering an "integrated" amp in a "micro" package. The A-M1 is an unusual design! The bass, treble, volume and balance controls lie hidden behind a drop-down door. (The speaker-selection switch, loudness button, and headphone jack are located there too.) If that sounds like a crazy place to put the volume control, look again. There's a five-button volume "switch" on the main panel. With it, you can increase or decrease the volume by 3 dB (from the "normal" as set by the conventional control), drop it 12 dB (sort of a mute), or kill the sound completely. Another five buttons select the source (indicated by LEDs), and another powers up the unit. Very neat and stylish.

The really dicey part of micro-component design comes with the power amp. How do you cram a lot of capacity into a small box, and, assuming

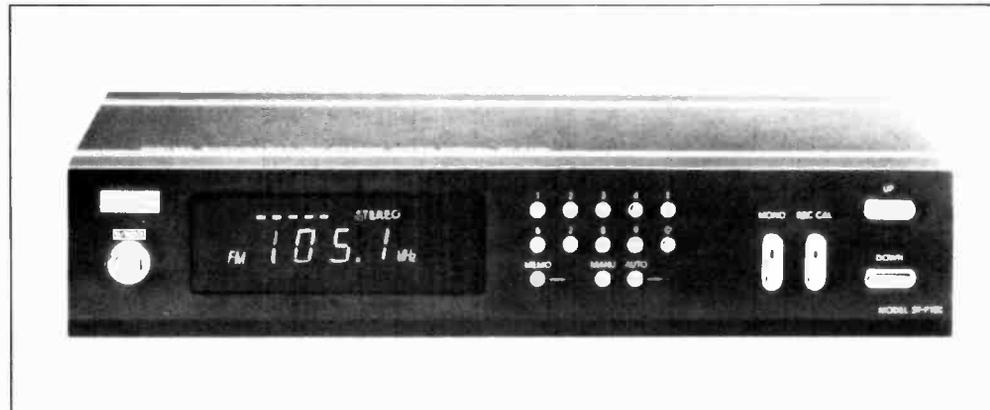


Sony's Avatar micro component systems come with a tuner, turntable, preamplifier and a pair of combination speaker/amplifiers. The GG-20F (\$1,795) is capable of 55 watts-per-channel output with 0.2% THD. The GG-10F (\$1,295) has 20 watts-per-channel with 0.25% THD. Optional cassette deck (\$550). Circle 94 for information.



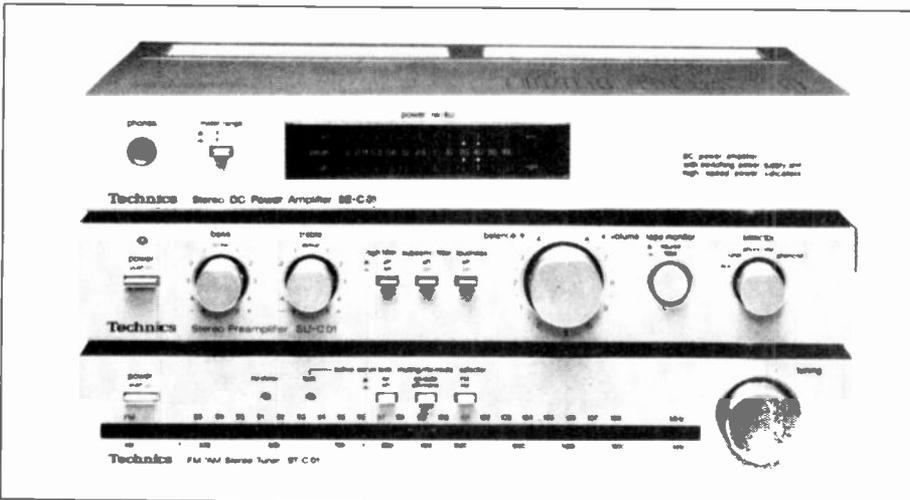
Toshiba's C-15 DC stereo preamplifier has high-gain dual FET DC amplifiers. The phono preamp circuitry is said to handle up to 300 mV without overload for high-output cartridges and direct-cut discs. The unit has an EQ-Direct switch that allows bypassing the tone controls when used with an equalizer. The C-15 is 10.1 in. wide, 2.1 in. high and 8.2 in. deep. Price: \$300; with black finish (shown) \$310. Circle 99.

Another of Toshiba's series of micro components is the F-15 Digital Synthesizer Stereo FM tuner. It has automatic scan and manual tuning plus 10 programmable presets. PLL digital synthesis is claimed to give it an accuracy of 0.0025%. Specifications: sensitivity, 0.95 μ V; S/N ratio 68 dB stereo and 72 dB mono; image rejection, 50 dB; and AM rejection 50 dB. \$360 (\$370 with black finish). Circle 99.



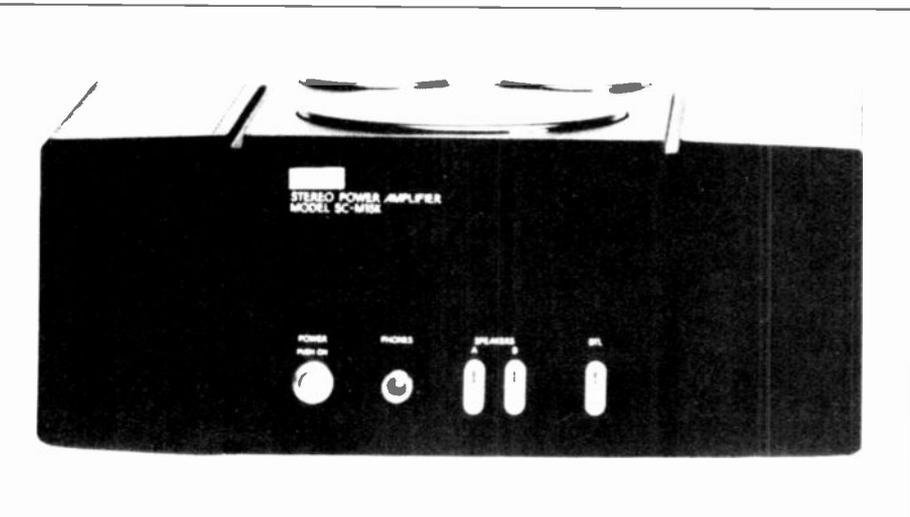


The Mitsubishi micro component system includes: the M-A01 power amp with 70 watts per channel RMS and 0.01% THD (\$500), the M-FO1 quartz-lock tuner (\$340), the M-PO1 preamplifier with a moving-coil head pre-amp (\$370), and the M-TO1 cassette deck with microswitches to control the mechanical parts (\$560). The stack is only 16 1/4 inches high, 10 3/4 inches wide, weighs 54 lbs. Circle 78.



Technics line of micro components includes a power amp, a preamp and an FM/AM tuner, each of which is only 12 inches wide, 2 inches high and 8 1/4 inches deep. The SE-C01 is a 40-watt-per-channel amplifier with 0.02% THD (\$360). The SU-C01 pre-amplifier has a moving coil amp (\$260). The ST-C01 tuner costs \$260. Circle 98.

The M-15 DC power amplifier from Toshiba has a power output of 40 watts minimum RMS per channel driven into eight ohms, with no more than 0.02% THD. Frequency response is essentially flat from DC to 70,000 Hz and the signal-to-noise ratio is 115 dB. Has a one-piece die-cast aluminum body. \$340 (\$350 black finish). Circle 99.



you get it there, what do you do to get rid of the heat that is generated? JVC's approach is to use a "digital" power supply. This is the so-called DC-to-DC converter you've read about. By converting the AC power line into DC immediately, using the DC to run a high-frequency power oscillator, you've moved the line frequency (60 Hz) up into the ultrasonic region. Now, a small transformer can handle as much power as a large one at the normal "line" frequency. And, once the oscillations are rectified back into DC, only small filter capacitors are needed to smooth them out. Combine this technology with a high-efficiency, computer-designed heat sink, and JVC's engineers were able to cram a 50-watt-per-channel amp into the A-M11.

Technics also takes the "digital" or "pulse" power-supply route in their SE-C01. The package is very tiny, sports a 40-watt-per-channel rating (at 0.03% THD) and is DC coupled throughout. Response extends from DC (0 Hz) to 100 kHz! And, the two channels can be strapped for mono operation to yield a 55-watt rating. A color-coded LED display indicates the power being delivered at any time.

Aiwa's SA-P22U manages 30 watts per channel at 0.06% distortion and also has an LED power indicator and DC design. Aiwa has stayed with the "conventional" power-supply design as has Toshiba and Mitsubishi.

The Toshiba M15 delivers 40 watts per channel at an impressive 0.02% THD. Thanks to its BTL (Balanced Transformer-Less) design, it will deliver 90 watts in mono. For sheer stereo oomph, Mitsubishi holds first place with the M-A01. Conventional in many respects (but small), the M-A01 delivers 70 watts per channel at an incredible 0.01% THD! It's a DC design using a low-noise FET input and has a peak-level indicator to warn you should you run out of that 70 watts.

Cassette Decks. Micro cassette decks are offered by Aiwa, Mitsubishi, and Toshiba. Aiwa's is only 2 1/4 inches high. Nonetheless, it offers most normal features: Dolby noise reduction, ferric/chrome selector switch, mike and line inputs, and a peak-level meter consisting of five LEDs per channel. There's even a "tape-running" LED. You can attribute Aiwa's miniaturization to a slot-loaded cassette mechanism similar to those on car-stereo systems.

Compared with Aiwa's super miniaturization, the Toshiba and Mitsubishi units are big. (But, by conventional standards, they're still mighty small.) The Toshiba D15 is a two-motor deck with dual-flywheel design.

MICRO COMPONENTS

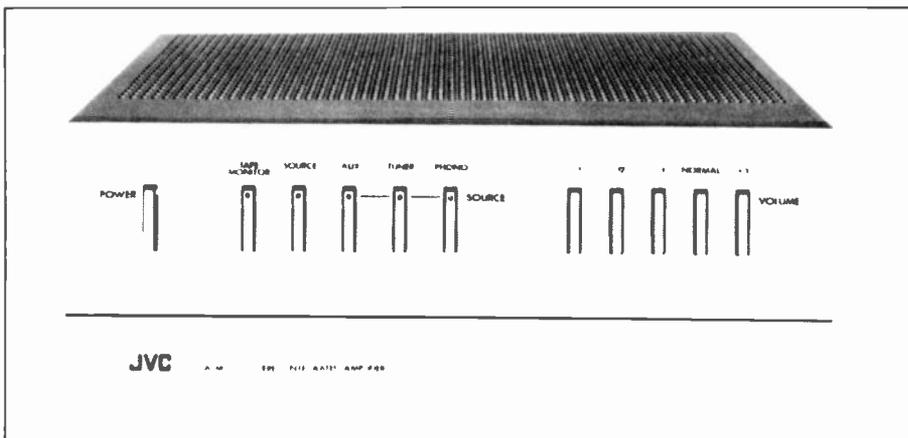
It's a front-loader with open cassette well and touch-pad IC-logic controls. Despite its small size (4.2-inches high), it offers memory rewind, auto play and (optional) remote control. Flutter is spec'ed at 0.04%. Bias and equalization switching between ferric and chrome is automatic (keyed by the identification notch on chrome—and chrome-equivalent—cassettes) with an override button for ferrichrome. A Sendust R/P head provides a response from 20 Hz to 18 kHz (± 3 dB) on chrome tape with a 65-dB S/N (Dolby on). LED peak-level meters indicate the signal strength.

The Mitsubishi M-T01 is also an open-well front-loader with closed-loop, dual-capstan drive. Flutter is 0.045%. It features mic line mixing and an output-level control. Separate three-position bias and equalization switches provide a wide range of combinations one of which should suit almost any common tape. There's Dolby, of course, *with or without* a 19-kHz multiplex filter. The M-T01 can be timer-started in either record or play and has memory rewind and memory play. An ASPS (Automatic Spacing Pause Button) inserts timed 3-second blanks between musical programs. (There's a regular *pause* as well.) Peak-reading meters indicate the recording level. That's a lot of goodies in such a small package.

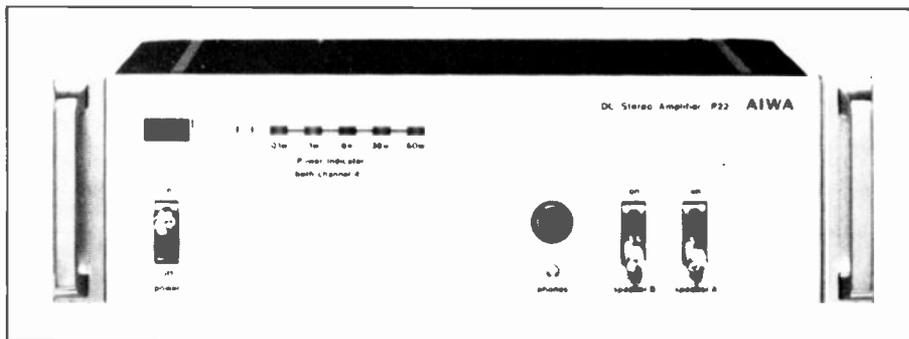
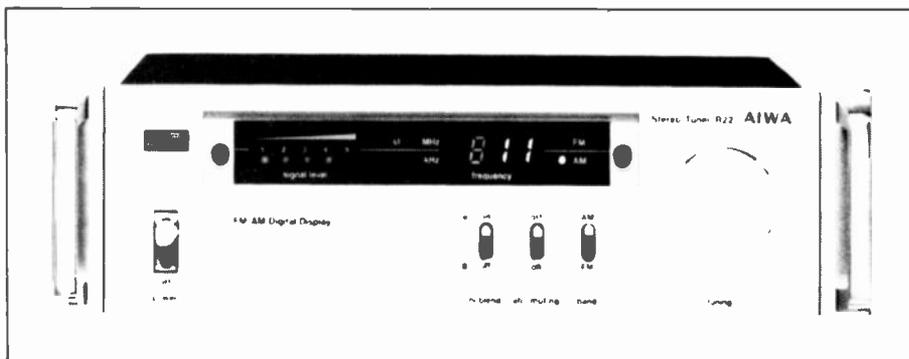
Mix and Match/Pros and Cons. Can you mix and match micro components from different manufacturers? From a technical standpoint, sure, why not? But aesthetically, you may not want to. The components in any one line have a similar appearance and a similar size and shape—at least as far as width and depth goes. (Height varies in accordance with the complexity of the insides.) They're designed to "stack," and, if you move out of the line, chances are you'll lose this feature.

Are micros really that much smaller? On a component-by-component basis, they sure are. But, if you were to tote up the *total* dimensions of the separate tuner, separate preamp, and separate power amp and compare that with one of the new mid-sized *receivers*—say, the Onkyo TX-20 or Rotel Macro 1000—the microminiaturization is less startling. What you do get is the ability to change the "form factor." Your final

(Continued on page 73)

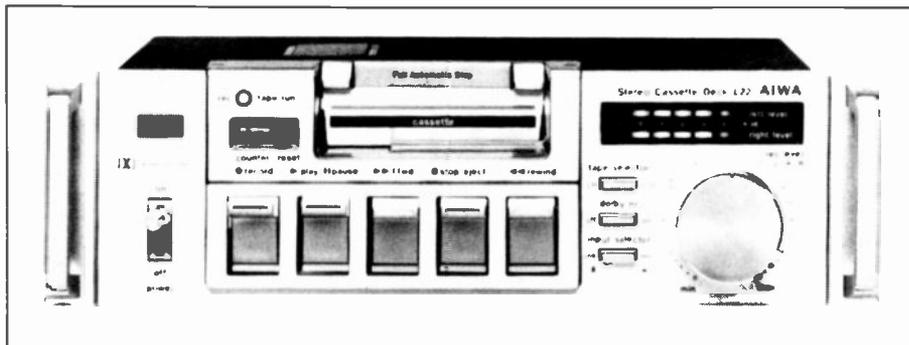


The JVC A-M1 micro power amplifier delivers 50 watts-per-channel RMS into an eight-ohm load. The total harmonic distortion is 0.03% with a frequency response from 20 to 20,000 Hz. It features a push-button volume control with five levels. This is done because the primary volume controlling would be on the preamp. Price: \$600. Circle 74.



Typical of Aiwa's series of micro components are the SA-R22U AM/FM Tuner (top) and SA-P22U Amplifier (bottom). The tuner has a four-digit LED display and a quartz crystal oscillator. The SA-R22U Tuner costs \$200. The SA-P22U amplifier has a power output of 30 watts-per-channel RMS into an eight-ohm load, with no more than 0.04% THD. It has a 'power bandwidth' of from 5 Hz to 30 kHz. Price \$210. Circle number 103.

The Aiwa SD-L22U cassette deck is unique in that it has an automobile type tape drive system, and measures only 2½ inches in height. It has a Dolby noise reduction system, an LED peak level meter and a normal/chrome selector. Frequency response is said to be from 25 to 16,000 Hz. Wow and flutter is 0.09% (WRMS). Price: \$260. Circle 103.



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The Wharfedale E's are the newest speakers in an unequalled tradition of excellence that goes back to the early days of music reproduction.

In those days, our speakers—like the unique sand-filled designs of Gilbert Briggs—were received with wide acclaim despite the limited technical resources of that era. Today's Wharfedale E's benefit from our space-age technology, and hold a special position of leadership in acoustic engineering.

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using computer optimization and holographic research, developing speakers with extremely wide dynamic range and no coloration. They've won the praise of lovers of every kind of music. And seem destined to keep that praise for years to come.

A Wharfedale E can fill a room with just a couple of watts. Or handle hundreds for unusually large areas. At any level, with any music, you won't detect any of the harshness or roughness inherent in lesser speakers.

Each Wharfedale E goes through a stringent Quality Control procedure that rejects all but the most perfect speakers. Those that pass represent

the highest attainable audio technology, enhanced by the skills of old-world craftsmen who make each pair of perfectly matched hand-rubbed, fine wood veneer cabinets.

Many speaker makers have come and gone in the nearly 50 years since the first Wharfedale was made. And when you listen to the E's you'll know why Wharfedale lasts.

The new E90 measures 45-3/8" H x 15-3/16" W x 14-3/4" D and has a typical frequency response of 30-18,000Hz \pm 3dB. The E70 is 32" x 13-1/2" x 14" with frequency response from 35-18,000Hz \pm 3dB. The E50 measures 25" x 13-1/2" x 13-1/2" with a frequency response of 40-18,000Hz \pm 3dB. The new E30 is 22-3/4" x 13-3/16" x 10-5/16" with a 45-18,000Hz \pm 3dB frequency response. Efficiency is 94dB at 1 watt and 1 meter for the E30, and 95dB for the other models.

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JANUARY/FEBRUARY 1980

Circle No. 30 On Reader Service Card



Our recording tape is considered by most audiophiles to be the world's finest tape.

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Our slip sheet is made of a substance that's so slippery, even glue can't stick to it.



Our leader not only keeps you from making recording errors, it also keeps your tape heads clean.

Our cassette is held together by steel screws to assure precise alignment and even distribution of pressure on all sides of the cassette.

Our special guide rollers make sure our tape stays perfectly aligned with your tape heads.

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Our tape is anchored to our hub by a special clamping pin that makes slippage impossible.

There's more to the world's best tape than the world's best tape.

Our reputation for making the world's best tape is due in part to making the world's best cassettes.

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and more work into our cassettes than most manufacturers put into their tape.

We do all this, because at Maxell

we believe in a simple philosophy.

To get great sound out of a cassette takes a lot more than just putting great tape into it.

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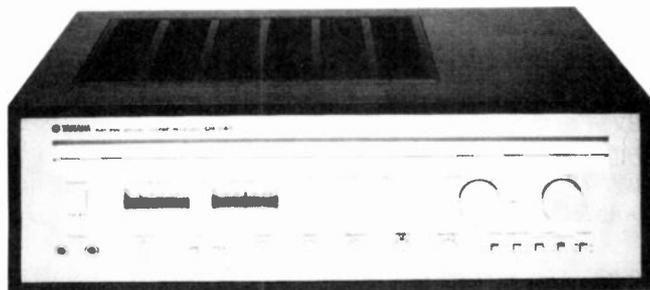
Circle No. 15 On Reader Service Card

Maxell Corporation of America, 60 Oxford Drive, Moonachie, N.J. 07074.

TEST REPORTS

RECEIVERS/51	54/AMPLIFIERS
TUNERS/52	56/EQUALIZERS
PREAMPLIFIERS/53	57/CASSETTE DECKS
INTEGRATED AMPS/53	

RECEIVERS



Circle No. 101 On Reader Service Card

YAMAHA CR-840 AM/FM RECEIVER

A 60-watts-per-channel AM/FM receiver with a flat output at as high as 72 watts-per-channel and less than 0.02% THD at any frequency. Has two degrees of FM selectivity which can be preset for optimum performance. \$495 in a metal cabinet.

DESCRIPTION: An AM/FM stereo receiver FTC-rated for 8 ohms at 60 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.02% THD.

Features include: a stereo beacon, FM center channel and AM/FM signal strength tuning meters, narrow (DX) and wide (local) FM I.F. selectivity that may be automatically switched to the optimum mode by the characteristics of the received signal or can be locked to the wide mode, FM automatic frequency control (called OTS—for Optimum Tuning System), a midband tone control, continuously variable loudness compensation, a subsonic filter, front panel switched break-in "adaptor" connections (for noise reduction system, graphic equalizer, etc.), a separate input signal selector for the recorders, automatic dubbing to and from either of two recorders, a subsonic filter, 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, adaptor, and two recorders. Outputs for two speaker systems, adaptor, two tape, and phones.

Controls are provided for: tuning, volume, balance, ganged bass, ganged midband, ganged treble, input selection to the amplifier, input selection to the recorders/tape dub selection, and speaker selection. There are switches for: power, low filter, high filter, stereo/mono mode, adaptor on-off, local (wide)/auto FM selectivity, FM muting/OTS (OTS is off when FM mute is off); and AM FM tuner selection.

The FM antenna input is 300 ohms or a 75 ohm coaxial connector. A loop assembly, affixed by the user to the chassis or an adjacent surface through a self-adhesive hinged mounting, connects to the AM antenna terminals.

One switched and two unswitched AC outlets are provided.

Overall dimensions are 20 in. wide x 6-9/16 in. high x 15 1/4 in. deep. Weight is 30 lbs.

PERFORMANCE—FM TUNER: For 300 ohm and "tee" antennas, full limiting was attained with 5 uV. The monophonic high fidelity sensitivity (60 dB quieting) measured 11 uV. The stereo high fidelity sensitivity (55 dB quieting) was 95 uV. Full mute release was attained with 5 uV.

At standard test level with LOCAL (wide) selectivity, the stereo frequency response measured +0/-0.1 dB from 30 to 15,000 Hz, down 0.4 dB at 20 Hz. Monophonic distortion measured 0.06% THD. Stereo distortion was 0.12% THD. The signal-to-noise ratio measured 83 dB. Stereo separation was 40+ dB.

In the AUTO (DX) narrow selectivity mode, the monophonic distortion measured 0.15% THD. Stereo dis-

TEST REPORTS / RECEIVERS

tortion was 0.2%. The selectivity is always in the local mode unless the received signal strength is less than 120 μ V, at which point the selectivity is automatically increased to eliminate alternate channel interference. In the stereo mode an mpx noise filter (stereo blend) is also switched in which reduces separation to 8 dB. (Note that the local/DX switching sensitivity is almost the value required for high fidelity FM reception—55 dB quieting.)

Even if the selectivity is *wide* for reception of a strong signal, but there is interference caused by another strong signal on an alternate channel, the selectivity will shift to the narrow mode to eliminate as much interference as is possible. If desired, selectivity can be locked in the wide mode by setting the selector switch to LOCAL.

In the local mode selectivity is fair. In the DX mode selectivity is excellent.

PERFORMANCE—AM TUNER: Overall performance

was average with the loop antenna affixed to the back of the receiver. Best reception was attained with the antenna sticking straight out, which adds another six inches to the overall depth. The loop appears to be more complex, and more trouble, than the more or less commonly used rod antenna.

PERFORMANCE—AMPLIFIER: The power output at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 72 watts RMS. The frequency response at 72 watts/8 ohms measured ruler flat from 20 to 20,000 Hz at a distortion no higher than 0.02% THD at any frequency.

The tone control range measured: ± 11 dB at 50 Hz; +6/−7 dB at the 3000 Hz midband center frequency; +8/−9 dB at 10,000 Hz.

The subsonic filter was down 1 dB at 30 Hz; 4.5 dB at 20 Hz.

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

TUNERS



Circle No. 81 On Reader Service Card

OPTONICA ST-4405 AM/FM STEREO TUNER

An unusually thin tuner; particularly suited where height is at a premium. Has tape recorder calibration output tone. \$300, in a metal cabinet.

DESCRIPTION: An AM/FM stereo tuner featuring a stereo beacon, LED FM center channel tuning indicator, 5-step LED signal strength indicator, and an FM Air Check 400 Hz output tone for presetting of a recorder's level controls. One set of variable line level outputs is provided.

The front panel has only one control: for tuning. The output level control is located on the rear apron. Front panel switches are provided for power, AM, FM mono, FM Auto (mono/stereo), FM muting, hi-blend (mpx noise filter), and Air Check.

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 measured 16 $\frac{3}{4}$ in. wide x 2 $\frac{3}{4}$ in. high x 15 $\frac{1}{2}$ in. deep. Weight is 11 lbs.

PERFORMANCE: Full limiting was attained with 4.8 μ V. For 300 ohm and "Tee" antennas the monophonic high fidelity sensitivity (60 dB quieting) measured 10 μ V. The stereo high fidelity sensitivity (55 dB quieting) was 70 μ V.

At standard test level the stereo frequency response measured +1/−1.8 dB from 20 to 15,000 Hz. Distortion depended on the tuning adjustment because the "center channel indicator" illuminates over a relatively large tuning range. Monophonic distortion ranged from 0.15% to 0.25% THD. Stereo distortion ranged from 0.15% to 0.3% THD. The signal-to-noise ratio measured 71 dB. Stereo separation was 40+ dB. Selectivity was good.

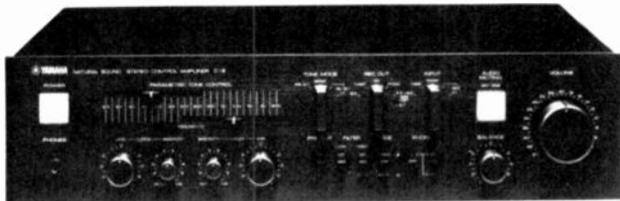
The maximum output level corresponding to 100% modulation of the transmitter was 0.8 volts.

The Air Check output level was 0.55 volts; 3.5 dB below the stereo and mono output level corresponding to 100% modulation of the transmitter. For particularly clean recordings we suggest the recorder be adjusted to indicate no higher than −4 dB (below 0-VU/0-dB) when feeding the Air Check signal.

Though stations can be received (with considerable noise) below 3.4 μ V input, the LED FM center channel indicator requires at least 3.4 μ V before it turns on. The 5-step signal strength indicator requires at least 5.5 μ V before the first (lowest value) step illuminates.

PERFORMANCE: AM TUNER: Generally average, with higher than average sensitivity to signals on the high end of the dial. ▲

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



Circle No. 101 On Reader Service Card

YAMAHA C-6 STEREO PREAMPLIFIER

A very versatile unit with superb performance. It includes a parametric equalizer that can function as a standard tone control. It has a ruler-flat frequency response from 20 to 20,000 Hz with no more than 0.007% THD. \$450. metal cabinet.

DESCRIPTION: A stereo preamplifier featuring parametric tone controls, and a separate input selector for the tape recorders that permits recording of one signal source while listening to another. There are two parametric equalizers: for the low frequencies (31.5 to 600 Hz) and high frequencies (600 Hz to 12.5 kHz). Both are calibrated in 1/3-octave increments. Each equalizer has its own level and bandwidth controls. The parametric equalizers can be defeated, switched to the preamplifier output, or switched to either of the two tape recorder connections.

Other features include automatic dubbing to and from either of two recorders, a switched head amplifier for one of two phono inputs allowing direct connection of an MC (moving coil) pickup, a subsonic filter, and an output hold-off that mutes the preamplifier's output for several seconds after power is applied.

There are inputs for two magnetic phono, tuner, aux, and two tape. Outputs for line level, two tape, and phones.

Controls are provided for volume; balance; low frequency parametric frequency, level and bandwidth;

and high frequency parametric frequency, level and bandwidth. There are switches for power, tone control mode, recorder input selection, amplifier input selection, 20 dB audio mute, preamplifier output on-off, low filter, high filter, stereo/mono, phono input selector, and MM/MC (moving magnet/moving coil) selector for the No. 1 phono input.

One unswitched and two switched AC outlets are provided.

Overall dimensions are 17 1/8 in. wide x 4 1/2 in. high x 13 1/4 in. deep. Weight is 13.7 lbs.

PERFORMANCE: (Note: This unit is rated for 2 volts output so all tests were conducted at 2 volts.)

At 2 volts output, the frequency response from 20 to 20,000 Hz measured ruler flat with a distortion no higher than 0.007% THD at any frequency. The output clipping level was 14 volts, and there was no effective increase in distortion up to the clipping level.

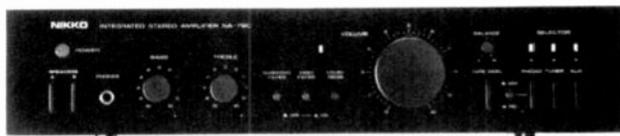
When the parametric frequency controls are set to their low and high frequency extremes and the bandwidth controls are set for maximum "width," the equalizers function as standard tone controls (by adjusting the LEVEL controls). In the "standard" tone control mode, the equalizers' tone control range measured ±12 dB at both 50 and 10,000 Hz. In the parametric mode, the maximum equalization was nominally ±12 dB at any center frequency.

The subsonic filter has essentially no effect at 30 Hz, and is only 1.5 dB down at 20 Hz.

The magnetic input hum and noise measured -66 dB. Stereo separation was 50 dB.

The parametric equalizers are well designed. The bandwidth control has a more or less constant expansion/contraction and the level control transitions are proportional to the degree of rotation. The equalizers proved extremely useful at taming unusual room acoustics and reprocessing old recordings that suffered from unusual tonal characteristics. They are a nice feature for the serious stereophile. ▲

INTEGRATED AMPLIFIERS



Circle No. 79 On Reader Service Card

NIKKO NA-790 STEREO AMPLIFIER

A 53-watts-per-channel stereo amplifier with low distortion and good frequency response. Nothing spectacular—just a nice small package that sounds real good. \$279.95 in a metal cabinet.

DESCRIPTION: An integrated stereo amplifier FTC-rated for 8 ohms at 53 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.04% THD.

Features include: a head amplifier that can be switched into the phono input for moving coil (MC) pickup, a subsonic filter, an output hold-off that prevents power supply turn-on transients from being fed to the speakers, and a subsonic filter.

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

Controls are provided for volume, balance, ganged bass, and ganged treble. There are switches for

TEST REPORTS / INTEGRATED AMPLIFIERS

power, speaker system A, speaker system B, subsonic input selection, and MM/MC magnetic phono input. filter, high filter, loudness compensation, tape monitor, input.

Switched and unswitched AC outlets are provided.

Overall dimensions are 16 $\frac{5}{8}$ in. wide x 3 $\frac{3}{4}$ in. high x 13 in. deep. Weight is 15.2 lbs.

PERFORMANCE: The power output at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 57.8 watts RMS. The frequency response at

57.8 watts/8 ohms measured +0/-1 dB from 20 to 20,000 Hz at a distortion no higher than 0.018% THD at any frequency.

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

The subsonic filter was down 1.5 dB at 30 Hz; 2.5 dB at 20 Hz.

The magnetic input hum and noise measured -68 dB; stereo separation was 53 dB. ▲



Circle No. 81 On Reader Service Card

OPTONICA SM-4305 INTEGRATED STEREO AMPLIFIER

An unusually thin amplifier; particularly suited where height is at a premium. A useful machine for the tape recordist. \$300, in a metal cabinet.

DESCRIPTION: An integrated stereo amplifier FTC rated for 8 ohms at 40 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.02% total harmonic distortion.

Features include a subsonic filter, automatic dubbing to/from either of two recorders, and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There are inputs for magnetic phono, tuner, aux, and two tape. Outputs for two speaker systems, two tape, and phones. Preamp outputs and main am-

plifier inputs are available on the rear apron.

Controls are provided for volume, balance, ganged bass, ganged treble, and input selection. There are switches for power, speaker system A, speaker system B, subsonic filter, high filter, mono/stereo mode, dub tape No. 2 to tape No. 1, dub tape No. 1 to tape No. 2, tape monitor No. 1, tape monitor No. 2, source monitor, loudness compensation, and 20 dB audio mute.

Two switched and an unswitched AC outlet are provided.

Overall dimensions measure 16 $\frac{1}{2}$ in. wide x 2 $\frac{3}{2}$ in. high x 15 $\frac{1}{8}$ in. deep. Weight is 17.7 lbs.

PERFORMANCE: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 46 watts RMS.

The frequency response at 46 watts/8 ohms measured +2/-0.4 dB from 20 to 20,000 Hz at a distortion no higher than 0.015% THD at any frequency.

The tone control range measured ± 13 dB at 50 Hz; ± 9 dB at 10,000 Hz.

The subsonic filter produced an attenuation of 6 dB at 20 Hz, 4 dB at 30 Hz, 2.5 dB at 40 Hz.

The magnetic phono input hum and noise measured -76 dB; stereo separation was 60 dB. ▲

AMPLIFIERS



Circle No. 125 On Reader Service Card

DESCRIPTION: A stereo power amplifier FTC-rated for 8 ohms at 220 watts RMS per channel, 20 to 20,000 Hz, at no more than 0.08% THD, or 700 watts RMS monophonic at no more than 0.12% THD.

CROWN SA-2 STEREO AMPLIFIER

A 220-watts-per-channel brute of a power amplifier. Produces full power across the audio spectrum with no more than 0.08% THD. The signal-to-noise ratio is a full 92 dB referenced to 240 watts into 8 ohms. \$1,595 with rack panel mount.

Features include: automatic overload output disable; user selected instant start or 4-second output hold off (amplifier's response goes down to DC); a low frequency overload sensor that disables the output if the output voltage attempts to exceed 26 volts at 5 Hz into

8 ohms; an output indicator that provides both a peak hold of the maximum signal in conjunction with a "running light" indicator for the signal immediately following the peak. After approximately 1 second, the peak hold indicator releases and locks onto the next signal peak. The output indicator for each channel consists of a series of LEDs calibrated from 0 (maximum output) to -42 dB in 3 dB increments. Above the 0 LED is a red LED indicating overload of the channel.

One set of line inputs and output are provided.

There are controls for right gain, left gain and power. The rear apron has slide switches for stereo/mono operation, 4-second output delay, and low frequency protection.

Overall dimensions are 19 in. wide x 7 in. high x 14¾ in. deep. Weight is 57 lbs.

PERFORMANCE: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz into 8 ohms measured 240 watts RMS. The frequency response at 240 watts/8 ohms measured +0/-0.4 dB from 20 to 20,000 Hz at a distortion no higher than 0.025% THD.

The input signal needed for 240 watts output measured 2.2 volts.

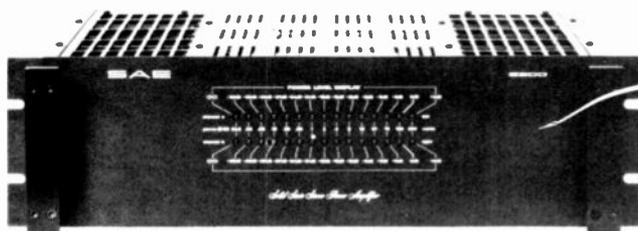
The signal-to-noise ratio referenced to 240 watts/8 ohms was 92 dB.

The output indicators are very effective. The highest LED, representing the peak signal power, holds for about 1-second while the signal lights under it, repre-

sents lower output power, presents a running pattern of the signal level, much like the peak volume indicators used in film and sound studios. (It gives a very accurate picture of what's taking place as far as power levels are concerned.) Each LED represents approximately 3 dB. The output meter frequency response is flat 20 to 20,000 Hz in the sense that the LED display does not change with frequency (the maximum meter variation can be only ±1.5 dB).

Above the output indicators are red LEDs which indicate overload. The protection circuits are fast and effective. At system overload, the red LEDs light instantly and the amplifier goes into **STANDBY** mode, recycling to **ON** in about 4 seconds. At signal overload, the red LEDs simply light to show the amplifier is driven beyond its capacity. If continuous overload causes the amplifier to overheat (almost impossible), the system overload will shut down the output for about 4 seconds. All in all, an effective safety and indicator arrangement.

Note: Though the amplifier's response goes down to DC, unless used for laboratory applications requiring response down to DC the use of the low frequency protection is recommended to prevent possible speaker overload caused by turntable rumble producing excessive amplifier output. The low frequency protection circuit has no effect on normal sound frequencies. ▲



Circle No. 88 On Reader Service Card

SAE 2300 STEREO AMPLIFIER

A 150-watts-per-channel stereo amplifier that we tested as capable of 163 watts with ruler-flat frequency response and no more than 0.015% THD. At full power the signal-to-noise ratio was 96 dB. \$700 in metal cabinet for 19-inch rack mount.

DESCRIPTION: A stereo power amplifier FTC-rated for 8 ohms at 150 watts RMS per channel, 20 to 20,000 Hz, at 0.05% THD.

Unit features: one speaker output and two line inputs per channel—one line input that is flat to almost DC (**NORMAL** input), another that is 6 dB down at 20 Hz (**NARROW** input). Also included are left and right 15-step LED output power indicators for 8 ohm loads

calibrated 0.03 to 300 watts and -36 dB to +3 dB with 0-dB representing 150 watts; and an output hold-off that prevents power supply turn-on transients from being fed to the speakers.

There aren't any controls or switches. Power is controlled by the associated equipment.

Overall dimensions are 19 in. wide x 5.25 in. high x 12.5 in. deep. Weight is 35 lbs.

PERFORMANCE: The power output per channel at the clipping level with both channels driven 20 to 20,000 Hz measured 163 watts RMS. The frequency response at 163 watts/8 ohms was ruler flat from 20 to 20,000 Hz at a distortion no higher than 0.015% THD at any frequency.

Maximum output power was attained with 1.8 volt input.

When feeding signal through the **NARROW** input, the response rolled off below 100 Hz: down 0.8 dB at 100 Hz; 2.5 dB at 50 Hz; 5 dB at 30 Hz; 8 dB at 20 Hz. (The instruction manual gives no practical use for this input. We suggest the average stereophile use the **NORMAL** input.)

The signal-to-noise ratio referenced to 163 watts output measured 96 dB.

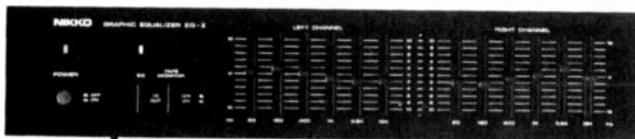
The LED-power indicators are acceptably accurate up to 0-dB, or 150 watts. At 150 watts, however, because of the frequency response of the circuit, the

TEST REPORTS / AMPLIFIERS

output power indication can be 300 watts when the actual output is 150 watts. The smallest measurement step between LEDs is 3 dB, and the frequency re-

sponse will vary 1 step high and low from 20 to 20,000 Hz; hence, we can assume the response is within ± 3 dB limits from 20 to 20,000 Hz. ▲

EQUALIZERS



Circle No. 79 On Reader Service Card

NIKKO EQ-II STEREO GRAPHIC EQUALIZER

A six-band graphic equalizer with ± 12 dB equalization and a flat response when the controls are centered. Distortion: 0.005% THD. A very good budget equalizer. \$199.95 in a metal cabinet.

DESCRIPTION: A stereo graphic-type equalizer with six center frequency controls per channel at 40, 125, 400, 1,200, 4,000 and 12,500 Hz providing ± 10 dB equalization. Unit connects to an amplifier's tape recorder jacks, with the recorder connections moved to the equalizer. Equalization is applied only to the amplifier input; the tape output is always "flat."

There are five linear equalizer controls for each channel. Switches for power, equalizer in/out, and tape monitor. The unit provides unity gain, same signal level out and going in).

One unswitched AC outlet is provided.

Overall dimensions are 16 $\frac{1}{2}$ in. wide x 3 $\frac{3}{4}$ in. high x 13 in. deep. Weight is 10.8 lbs.

PERFORMANCE: Note: Unit was tested at its rated output of 1 volt.

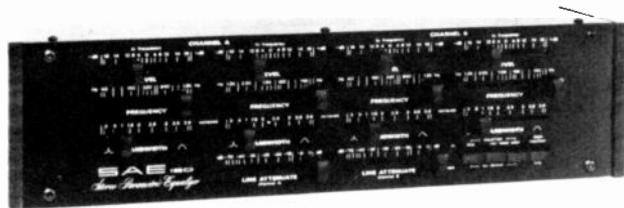
With the equalizer controls at their center (no equalization) position, the frequency response measured $+0/-0.3$ dB from 20 to 20,000 Hz at a distortion no higher than 0.005% THD at any frequency.

The output clipping level with full boost applied was 4.8 volts.

The equalization range for each control was nominally ± 12 dB.

Because there is no input, or sensitivity control, the user must be careful to prevent overload by insuring the input signal does not exceed 1 volt if full boost is used at any frequency. While this is normally not a problem, some equipment, particularly tape decks, have a maximum output level greater than 1 volt, and the user must adjust the level into the equalizer so it is below 1 volt if minimum distortion is to be attained.

While this device offers greater equalization possibilities than standard tone controls, its six center frequencies are somewhat limiting when compared with a full-octave graphic equalizer. But it is a good compromise at a budget price. ▲



Circle No. 88 On Reader Service Card

SAE 180 STEREO PARAMETRIC EQUALIZER

A stereophile version of a studio type parametric equalizer in a home compatible cabinet. Does everything you'd expect an equalizer to do and does it well. \$250, metal cabinet with wood trim.

DESCRIPTION: A stereo parametric equalizer consisting of two identical but independent sections with common switching that can connect the equalizer to

the amplifier input, a tape output, or a tape input. Each section has two frequency selectors covering the approximate range of 40 to 1.2 kHz and 1.2 k to 20 kHz, two ± 16 dB attenuators, and two bandwidth adjustments covering 0.3 (narrow) to 3.6 (wide) octaves, and a level control that provides output level adjustment from unity gain (no amplification; output level equal to input level) to full off.

The equalizer connects to an amplifier's tape jacks, with the tape connections moved to the equalizer.

Switches are provided for: equalize amplifier, equalize tape output, equalize tape input, and tape/source monitor. There is no power switch. Power is controlled by the associated equipment.

Overall dimensions are 18.1 in. wide by 4.4 in. high x 3.5 in. deep.

PERFORMANCE: Note: Tests were conducted at the rated output of 2.5 volts.

With the equalizer's level controls centered (removing equalization from the circuit, the frequency response measured $+0/-0.8$ dB from 20 to 20,000 Hz

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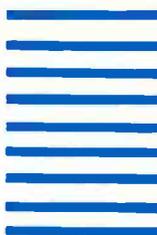
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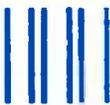
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at a distortion no higher than 0.015% THD at any frequency.

The output clipping: level was nominally 9 volts.

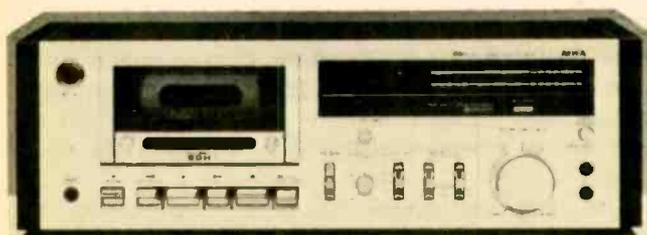
With maximum equalization applied, the worst-case distortion just below the clipping level of 9 volts measured 0.15 THD. When the output level control was adjusted so that the output level with full equalization did not exceed 2.5 volts, the distortion was no higher than 0.015%.

The frequency calibrations on the equalizer frequency controls are approximate and serve to get the user close to a desired frequency; then it's up to the user to fine-tune the control for personal preferences.

Since there are no overload indicator devices, it's up to the user to make certain heavy equalization does not result in clipping. This will normally not be a problem with preamplifiers whose output voltage does not exceed 1.4 volts. However, to be certain of minimum distortion it's best to adjust the parametric's level control(s) so that the equalized signal appears to the ear to be the same volume as the unequalized signal. (This is not a particularly accurate "match," but it is good enough to keep distortion as low as is possible.)

Overall, the SAE model 180 is relatively easy to use and can serve as a stereophile's equalizer. ▲

CASSETTE DECKS



Circle No. 103 On Reader Service Card

AIWA AD-L40U STEREO CASSETTE DECK

A straight forward deck that's a real winner for the price, particularly when using metal tape. \$490.00, in a metal cabinet with wood trim.

DESCRIPTION: A front loading Dolby stereo cassette deck for Normal, ferrichrome, chrome-bias and metal tapes. The coding notches built into modern chrome-bias tape shells automatically switches the bias and equalization for chrome-bias tapes. A bias adjustment, calibrated specifically for many popular tape brands and types, is provided for the Normal tape selector (it's inoperative for other tape types).

Other features include: left and right bar-graph type meters that can be switched to the VU or peak-level mode; a record mute that disables the input signal while the tape continues to drive; a record mute timer that flashes at one-second intervals while the mute is applied; automatic end of tape stop/disengage; tape mechanism pause control release that permits automatic play or record start-up controlled by an optional programmable timer; and a reset timer.

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

Controls are provided for concentric-clutched left and right record level, ganged output level, and nor-

mal fine bias adjust. There are switches for power, Dolby/Dolby with mpx filter, tape bias, tape equalization, input selection, and record mute.

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

Overall dimensions are 17 $\frac{1}{8}$ in. wide x 5 $\frac{1}{2}$ in. high x 11 $\frac{1}{8}$ in. deep. Weight is 19.9 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured +0/-1.6 dB.

Using Maxell UD/XL Type I tape: Without Dolby the record/play frequency response measured +1/-1.8 dB from 40 to 15,000 Hz; down 3 dB at 33 Hz. Distortion at the meter indicated 0-VU record level was 1.1% THD with 9 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level measured 49.5 dB.

With the Dolby active the record/play frequency response measured +0/-3 dB from 33 to 13,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 54 dB wideband, 61 dB narrowband.

Using Sony Dual ferrichrome tape with Dolby, the record/play frequency response measured +0/-2.5 dB from 40 to 15,000 Hz. Distortion at the 0-VU record level was 0.9% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to a 0-VU record level was 54 dB wideband, 61 dB narrowband.

Using TDK-AD chrome-bias tape with Dolby, the record/play frequency response measured +2.5/-2 dB from 40 to 15,000 Hz. Distortion at the 0-VU record level was 1% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband, 60 dB narrowband.

Using Scotch Metafine metal tape with Dolby, the record/play frequency response at 0-VU record level was +0.6/-3 dB from 33 to 12,800 Hz; down only 5 dB at 14,000 Hz. (Outstanding performance for a

TEST REPORTS/CASSETTE DECKS

0-VU level recording.)

At the standard cassette tape test level of -20 dB the record/play frequency response was $+3.3/-3$ dB from 33 to 15,000 Hz. (This machine needs a slightly better Dolby tracking alignment.) Distortion at the meter indicated 0-VU record level was 1.2% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio measured 54 dB wideband, 61 narrowband.

The maximum output level corresponding to a 0-VU record level was nominally 0.5 volts.

Wow and flutter measured 0.12% with peaks to 0.14%.

The bar-graph level indicators are unusually large and have good calibration. The peak mode has a fast rise and a moderate decay, allowing relatively easy tracking by the eye. We recommend all recordings be made using the peak-level metering mode.



Circle No. 74 On Reader Service Card

JVC KD-A6 STEREO CASSETTE DECK

A top performance cassette deck that does just about everything well. Gives remarkable performance with budget-priced tapes. Works with normal, chrome, ferrichrome and metal tapes. Suggested retail price: \$479.95 in metal cabinet.

DESCRIPTION: A front-loading stereo cassette deck with JVC's ANRS (Dolby compatible) and Super ANRS noise reduction systems. Features include: selectors for Normal, ferrichrome, chrome-bias, and metal tapes; left and right VU meters with five peak-indicating L.E.D.s at -10 dB, -5 dB, 0-VU, $+3$ dB and $+5$ dB integrated with the VU scale; a five-step fine-tune record equalization selector, and an equalization chart (in the manual) for the most common and popular tapes; a $\pm 10\%$ metal tape bias adjustment switch; a $\pm 10\%$ pitch (motor-speed) control; automatic end of tape stop/disengage; a record mute that disables the input signal while the tape is driving; a memory reset counter; and a record/play timer control switch for use with an optional programmable timer.

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

Controls are provided for concentric-clutched left and right record level, ganged output level, and pitch.

A decal on the front panel indicates the recommended fine bias adjustment for most popular tapes. The calibrations proved unusually accurate. For those who are not satisfied with factory suggestions, an FM interstation noise adjustment procedure is suggested in the manual. (A recording is made of FM interstation noise and then the playback is compared with direct monitoring of the noise.) Because the machine does not have simultaneous record/play it is a time consuming procedure which at best did not produce better results than simply setting the fine bias adjustment to correspond with the front panel calibrations.

Special commendation was given by the listening panel to the metal tape performance. According to the panel, the high frequency performance at high volume levels is unusually clean, as would be expected from the 0-VU record/play measurements. ▲

There are switches for power, input selection/record mute, ANRS/Super ANRS on-off, tape selection, metal tape selection, record equalization, record/play timer control, and counter memory on-off. A switch on the rear apron provided $\pm 10\%$ bias variation for metal tape.

The tape mechanism has touch buttons for the record interlock, play, REW, FF, stop, and pause. There is a push button for eject.

Overall dimensions are $17\frac{3}{4}$ in. wide x $4\frac{3}{4}$ in. high x $12\frac{1}{2}$ in. deep. Weight is 18 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured $+0.5/-1$ dB.

Using TDK-D tape: without ANRS, the record/play frequency response measured ± 1 dB from 40 to 14,000 Hz; down 2.8 dB at 28 and 15,000 Hz. (Outstanding performance from a budget tape.) Distortion at the meter-indicated 0-VU record level was 1.2% THD with 9 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 47 dB.

With the ANRS active, the record/play frequency response measured $+0.3/-1.5$ dB from 40 to 13,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-VU record level was 50 dB wideband; 56 dB narrowband.

Using Sony Duad (ferrichrome) tape: with ANRS, the record/play frequency response measured $+1.5/-3$ dB from 25 to 13,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.1% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 54 dB wideband; 60 dB narrowband.

Using TDK-SA (chrome-bias) tape: with ANRS, the record/play frequency response measured $+1.5/-1$ dB from 40 to 14,000 Hz; down 3 dB at 28 and 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.1% THD with 6 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level

was 55 dB wideband; 60 dB narrowband.

Using Scotch Metafine metal tape: with ANRS, at 0-VU record level, the frequency response measured an unusually wide range (even for metal tape) $+0.2/-3$ dB from 28 to 13,000 Hz; down only 6 dB at 15,000 Hz. At the standard cassette test level of -20 dB, the record/play frequency response measured $+0.2/-2.5$ dB from 29 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 52 dB wideband; 58 dB narrowband. Using Super ANRS, which reduces high frequency saturation, the sound quality from the metal tape is almost awe-inspiring.

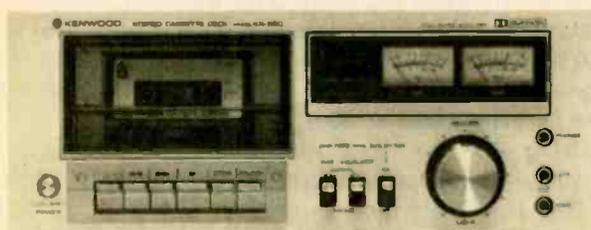
The maximum output level corresponding to 0-VU

record level was nominally 220 mV. (This is about $1/3$ to $1/2$ the usual cassette deck output level, but even so is more than is needed for high fidelity equipment.)

Wow and flutter was a rock-steady 0.06%.

The peak indicating L.E.D.s are precisely calibrated. They are integrated into the VU meter scale—rather than being a separate indicator—and provide an excellent "picture" of the average-to-peak ratios of the input signal. (Makes it much easier to adjust levels for optimum recording. A particularly well thought out feature.)

The pitch control provided a speed variation range of $\pm 12\%$. (About the only useful purpose of this feature is to correct speed variation—if it exists—of pre-recorded tapes.) ▲



Circle No. 75 On Reader Service Card

KENWOOD KX-550 STEREO CASSETTE DECK

This cassette deck gets very good performance for the money. Best results are with high-priced tapes. Uses normal, chrome and ferrichrome tapes. Retail price: \$235 In a metal cabinet.

DESCRIPTION: A front-loading Dolby cassette deck featuring: bias and equalization selectors for normal, Ferrichrome, and chrome-bias tapes; two calibrated VU record level meters; automatic end-of-tape stop/disengage; and a reset counter.

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

Controls provided are concentric-clutched left and right record level. There are switches for power, bias select, equalization select, and Dolby on-off.

The tape mechanism has lever controls for the record interlock, rewind, play, fast forward, stop, and pause. The cassette is directly loaded and removed by hand.

Overall dimensions are $15\frac{1}{4}$ in. wide x $6\frac{1}{4}$ in. high x $11\text{-}1/16$ in. deep. Weight is 11.9 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured $+2.1/-2$ dB.

Using Maxell UD/XL tape: without Dolby, the record/play frequency response measured $+0/-1.5$ dB from 40 to 14,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 9 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 48 dB.

With the Dolby active, the record/play frequency response measured $+0/-3$ dB from 40 to 12,000 Hz; down 3.5 dB at 13,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio measured 54 dB wideband; 58.5 dB narrowband.

Using Sony Ferrichrome tape: with Dolby, the record/play frequency response measured $+1/-1.2$ dB from 30 to 14,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.4% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 56 dB wideband; 62.5 dB narrowband.

Using TDK-SA (chrome-bias) tape: with Dolby, the record/play frequency response measured $+0/-3$ dB from 40 to 14,000 Hz. Distortion at the meter-indicated 0-VU record level was 0.08% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 55 dB wideband; 61 dB narrowband.

The output level corresponding to a 0-VU record level was nominally 450 mV.

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

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



Circle No. 85 On Reader Service Card

PIONEER CT-F1250 STEREO CASSETTE DECK

This unit wrings outstanding performance from low-priced tape and even better performance from the high-priced formulations. It is a front-loading deck with three heads and simultaneous record/playback head. \$695 in a metal cabinet.

DESCRIPTION: A front-loading 3-head system (simultaneous record/play), dual capstan, Dolby cassette deck for normal, ferrichrome, chrome-bias, and metal tapes. Features include: individual adjustments and a calibration system for tape bias, equalization, and level; $\pm 6\%$ pitch (motor speed) adjustment; left and right fluorescent display bar-graph level indicators that can be set to indicate average, peak, or peak-hold record/playback level; an electronic memory counter providing auto stop/disengage/rewind/play, repeat play, and play from counter zero to end; microphone/line input mixing; a record mute that disables the input signal while the tape drives; and a control switch that permits record or play start-up to be controlled by an optional timer.

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

Controls are provided for concentric-clutched left and right microphone level, concentric-clutched left and right line level, concentric-clutched left and right output level, pitch, bias level, tape sensitivity level, and tape equalization. (The bias, level, equalization, and pitch controls are detented at their "normal" adjustment.) There are switches for power; tape type; Dolby/Dolby with mpx filter; tape/source monitor; average metering; peak metering; peak-hold metering; counter memory stop, play, repeat, end, off and reset; timer start mode; meter display dim; meter display bright.

The tape mechanism has touch buttons for the record interlock, forward, REW, FF, stop, pause, and record mute. The tape is loaded and unloaded directly by hand.

One unswitched AC outlet is provided.

Overall dimensions are 16-9/16 in. wide x 7 3/8 in. high x 14 1/2 in. deep. Weight is 24 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz frequency range measured $+1.5/-2.3$ dB.

Using TDK-D tape: without Dolby, the record/play frequency response measured $+0.2/-2$ dB from 40 to 15,000 Hz; down 3 dB at 30 Hz. Distortion at the meter-indicated 0-VU record level was 1.2% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 46 dB.

With the Dolby active, the record/play frequency response measured $+0/-3$ dB from 30 to 13,000 Hz. Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-VU record level was 52 dB wideband; 58 dB narrowband.

Using Sony Duad ferrichrome tape: with Dolby, the record/play frequency response measured $+1/-2$ dB from 40 to 13,000 Hz; down 3 dB at 30 and 14,000 Hz. Distortion at the meter-indicated 0-VU record level was 0.07% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 54 dB wideband; 60 dB narrowband.

Using TDK-SA tape: with Dolby, the record/play frequency response measured ± 3 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 0.09% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level measured 53 dB wideband; 61 dB narrowband.

Using Scotch Metafine metal tape: with Dolby, at 0-VU record level, the frequency response measured $+0.5/-1$ dB from 31 to 9000 Hz; down 3 dB at 30 and 10,500 Hz. At the standard cassette tape test level of -20 dB, the frequency response measured $+2.5/-3$ dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-VU record level was 0.09% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 51 dB wideband; 58 dB narrowband.

The maximum output level corresponding to 0-VU record level was 680 mV. (The detented setting of the output level control results in a nominal output of 420 mV.)

Wow and flutter measured a rock-steady 0.03% (among the very lowest values we have ever measured for cassette equipment).

The pitch control range measured $\pm 9\%$.

PERFORMANCE—CALIBRATION SYSTEM: The bias, level, and record equalization is accomplished by adjusting the appropriate control until a set of associated L.E.D.s have equal illumination or "flicker." There is some interaction between the bias and equalization and it's possible to go back and forth, changing adjustments, and never finish—this is particularly true of the metal tape calibration. The best method is to set all controls at full counter-clockwise and bring them up until the L.E.D. indicators match. Do not change an adjustment after you have moved to the next control

regardless what the indicators show if you go back to recheck a prior adjustment. Following this procedure, the system is excellent, taking but a few seconds to precisely calibrate the machine for any tape. Because the single set of adjustments affects all tape types, for maximum convenience it is suggested the user more or less standardize on one brand or type of tape.

PERFORMANCE—METERING: Top notch all the way. In the *average* mode, the bar-graph display has similar ballistics to a standard VU meter. In the *peak* mode, the maximum value is held for about two seconds while the light-bar tracks the peak value of lower level signals. If the program peak suddenly exceeds the holding value the display instantly indicates the higher peak value. In the *peak hold* mode, the meter continuously displays the absolute maximum signal until it is

exceeded, at which point the new peak value is maintained. The *peak hold* mode is most effective when presetting record level adjustments for a record or tape dub as the program can be sampled for the maximum peak signal before recording.

PERFORMANCE—COUNTER: The four-digit electronic counter indicates in units of 1-second; i.e., if the display indicates 0120 the recording is 120 seconds (or two minutes). When the tape mechanism is shifted to the fast wind modes the counter tracks the higher speed so it is always precisely on the correct count when the tape drive is stopped, or started in the play or record mode. Regardless of the number of starts, stops, or fast winds, from beginning to end of a C-90 tape the counter accuracy was within 1-second. (You must use this counter to fully appreciate its value.) ▲



Circle No. 102 On Reader Service Card

SANYO RD 5372 STEREO CASSETTE DECK

A microprocessor controlled three-head cassette deck with automatic repeat rewind and auto-play modes. Bias adjustable for normal, chrome, ferrichrome and metal. \$499.95, in a metal cabinet.

DESCRIPTION: A front loading, 3-head system (simultaneous record/play), Dolby cassette deck for Normal, ferrichrome, chrome-bias, and metal tapes. Features include: left and right VU meters; an electronic memory reset counter providing continuous repeat play of the complete tape, automatic rewind and stop at the beginning, automatic rewind and stop at counter zero, automatic rewind and replay from counter zero, automatic end of tape stop/disengage; peak record level L.E.D. indicators; record level limiter; control switches that permit record or play start-up to be controlled by an optional timer.

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. Switches for power, tape type, tape/source monitor, Dolby, mpx filter, record level limiter, counter memory on-off, counter reset, continuous repeat play, auto rewind and stop (or replay at counter zero), timer control of record, timer control of play, and timer control off.

The tape mechanism has touch buttons for the record interlock, play, REW, FF, stop, and pause. There is a pushbutton for eject.

Overall dimensions are 17.7 in. wide x 5.5 in. high x 11.8 in. deep.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured +1/-2 dB.

Using Scotch Master I tape: without Dolby, the record/play frequency response measured +0/-3 dB from 30 to 14,500 Hz. Distortion at the meter-indicated 0-VU record level measured 2% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level measured 45 dB.

With the Dolby active, the record/play frequency response measured +0.8/-3 dB from 30 to 12,000 Hz. Distortion and headroom was essentially the same as for non-Dolby. The signal-to-noise ratio referenced to 0-VU record level measured 48 dB wideband; 57 dB narrowband.

Using Sony Duad ferrichrome tape: with Dolby, the record/play frequency response measured +0/-3 dB from 40 to 3,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.5% THD with 8 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 46 dB wideband; 58 dB narrowband.

Using TDK-SA chrome-bias tape: with Dolby, the record/play frequency response measured +0.1/-3 dB from 30 to 10,000 Hz. Distortion at the meter-indicated 0-VU record level was 1.3% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level was 49 dB wideband; 61 dB narrowband.

Using Scotch Metafine metal tape: with Dolby, the record/play frequency response at 0-VU record level measured +0/-3 dB from 30 to 10,500 Hz. At the standard cassette tape test level of -20 dB, the record/play frequency response was +0/-3 dB from 40 to 10,000 Hz. Distortion at the meter-indicated 0-VU

TEST REPORTS/CASSETTE DECKS

record level was 1.9% THD with 9 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-VU record level measured 46 dB wideband; 58 dB narrowband.

The maximum output level corresponding to a 0-VU record level was nominally 800 mV.

Wow and flutter measured 0.12% with peaks to 0.17%.

The limiter cut in hard at 0.5 dB below 0-VU and

had a fast release, providing a full-limiting (no compression) characteristic. The peak record level indicators faded in from slight to full brightness over the range of +3 to +4 dB above 0-VU.

The electronic four-digit timer was relative, similar to the mechanical type in that each change of digit did not represent 1-second. As with almost all timers, mechanical and electrical, it tracked correctly through the fast wind modes. ▲



Circle No. 126 On Reader Service Card

SHARP RT-1199 STEREO CASSETTE DECK

A programmable cassette deck which can automatically locate up to ten separate programs on a section of tape. Can use normal, chrome, ferrichrome and metal. \$329.95, metal cabinet.

DESCRIPTION: A front loading Dolby cassette deck for Normal, ferrichrome, chrome-bias and metal tapes. Features include: Auto Program Locate Device (APLD) that fast winds to any of ten selected programs and then automatically resumes play; automatic location and play of the previous or next program; automatic end of tape stop/disengage; left and right peak indicating bar-graph level indicators with user-selected peak-hold feature; microphone/line input mixing; and a reset counter.

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

Controls are provided for concentric-clutched left and right microphone level, concentric-clutched left and right line level, and ganged output level. There are switches for power, Dolby, bias select, equalization select, metal tape, level indicator peak-hold, and nine APLD selectors (providing 10 searched programs).

The tape mechanism has lever controls for the record interlock, REW, play, stop, FF, pause, and eject. The mechanism is placed in the APLD mode, or the next or previous program is played, when either fast wind lever and the play lever is depressed.

Overall dimensions are 16-15/16 in. wide, 5-11/16 in. high x 9-11/16 in. D. Weight 13.2 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 2,500 Hz range measured +0.4/-1.5 dB from 63 to 12,500 Hz, rising

to +4 dB at 40 Hz.

Using Maxell UD tape: without Dolby, the record/play frequency response measured +2.1/-2.6 dB from 30 to 13,000 Hz. Distortion at the meter-indicated 0-dB record level was 1.1% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 52 dB.

With the Dolby active, the record/play frequency response was +2.1/-3 dB from 30 to 11,500 Hz. Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-dB record level measured 58 dB wideband; 64 dB narrowband.

Using Sony Duad ferrichrome tape: with Dolby, the record/play frequency response measured +1.6/-3 dB from 30 to 15,000 Hz. Distortion at 0-dB record level was 1.9% THD with 4 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 58 dB wideband; 65 dB narrowband.

Using Maxell UD/XL II chrome-bias tape: with Dolby, the record/play frequency response measured +1.9/-3 dB from 30 to 12,000 Hz. Distortion at 0-dB record level was 59 dB wideband; 65 dB narrowband.

Using the recommended TDK MA-RO metal tape: with Dolby, the record/play frequency response at 0-dB record level measured +1.8/-3 dB from 30 to 11,000 Hz. At the standard cassette tape test level of -20 dB, the record/play frequency response measured +2.5 dB from 30 to 15,000 Hz. Distortion at 0-dB record level was 1.5% THD with 4 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 57 dB wideband; 63 dB narrowband.

The maximum output level corresponding to a 0-dB record level measured nominally 0.9 volts.

Wow and flutter measured 0.08% with peaks to 0.17%.

The bar-graph meter is always peak indicating. When placed in the peak-hold mode it "permanently freezes" any reading that exceeds 0-dB record level, continuing to track the program level below the peak value. If another peak exceeds the peak value the new peak value is held. This permits a prerecorded program to be easily checked for maximum recording level before the recording is started. All values above 0-dB, whether held or allowed to track, indicate as rectangles rather than as light bars (a very convenient way to keep track of excessive recording level).

The APLD works by counting the pauses between programs while in the fast wind mode. If the user programs APLD with a "2" the mechanism will run ahead, skip past two pauses, sense the third pause, and switch to the play mode. For dependable operation the APLD requires a pause of approximately 4 seconds between programs. Prerecorded records and tapes have the required pauses, the user must add them if

making "live" home recordings. If the pause is less than 4-seconds the APLD can miss it. Also, the APLD will sense as a program pause natural pauses in recorded speech, and low level signals and/or lulls in classical music. It proved most effective with pop and rock which generally have no musical pauses. Overall, the APLD works very well. ▲



Circle No. 94 On Reader Service Card

SONY TC-K45 STEREO CASSETTE DECK

A full-feature cassette deck with automatic stop/disengage at the end of a tape and automatic replay at the end of rewind. Has peak indicating bar-graph level meters. \$320 in a metal cabinet.

DESCRIPTION: A front-loading Dolby cassette deck featuring: bias and equalization selectors for Normal, ferrichrome and chrome-bias tapes; left and right peak indicating and peak reading bar-graph level indicators; a record mute that disables the input signal while the tape continues to drive; automatic stop/disengage at the end of the tape; automatic replay after rewind; and a memory reset counter.

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

Two concentric (not clutched) controls are provided for the left and right record level. There are switches for power, microphone/line input selection, bias select, equalization select, Dolby, and counter memory on-off. The record mute is a spring-return position of the input selector.

The tape mechanism has lever controls for the record interlock, REW, stop, play, FF, pause, and eject. Automatic replay after rewind is provided when both the REW and play levers are depressed.

Overall dimensions are 17 in. wide x 5½ in. high x 11½ in. deep. Weight is 12.8 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz range measured +2.5/-3 dB from 40 to 10,000 Hz, down 3.5 dB at 12,500 Hz range measured +2.5/-3 dB from

40 to 10,000 Hz, down 3.5 dB at 12,500 Hz.

Note: The bar graph meters are calibrated in absolute peak level, or 0-dB, and VU, with 0-VU being 4 dB below the 0-dB peak record level. All tests were referenced to 0-dB, which provides optimum signal-to-noise ratio coincident with protection against excessive recording levels. Note there is no "headroom" for distortion measurements because 0-dB is already at maximum record level.

Using TDK-D tape: without Dolby, the record/play frequency response measured +1/-1.5 dB from 40 to 15,000 Hz, down 3 dB at 30 Hz. Distortion at 0-dB peak record level was 2.5% THD. The signal-to-noise ratio referenced to 0-dB record level was 46 dB.

With the Dolby active, the record/play frequency response measured +1/-3 dB from 30 to 11,500 Hz. Distortion remained the same. The signal-to-noise ratio referenced to 0-dB record level was 49 dB wideband; 56 dB narrowband.

Using Sony Duad ferrichrome tape: with Dolby, the record/play frequency response measured +2/-2.1 dB from 30 to 15,000 Hz. Distortion at the 0-dB record level was 2.7% THD. The signal-to-noise ratio referenced to 0-dB record level was 50 dB wideband; 60 dB narrowband.

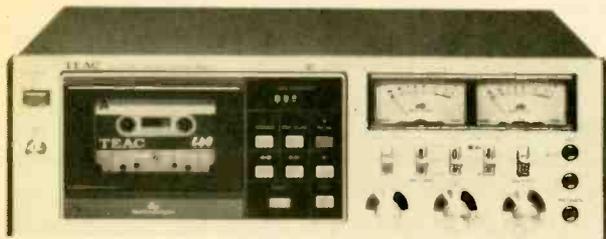
Using TDK-SA chrome-bias tape: with Dolby, the record/play frequency response measured +2.8/-2.5 dB from 30 to 15,000 Hz. Distortion at the 0-dB record level was 2.8% THD. The signal-to-noise ratio referenced to 0-dB record level was 48 dB wideband; 59 dB narrowband.

The maximum output level corresponding to a 0-dB record level was 0.8 volts.

Wow and flutter measured 0.09% with peaks to 0.12%.

The bar-graph indicators "hold" the peak level for approximately two seconds, while the bar-graph below the peak value tracks the program level. If a program peak exceeds the "holding" value the bar-graph tracks upwards to the new peak value, which again will hold for two seconds. The indicators are calibrated in both dB and VU, with 0-VU being 4 dB below 0-dB. Since 0-dB represents the standard saturation level for tape, it is suggested that recording levels be adjusted so the program peaks are as close as possible to 0-dB. ▲

TEST REPORTS/CASSETTE DECKS



Circle No. 10 On Reader Service Card

TEAC A-550RX dbx/DOLBY CASSETTE DECK

A dbx noise reduction system produces recordings that are really "dead quiet" and almost free from high frequency saturation, even with conventional tapes. Price: \$550 in a metal cabinet.

DESCRIPTION: A front loading cassette deck featuring both dbx and Dolby noise reduction systems, and bias and equalization selectors for Normal, chrome-bias, and metal tapes. Other features include: left and right peak-reading record level meters; solenoid operation with built-in prewired socket for an optional full-function remote control; automatic end of tape stop/disengage; memory reset counter, play and record control by external timer; a record mute that disables the input signal while the tape drives.

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

Controls are provided for left and right record level with tandem operation provided by a friction-locked belt drive (adjusting one control simultaneously adjusts the other), and ganged output level. There are switches for: power, timer control, counter memory on-off, tape bias, tape equalization, microphone/line input, and dbx/Dolby noise reduction selector.

The tape mechanism has touch buttons for the record interlock, forward, REW, FF, pause and record mute. There is a push button for the cassette ejection.

Overall dimensions are 17-5/16 in. wide x 5 3/4 in. high x 13 1/2 in. deep. Weight 22 lbs.

PERFORMANCE: The playback frequency response from a standard test tape with a 40 to 12,500 Hz frequency range measured +0.7/-1.7 dB.

Using TDK-D tape: without Dolby, the record/play frequency response measured nominally ± 3 dB from 25 to 11,500 Hz with a 3.5 dB peak at 50 Hz. Distortion at the meter-indicated peak record level of 0-dB measured 1.5% THD with 5 dB headroom to 3% THD.

The signal-to-noise ratio referenced to 0-dB record level was 46.5 dB.

With the Dolby active, the record/play frequency response measured ± 3 dB from 25 to 10,000 Hz with a 3.5 dB peak at 50 Hz. Distortion and headroom remained the same. The signal-to-noise ratio referenced to 0-dB record level was 55 dB wideband, 64 dB narrowband.

Using TDK-SA (chrome-bias) tape: with Dolby, the record/play frequency response measured +1.5/-2 dB from 30 to 15,000 Hz; down 3 dB at 25 Hz. Distortion at the meter-indicated 0-dB record level was 1.4% THD with 5 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 54.5 dB wideband, 63 dB narrowband.

Using Scotch Metafine metal tape: with Dolby, the record/play frequency response at 0-dB record level, was +2/-3 dB from 30 to 8,500 Hz. At the standard -20 dB test level, the frequency response measured +2/-3 dB from 30 to 15,000 Hz. Distortion at the meter-indicated 0-dB record level was 1.4% THD with 7 dB headroom to 3% THD. The signal-to-noise ratio referenced to 0-dB record level was 54 dB wideband, 64 dB narrowband.

The output level corresponding to 0-dB record level was nominally 560 mV maximum.

Wow and flutter measured 0.08%.

PERFORMANCE: DBX NOISE REDUCTION SYSTEM: The dbx system is independent of the Dolby—the two cannot be switched in together. It is a compression/expansion system, hence, it provides both noise reduction and protection against transient peak signals driving into tape saturation. Effectively, it expands the 0-dB record level high frequency response.

Used with Metafine tape, the dbx system resulted in an absolutely dead quiet output with a signal-to-noise ratio referenced to 0-dB record level of 70 dB wideband, 77 dB narrowband. Further, the compression produced a 0-dB high frequency response down 3 dB at 10,000 Hz and 5.5 dB at 12,000 Hz, in contrast to -5 dB and -10 at the same frequencies without the dbx compression. Similar advantage is attained with other tape formulations. At the standard -20 dB test level, the Metafine frequency response was essentially the same as attained using Dolby.

Overall, the noise reduction of the dbx system is phenomenal, or spectacular, depending on one's point of view. The system is particularly effective when recording live through microphones. ▲

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

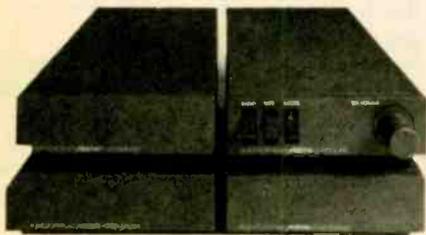
AUDIO SHOWCASE

(Continued from page 14)

and provides 4 to 10 dB higher efficiency than most other satellites, according to the company. Each speaker can be driven to normal room levels by as little as 10 watts, yet the Satellite can handle 200 to 400 watt peaks per channel, and can produce output sound power levels 6 to 14 dB higher than most satellites. The radiating system of the S-I is a four driver, phased array with a critical group delay alignment for the drivers and crossover networks to provide high efficiency, precise imaging and sharp transient detail. Unique with the S-I is the inclusion of four separate input networks to provide the different sound characteristics of English, German and American speakers, plus two high frequency contours. These are available by simple selection of input terminals on the S-I. The controlled vertical dispersion pattern means less wastage or smear by unwanted ceiling and floor reflections.

British Amplifier/Preamplifier

Zephyr Electronics Group is now importing the Boothroyd/Stuart Meridian range electronics products from England. A model 101 preamplifier is an all-discrete, low feedback unit. All signal processing electronics are carried on three plug-in modules that permit



Circle No. 106 On Reader Service Card

periodic update or extension of the equipment. Phono modules to match virtually any magnetic or moving coil pick-up are available. Price of the preamp is \$475. Model 103D amplifier also features low feedback, and uses an individual toroidal power supply to deliver high current into any loud-speaker load. The amplifier is rated at 45 watts per channel. It's priced at \$640. Specifications for the 101 pre-amp: frequency response, 20 to 20,000 Hz; radio/tape response, 5 to 50,000 Hz; distortion, less than 0.01%. Specifications for the 103D amplifier: output, 35 watts per channel into 8 ohms; input, 0 dBm (775mV) over 10k for 35 watts; distortion, less than 0.1%, 20 to 20,000 Hz at all powers up to 35 watts and typically less than 0.01% at 1 kHz; noise, less than -90 dB CCIR.

Metal Audio Cassette Tape

Fuji claims that the company's new metal tape offers twice as much, in some cases much more, output than do other tapes, depending on the frequency used for comparison. Measurements are said to confirm that the new tape delivers 7 to 12 dB more MOL (maximum output level) than do typical "chrome" tapes, and 3 to 9 dB more than Fuji's own FX-11 tape. The new



Circle No. 115 On Reader Service Card

tape can be played with "excellent" results on equipment having chrome playback facilities. Manufacturer's suggested list pricing for the new Fuji products will be \$8.80 for the C-46 cassette and \$10 for the C-60, one hour cassette.

COUNTERFEIT TAPES

Beware of bargain-priced TDK SA-C90 cassette tapes, they're probably counterfeits. Many of these tapes have been offered through newspaper ads at \$2.59 per tape in boxes of 10 tapes. Real TDK SA-C90 costs \$5.69 per tape so any such extreme bargain is almost sure to be a fraud.

You can recognize the counterfeits by the smudged printing on the index liner card, a nonfunctional cellophane opening strip on the outer wrapper (the real thing has no strip) and the lack of a finger-indentation at the top of the box for opening. The 10-cassette carton from the counterfeiter is printed only in brown instead of brown and green, and it will not have a lot number stamped on top. Needless to say, the performance, reliability and sound reproduction quality is significantly inferior to the real TDK SA-C90. ▲

ON OUR COVER

High performance in a small package—that's what micro-components are all about. Sony's top-of-the-line micro's are shown on this month's cover. On the bottom is the TA-P7F integrated, 50-watts-per-channel amplifier with less than 0.01% THD (\$500). On top of it is the ST-P7J Quartz crystal locked FM tuner with digital display and eight programmable presets (\$500). The direct-drive, quartz-locked turntable, model PS-P7X has low wow and flutter, and rumble spec's (\$450). Rounding off the system is a pair of SS-5CX speakers that are only 9½ inches high, have a 5-inch woofer and a 1-inch dome tweeter, and a voice-coil cooling system (\$600 per pair).

SOUND PROBE: BOSE 901 SERIES IV

(Continued from page 28)

from the rear, looking somewhat like the business end of a jet plane. They are in fact air jets to relieve the back pressure generated by the pumping action of all those speaker cones in a surprisingly compact enclosure (measuring a mere 12 inches high by 21 inches wide by 13 inches deep with a slightly curved front and a triangular apex in the rear). The air flow in these ducts is so powerful that it will blow out a match held near the opening when the music hits a low note. Thanks to its

vented design, the Bose 901 Series IV is far more efficient than earlier versions of the Bose, needing a mere 10 watts to drive it to ample volume. Yet it will handle as much as 1000 watts of power—and that third zero is no misprint! It is interesting that—unlike in ordinary bass ports—no sound issues from the air vents. Their resonant frequency lies below the audible spectrum. As a result, they can relieve back pressure and assure efficiency without creating a false bass boom.

To obtain adequate reflections from the back wall, the Bose 901 must be located at least 12 inches away from the wall in back of it. Attractive speaker stands are available for optimum positioning; or, thanks to its compactness, the speaker can also be conveniently hung from the ceiling so that it takes up no floor space at all.

Performance:

In terms of sheer musicality, this speaker ranks with the finest, and in spaciousness of sound it is unsurpassed.

Yet despite the enveloping character of the sound presentation, there was no loss of stereo localization because not all of the sound is reflected. One of the nine drivers in each speaker aims directly forward to assure accurate stereo imaging. Yet at the same time, we were able to walk all over the room without ever losing the stereo effect, and the dispersion of all frequencies is quite

uniform, so that the frequency balance remains the same in any location.

The Bose 901 sounded totally convincing with any type of music. From solo piano to massive symphonic scores, everything sounded airy, open, and smooth, with pristine highs and a bass so solid you could almost touch it. Sharp transients etched every tonal nuance, but nothing ever sounded

harsh. Of course, these are qualities expected from any first-rate speaker. What gives the Bose its unique distinction is a sense of sonic size—an effortless bigness of sound that makes even a large orchestra believable in your living room. In all, it is a speaker well worth its, \$810-per-pair price (\$950 with equalizer) and one we could live with happily. ▲

SOUND PROBE: KEF-101

(Continued from page 28)

of the KEF-101 is the power handling ability of this little bantam with its 4½-inch woofer. It will take as much as 100 watts amplifier power, producing peak sound-pressure levels of 100 db—enough to handle the biggest orchestra or the hardest rock. But with that kind of power pouring into the little speaker, special overload protection must be provided. The KEF-101 contains a self-powered circuit—called the S-Stop—containing sensors which monitor the input to each drive unit. Whenever the signal level exceeds safe limits, the S-Stop attenuates the signal fed to the drivers. Unlike a fuse, it never cuts off the speaker entirely, so the sound goes uninterrupted. The circuit then continues to monitor the incoming signal, and as soon as it drops back to a safe level, the attenuator is bypassed and the full signal is restored to the drivers.

A red light on the front panel lights up to let you know whenever the attenuator is in action. As for minimum power, the manufacturer recommends at least 20 watts per channel.

KEF is one of the few companies to publish distortion specs for speakers. In case of the 101, second harmonic distortion is less than 1 percent from 120 Hz to 20 kHz, and third harmonic distortion less than 1 percent from 70 Hz to 20 kHz, measured at a distance of 1 meter on axis at a mean sound pressure level of 90 db.

Performance:

This little speaker simply charmed us with its complete naturalness, but naturally we like it better in light-textured music that doesn't require heavy bass. Thanks to its unusually linear response, the sound of string instruments is particularly sweet and smooth. A

string quartet, for example, sounded as beautiful as we ever heard it on any speaker, regardless of size or price. The same was true of small jazz groups, with the sax and clarinet sounding splendidly warm, reedy and all there, while the drums were marvelously sharp and accurate in their transients. For heavier orchestrations, we turned up the bass control on our Sony receiver and the resulting balance was so good that we missed the bottom frequencies only when we deliberately reminded ourselves about the low end. As for volume levels, this little speaker could match the big ones decibel for decibel. Treble dispersion is superb. We could go anywhere in the room without losing the highs. In sum, here's a bantam that lets you forget its size, and it's the best mini we've heard so far. It costs \$250 per speaker. ▲

OPERA: NICOLAI GEDDA

(Continued from page 24)

Les Contes d'Hoffmann, Tamino in *Die Zauberflöte*, Dmitri in *Boris Godunov*, Nemorino in *L'Elisir d'Amore*, Elvino in *La Sonnambula*, Don Jose in *Carmen* and last season's two arduous additions, Jenik in *The Bartered Bride* and Ernesto in *Don Pasquale*. The success of the last role is worth mentioning. Here was a man 53 years old taking on for the first time in any house the presentation of a light, high-flying bel canto role of a juvenile character. Gedda brought it off with panache—maybe not with the complete ease he might have had when he was a young tenor, but with all the style imaginable as well as a strong voice and great vocal production ease. Gedda still vaults up to high notes with accuracy, precision and the kind of security that has long been the delight of his audience.

On the negative side, his voice now can sound hard and pinched. Lacking a cushion of sensuous sound, it can show age in its dryness and occasional asperity. Any regular opera goer has heard this from Gedda. But in the right repertory or on the song platform there is still no more elegant nor stylish an artist.

Fortunately, he has a long and im-

portant legacy of records. Early on in his career he was signed by EMI which in the United States is Angel Records. Though he has recorded for other companies, the greatest wealth of his material is with Angel, and his discography still continues to grow. At the moment he can be heard on 44 complete recordings of opera and operetta, a number that is even more staggering when one realizes that there are not more than 80 or 90 operas in the working repertory of most international opera companies.

His work can be divided easily into periods. The young Gedda can be heard in all his easy, debonair manner with Maria Callas in her recording of Rossini's gay comic opera, *Il Turco in Italia* (Seraphim 6095) and also with the soprano in the slightly later *Madama Butterfly* (Angel 3523). The two recordings show the clear dichotomy in the tenor's career. The first has everything going for it. He is perfect for comedy, even though his voice is not melliflously Italian in the manner of Tito Schipa's or Ferruccio Tagliavini's. He handles the ornaments easily and is fluent throughout. In the *Butterfly* he is certainly not bad—the role has rarely

been done more brilliantly. But the melting sensuality that characterizes the Italian tenor's way with Puccini is not his. Still, a few years later in his "middle" period, he recorded a formidable *La Boheme* (Angel S-3643) with Mirella Freni. Gedda may not be the perfect Rodolfo, but he has all the youth and ardor needed, plus flawless musicianship. His treatment of the third act recitation with Mimi hiding behind the tree has the right kind of pathos and feeling without once dipping into bathos. From the early days comes his exemplary Faust, with Victoria de los Angeles as Marguerite and Boris Christoff as Méphistophélès (Angel S-3622). This recording of Gounod's masterpiece has never been equalled for its genuine French feeling and its quality singing, and Gedda is as close to an ideal Faust as anyone since Jussi Bjoerling. From the same period comes his recording of Barber's *Vanessa* (RCA ARL-2-2094). This gives an opportunity to hear Gedda's commendable English (just after he learned the language) and his way with a non-standard opera. He enters into whatever he sings with a grasp of the style and a feeling for the métier.

Other records could be cited from

the early period, but in the middle period (besides the *Bohème*) can be found his famous Don Jose with Maria Callas as Carmen (Angel S-3650X). Here the tenor has the familiar clarity of voice which is so right for a French opera, but he has added to it the power and strength that makes the denunciation of Carmen in the third act so telling. Gedda in a role such as Don Jose is more effective on disc than in the house, where his stage attitude lacks some dramatic involvement. He is marvelous for comedy or for any aristocratic type role but not as good for a hero-mythic or political. It was about this time that one of his famous records was made: "Evening Bells and Other Favorites" (Seraphim S-60225), on which one can hear his marvelous lyricism within pure Russian style and his mastery of the Russian language. Many of the operettas were recorded in this period and best reflect the lightness and buoyancy of his tenor. Also on record at this time was his wonderful reading of the Italian tenor in *Der Rosenkavalier* (Angel S-3563), a performance that he often gave at the Metropolitan during the '60s.

His alliance with Beverly Sills, which has characterized much of the music he has recorded in the last decade, has one

marvelous high-point—the *Manon* (ABC ATS 20007). With Julius Rudel conducting, this is one of the really satisfying opera recordings. His voice is perfect for Des Grieux: he can spin out the Dream aria; the high B-flats of the aria in the St. Sulpice Scene are easy, and the ensuing duet in that scene is as passionate on records as it was when I saw the two play together at the San Francisco Opera in 1971. Unfortunately, many of their other combinations are not so happy. In *The Barber of Seville* (Angel SX-3761) he has the style, but he sounds older and somewhat strained for a young nobleman, and in *I Puritani* (ABC ATS 20016) he is better, but not really up to the demands of Arturo. He can sing the notes but the wanted sheen and ease of bel canto in the ornaments and the high notes is not present. Even less satisfying is his work in Bellini's *I Capuletti e i Montecchi* (Angel SX-3824) in which frankly, he sounds tired. Charpentier's *Louise* (Angel SCLX-3846), again with Miss Sills, was a mistake for both artists. Gedda never had the kind of heroic quality ideal for Julien, and at the stage of his career when he recorded this, he was much overtaxed. Again style is there, but not the right sound.

All accomplishments recently have not been unpleasant, however. He was heard as Dmitri in an otherwise not too impressive recording of *Boris Godunov* (Angel SX-3844) in which the quality of his voice has the right brilliance and power for the role, and his treatment of the language is beyond criticism. Gedda can sing Russian in such a way as to make it one of the most musical of languages, never sounding nasal in quality. And finally, again in Russian, one of his latest recordings is splendid: Shostakovich's *Lady Macbeth of Mtsensk* (Angel SCLX 3866). Here his style and use of language come together to make a powerful portrayal of the worthless betrayer of Katerina Ismailova. His voice does not sound tired, and the role does not demand the easy, flowing lyricism not readily available to a tenor who has been singing for over 25 years. It is a wonderful album, marvelously conducted by Mstislav Rostropovich with his wife, Galina Vishnevskaya, as an unforgettable Katerina.

As Gedda goes on, his career, fortunately well documented, will testify to all future generations that in the 50s, 60s and 70s there was at least one artist, and a tenor at that, who based a great international career on style, elegance and a taste that never failed. ▲

JAZZ: LENNIE TRISTANO

(Continued from page 16)

before an audience in more than a decade. But in that same decade, Marsh played frequently—with his own groups, with Konitz, and with the Supersax ensemble. And Konitz's playing became increasingly personal; he performed and recorded prolifically (after a record silence from 1961 to 1967), and was recognized as an influential voice, essential in his own right.

Tristano's first records were made in 1944 as a sideman with a Woody Herman-based group led by trombonist Earl Swope. Unissued for more than thirty years, these recordings are now on *The Lost Session* LP (Jazz Archive) along with piano solos of similar vintage. They show Tristano's early style, clearly descended from Art Tatum, but more limited in texture. Other very-early-Tristano (mostly solos, or trios with Bauer and a bassist) is out of print, but Savoy will issue its holdings in an anthology of several pianists' work.

The classic Tristano-Konitz-Marsh-Bauer sextet appears on half of *Cross-currents* (Capitol). (The other side has an absorbing big band piece by George Russell, but otherwise only collects some of the least worthy Dizzy Gillespie on record.) Here are the essentials of the Tristano style—the long

unison lines, phrased asymmetrically over subdued drumming; the cool, vibratoless, almost breathless tone. Featured here are "Intuition" and "Digression," totally improvised pieces that forecast the "free jazz" movement by a decade. Tristano, Konitz and Bauer have four selections on *First Sessions 1949-1950* (Prestige), including "Subconscious Lee," and Konitz heads another group made up of Marsh and pianist Sal Mosca.

The bulk of Tristano from the 1950s and 1960s is also out of print; collectors should watch for *Lennie Tristano* (Atlantic) and especially *The New Tristano* (Atlantic), a solo *tour de force* from 1961—long before the solo piano craze. In catalog from the same period, however, is *Descent into the Maelstrom* (Inner City). This collection varies in recording quality, but ranges from works from the early 1950s (including the linear inventions "Ju-Ju," "Pastime," and the prophetic title track, a free improvisation) through unused takes from *The New Tristano* to the last known Tristano on record.

The earliest Konitz, with the Claude Thornhill band, is on *The Memorable Claude Thornhill* (Columbia). During his first Tristano period, he also worked with the celebrated Miles Davis nine piece "nonet" on *The Original*

Birth of the Cool (Capitol). Konitz and Davis appear in a smaller setting on half of *Ezz-Thetic* (Prestige); the other side has an unusual Modern-Jazz-Quartet-like group with Teddy Charles on vibes and Jimmy Raney on guitar. Konitz with Kenton is perhaps best represented by *Contemporary Concepts* (Creative World), but can also be found on *New Concepts of Artistry in Rhythm, Sketches on Standards and Portraits on Standards* (all Creative World). The extensive 1955-1961 Konitz discography is all out of print. Of special interest to collectors are *Lee Konitz and Warne Marsh* (Atlantic), one of the best "Tristanoless" recreations of the original Tristano group sound, and *Motion* (Verve), a piano-less trio with Elvin Jones on drums.

The Lee Konitz Duets (Milestone) recorded in 1967 is Konitz at his most daring, in a dozen different settings with nine diverse musicians. Further duets, featuring the unbelievably oblique time sense of the mature Sal Mosca, are on *Spirits* (Milestone). *Satori* (Milestone) presents a quartet with the Algerian pianist Martial Solal, one of the wittiest of musicians. And *Piecemeal* (Milestone) is by a quintet with trombonist Marshall Brown, Konitz's most frequent partner of the early 1970s, but not a compelling solo-

ist.

Konitz's late 1970s records in intimate settings have always been thoughtful, but too bare of texture for casual listening. They include the solo album *Lone Lee* (Inner City); duets with pianist Hal Galper on *Windows* (Inner City) and bassist Red Mitchell on *I Concentrate on You* (Inner City); and a trio with pianist Paul Bley and guitarist Bill Connors on *Pyramid* (IAI). From the same period, his records with conventional small groups are less even, but sometimes more readily enjoyed. *The Lee Konitz Quintet* (Chiaroscuro) pairs him with Bob Mover, a young altoist often compared to Konitz, while the more "Tristanoesque" *Figure and Spirit* (Progressive) with tenorist Ted Brown is equally good. But *Crosscurrents* (Fantasy) with Marsh and pianist Bill Evans is

surprisingly listless; and *Tenorlee* (Choice), despite some moving playing by Konitz and pianist Jimmy Rowles at slow tempos, finds Konitz too tentative on the relatively unfamiliar tenor sax.

Konitz's current nine-piece band is more or less based on the Miles Davis "nonet" mentioned above. *The Lee Konitz Nonet* (Roulette) will be harder to find, but has more adventurous writing; *The Lee Konitz Nonet* (Chiaroscuro) is as spirited in execution, equally imaginative in solos, and as balanced in program.

Marsh's best work apart from Tristano and Konitz is on an import re-issue, *Jazz of Two Cities* (French Blue Note), which preserves the work of a late-1950s group with the aforementioned Ted Brown. The best-distributed Marsh is *Apogee* (Warner Brothers),

a collaboration with sharply contrasting fellow tenorist, Pete Christlieb. A similar group without Christlieb appears on *All Music* (Nessa); on *Warne Out* (Interplay), the focus is even more directly on Marsh, the only solo voice in a pianoless trio. Both of these are outstanding, but there can be too much of even so good a soloist as Marsh; as illustrated in *The Art of Improvising* and *The Art of Improvising Volume Two* (both Revelation). These recordings are entirely composed of Marsh solos snipped out of tapes of live performances from the late 1950s, and the effect (accentuated by the packaging which presents the excerpts as a scholars' guessing-game) is to exaggerate the stock of clichés and mannerisms that form part of the work of even the most artistic of improvisors as Warne Marsh. ▲

EXPAND YOUR COMPONENT SYSTEM

(Continued from page 44)

at the output by as much as 6 decibels. The unit features twin fluorescent indicators for accurate range and level adjustments.

Virtually every cassette recorder claiming to be "high fidelity" has some sort of built-in noise reduction system, with the Dolby system by far the runaway favorite. Excellent signal-to-noise ratios are attainable—high enough to satisfy even critical buffs and music lovers. But you may be super critical. If so, you're in luck thanks to several new add-on noise reduction units that will be on your audio dealer's shelves by the time this appears in print.

Sanyo's Model N55 Super D noise reduction system is said to offer up to 10 dB more noise reduction than is available from the best consumer units, and to overcome the problems of various existing systems such as "breathing," the audible switching in and out of a noise reduction circuit. The N55 is a compander system in which signals are compressed during recording, expanded in playback. Its 2:1 "compression" ratio is said to effectively double the dynamic range of the tape machine used, which need have only a 50 dB minimum signal-to-noise ratio to achieve the full 40 dB of noise reduction possible with the N55 Super D. Features include fluorescent peak-reading signal level meters, source/tape switch permitting off-the-tape monitoring with proper decoding, and defeatable 19 kHz multiplex filter.

The first product using Telefunken's "High Com" U401B proprietary audio interference suppressant broadband compander circuit is Nakamichi's Hi-Com Two outboard noise reduction system, priced at \$420. It was designed specifically to improve the signal-to-noise ratio of high quality cassette

decks. The new unit uses a two-to-one compression/expansion ratio to achieve a 20 dB improvement in cassette signal-to-noise ratio. While its use need not be limited to such, Nakamichi notes that optimum results will be obtained with state-of-the-art equipment, and the use of metal tape. The system can also be used with reel equipment. The unit's cabinet comes with rack-mount handles.

For those who never boarded the four-channel bandwagon, or want to improve an existing quadraphonic outfit, there's an excellent opportunity to do so in the form of a deluxe—and expensive (\$995)—add-on, the Fosgate "Tetra Two." Looking somewhat like a small recording studio console, the unit utilizes the famous Tate Directional Enhancement System four-channel matrix decoder that not only decodes SQ-encoded material into four-channel sound, but can take an ordinary stereo record, analyze its signals to determine the intended direction of the various musical elements, and convert them into a four-channel format. The Tetra Two develops a minimum of 35 dB channel separation with less than .05% THD. It features an elaborate LED display that is fun to operate. The display shows the directions in which the sounds are going—and which speakers are getting what sounds. A set of controls enables you to "play around" with the sound placement, to suit your pleasure or musical whims.

One of the most new add-on items is the Centrex Bodysonic system introduced by Pioneer Electronics of America. It is a two-part device that connects to any home stereo system to expand your musical listening experience by adding *feeling* to it. The company said Bodysonic was developed

for the music lover who wants to be "totally immersed in his or her favorite music." Pioneer calls the process to achieve this *bone conduction* of sound. The Centrex Bodysonic consists of a cushion for placement on a sofa or chair, and an amplifier that connects to your stereo rig. The cushion has transducers in both its back and seat sections which transmit the bass impulses of the music being heard directly to the person sitting against it. A control dial is part of the cushion, allowing you to adjust the intensity of the impulses. Pioneer recommends that headphones be used for optimum Bodysonic enjoyment.

The basic Bodysonic systems—cushion and amplifier—has a suggested price of \$200. One amp will regulate two cushions; an additional cushion can be had for \$100.

Imagine a gadget that can record programs off the air in your absence (with the aid of a tuner and tape recorder). It will also remind you to listen to preselected programs by switching them on automatically for you, and will wake you up not only to your favorite disc jockey or choice of FM station, but also with a disc or recorded cassette selected the night before. There actually is such a device. It is the Sanyo E55 microprocessor programmable timer that looks like a piece of deluxe hi-fi gear, including rack-mount handles. Priced at \$250, it offers in the company's words, "possibilities limited mainly by your imagination and creativity in finding chores for it to do."

In another vein, it can *protect* your hi-fi rig by acting as a burglar deterrent; it can switch lights on and off at pre-programmed times when you're away from home. It can also be an energy (physical & electrical) saver by

LITERATURE LIBRARY

303. JVC's color brochure on their **video product** line covers a wide spectrum of the latest achievements in video technology— $\frac{1}{2}$ " color videocassette recorders, $\frac{3}{4}$ " cassette players/recorders, cameras, TV monitors and accessories. A comparison chart of different recorder and camera models is included.



307. Nautilus Recordings supplies a booklet called **The Superdiscs—There is a Difference**. It explains in detail the differences between analog-to-disc recording (used to make most recordings), direct-to-disc recordings, and digital-to-disc recordings. The sonic advantages of direct-to-disc and digital-to-disc recordings are explained—questions about their limitations and relatively high cost are answered.

317. Empire has introduced five professional care products into their **Audio Groome** line and they're all explained in a handy pocket-sized leaflet. "Revolutionary" record and stylus cleaning devices such as their Disco Film album cleaner and the Static Eliminator, which neutralizes a charged record before it attracts dust, are featured.

318. Audio-Technica refers to its **stereophones** as "Personal Transducers." A brochure on the subject provides a glimpse of the attention that goes into the manufacturing of their products. Included in their brochure are the advances that have been made in the performance, comfort and appearance of both the electret condenser and dynamic moving coil stereophones. Technical data and specifications as well as suggested retail prices are provided.



319. Acoustic Research tells how to make a more informed judgement when buying speakers in their **Truth In Listening** brochure. Practical considerations such as price, design, and engineering are noted, as well as technical information such as sound waves and their relationship to speaker placement. All this is provided to make selecting speakers trouble free.

320. Audio Control's booklet, **How To Hook Up And Enjoy Your Stereo System**, compiles sound advice on how and where to set up your hi-fi. A separate section on equalization—what it is and why it makes music sound better—is given for the stereo enthusiast.

324. Yamaha capsules all there is to know about reproducing sound in their latest brochure, **An Introduction to Stereo**. It gets down to basics as it offers clear descriptions and illustrations of every component in a sound system.

325. Bose has catalogued technical and general information on the **Spatial Control Receiver** and the matching **901 Series IV** loudspeakers. The question and answer format lends itself to easy comprehension of the facts on their new advancements.



326. Nortronics **recorder care manual** contains up-to-date developments on products and technology needed for the care of your tape equipment. The principles of magnetic recording are spelled out with the aid of diagrams and charts, while the recorder maintenance section of the brochure outlines how each part of the unit should be cared for. A recommended recorder care program providing a time schedule and list of products is given.

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letting you stay in bed rather than getting up and turning off your system. It can be set via its 24-hour digital clock system to switch off the system automatically when your listening is over.

For the audio buff who likes to know about the inner workings of his rig for an extra measure of pleasure, H. H. Scott has dreamed up just the product to satisfy that inquisitiveness. It is Scott's Model 830Z "Audio Analyzer." This device, priced at \$600, can visually demonstrate the effects of tone controls, loudness contour, and filters on its 110 LED display when hooked into a receiver, preamp or amplifier. Used with a turntable, you can verify cartridge frequency response, tape bias, equalization, recording levels, as well as tape compatibility. The device can also check speakers for acoustic adjustment, efficiency, volume levels, and even optimum speaker placement.

Now, assuming you've become intrigued enough to want some of the goodies described above, you might wonder how you're going to connect them into your system. Adding one or

two would pose no problem, but let's say—just for the fun of it—that you're going to buy several add-ons. You might find yourself fighting a rat's nest of patchcords and wiring, which, of course, would upset the listening room decor, and perhaps irritate other members of the household.

Dubie Corporation comes to the rescue. Noted for its products in the sound control field, Dubie has come up with the CD-35 Sound Control System which, it says, "transforms your sound system into a music center with yourself and Dubie as talented 'Conductors.'" List priced at \$400, the unit can accommodate six recorders, two turntables, amplifier/receiver, and four pieces of signal processing equipment. In essence, the company says, the Dubie has the distinct and unique ability to allow an audio enthusiast to switch from dubbing, mixing, recording, playback, monitoring, adding sound-on-sound, and fading with no need to change patchcords. It has 23 rotary controls—enough to satisfy the most ardent buff wanting to play the role of audio engineer. ▲

SIZING UP MICRO COMPONENTS

(Continued from page 48)

system can be tall and narrow instead of short and squat. And, of course, you get the regular advantages of separates and, in many cases, pretty impressive specs.

Do micros have any user or technical drawbacks? Well, perhaps a few. Meters—where there are any—tend to be small and more difficult to read. Frequently, LEDs are used to replace them; in the mind of some, LEDs are a less felicitous indicator than the traditional meter. Knobs tend to be small and closely spaced, which makes them more difficult to manipulate than those on conventional-size gear. A particular feature that you want might be missing, but, of course, that can be true on

any component. Super-power is unavailable, although the ratings seem adequate for normal use, and the facility to strap the stereo power amp for mono operation zaps up the rating for those who can afford to double up on their power amps.

Obviously, you don't lose in terms of specifications with a micro. Many full-size components would have difficulty measuring up. If you're tired of giving up half your living space to your hi-fi addiction, or if you prefer understated contemporary styling, micros may be the answer. They're the obvious out in setting up a high-quality apartment or dorm system. Good things can (and do) come in small packages! ▲

MULTI-TRACK RECORDING

(Continued from page 39)

to \$10,000. Prices on all multi-track recorders will vary according to the number of tracks and available features. Many fine sounding recordings have been made on these low-cost multi-track tape recorders. In fact some commercially released record albums have been made on economy tape recorders in home or private recording studios. Inexpensive mixing consoles, signal processors, and various other types of recording equipment is also available.

In the last few years a new rage has been sweeping the country. Many audiophiles and musicians have been building inexpensive recording studios in their homes. Economical professional

recording equipment can be found in the pro-sound department of many hi-fi stores and music stores, or in specialty pro-sound shops. A number of commercial courses and books are available on professional recording as well as courses that are available from a number of universities. Many musicians who wish to record a master tape for a record are finding that the same amount of money they would spend in studio time will purchase the equipment for their own private recording facility or studio. Likewise many audiophiles who have a desire to be professional recording engineers can now find it within their financial reach to have their own re-

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I certify that the statements made by me above are correct and complete.

(signed) V. C. Stabile
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(signed) V. C. Stabile
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HI-FI STEREO BUYER'S GUIDE
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11	Bose	CV3
29	Celestion	8
21	Crown	4
—	Discwasher	CV2
16	Electro-Voice	10
25	GC Electronics	22
5	JBL	11
—	Kenwood	29
15	Maxell	50
28	McIntosh	16
23	Mitsubishi—Home	18, 19
24	Mitsubishi—Car	30
13	Ohm	5
9	Ortofon	23
12	Panasonic	CV4
14	Pickering	25
30	Rank	36
22	Revox	9
8	Sansui	17
17	Shure	15
18	Shure	27
6	Sony	12, 13
—	United Audio	21
26	Yamaha	1

ording studio.

If the subject of multi-track recording interests you or if this type of equipment will fill your current needs,

take the time to investigate. You will find a whole new world of sound and creativity in the world of professional multi-track recording. ▲

INNOVATIONS IN TUNER TECHNOLOGY

(Continued from page 35)

since some tones are not set to correspond with 50% modulation.)

Even if there are no Dolby-encoded broadcasts in your area, the test tone is useful to set the recording level when taping. Merely switch on the test tone and set your record-level controls for a reading of about -6 dB on the tape-deck meters. If the tone corresponds to 50% modulation, the music level will be peaking to 0 dB at maximum (100%) modulation.

If you wish to receive Dolby-encoded broadcasts properly, your tuner must be equipped with a second equalization (25 microseconds as opposed to the "standard" 75 microseconds) and a Dolby-B decoder. Many tuners afford the choice of equalization, but relatively few have a Dolby decoder built in. Without a self-contained decoder, you must use an external Dolby system (and there are precious few of them on the market!) When receiving a Dolby broadcast on a system without Dolby decoding, use the "standard," 75-microsecond equalization. You won't get the noise-reduction benefits of Dolby, but the response will be more natural than had you used 25-microsecond de-emphasis without decoding.

On the subject of external "black boxes," some tuners have a "detector-output" jack. This is meant to feed an external discrete-quadraphonic decoder if and when discrete quad is approved by the FCC. Considering the overwhelming lack of interest in quad right now, we wouldn't hold our breath!

Band Width. Many tuners now offer a choice of wide or narrow IF bandwidth. A few years back, this was a rarity indeed. Distortion is lower in the wide-band mode, and the capture ratio is better too. But, in urban areas where there are many FM stations on the dial, the selectivity of a wideband IF amplifier is insufficient to separate them. Here's where the narrowband mode comes to the rescue. By offering you a choice of bandwidths, you can set up your tuner for best reception under any conditions—wideband when the station is "in the clear" narrowband when there is a station at a nearby frequency. Some tuners make the choice for you and automatically switch to narrow.

Noise. The old "stereo noise filter" is coming back, frequently under a new name (high-blend or some such designation). Such a "filter" is not usually a filter at all but merely a blending of the two channels at high frequencies.

This reversion to mono in the treble region reduces the noise on weak stereo broadcasts while preserving some semblance of stereo imaging. With most tuners, you decide when to use the blend; others decide for you and go into auto-blend on weak stereo signals.

Don't confuse the blend or "stereo noise filter" with the MPX (or 19-kHz pilot) filter. All modern tuners have circuitry to eliminate the 19-kHz pilot that accompanies a stereo broadcast. Although inaudible in itself, the pilot "confuses" Dolby-equipped tape decks and so must be removed. Many tuners use a sharp filter to kill the pilot; others use a more modern "cancellation" circuit that subtracts out the pilot without recourse to a filter that might impair the high-frequency amplitude and phase response.

Almost all tuners now have some sort of muting circuit to suppress the interstation noise when tuning. Most tuners have a fixed muting level (the signal strength required to bring the tuner to life), others afford a choice of several levels. Still others offer you a continuously-adjustable muting point, usually via a rear-panel control. That's nice since it allows you to set the muting to an optimum level for your reception area. If there is a trend in muting circuitry, it seems to be towards combining the muting and stereo/mono switch into one. When the muting is switched off, you're in mono, like it or not.

State of the Art. Along the technological front, we should mention at least two sets (Philips AH-673 and Sansui TU-919) that offer much better-than-average AM sections. On most high-fidelity tuners and receivers, the AM circuitry is a sorry excuse indeed. In another technological area, Kenwood has developed a new "pulse-counting" FM detector circuit. This technology, which has heretofore been used mainly in the telemetry field, provides an inherently linear, wideband detector. Distortion is theoretically extremely low, and tuning becomes less critical. Kenwood is using the new technique on several products, and we'd not be surprised to find others abandoning traditional detectors for this approach.

FM tuners and receivers have reached a high level of technical excellence. We can expect future innovations, of course, but they will likely be along the lines of features and improved performance under adverse reception conditions. ▲

Why do we make more than one speaker?

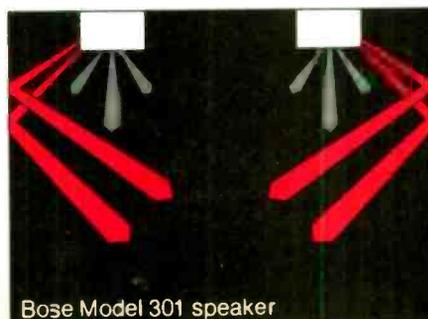
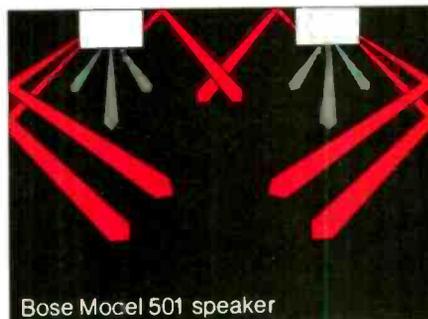
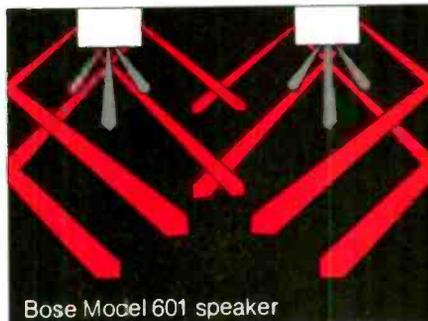
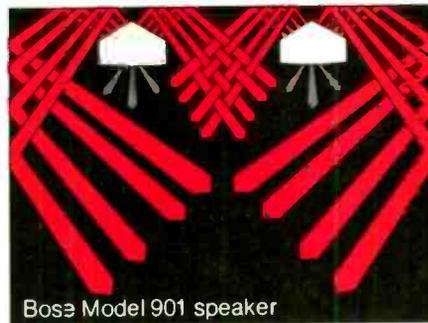
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Give it a Technics frequency-generator belt-drive turntable. Each has the ingredients to knock rumble, wow and flutter and speed inaccuracy for a loop without knocking your budget for a loop.

Technics

Model	Wow & Flutter (WRMS)	Rumble (DIN B)	Price*
SL-B1 Manual	0.045%	-70dB	\$100
SL-B2 Semi-Auto	0.045%	-70dB	\$130
SL-B3 Auto	0.045%	-70dB	\$150

*Technics recommended price, but actual price will be set by dealers.

They'll all whip your stereo system into shape, because they all combine an FG servo-controlled DC motor with electronic speed selection. What it all means is these turntables rotate accurately regardless of load or AC line fluctuations. And since speed selection is done electronically instead of mechanically, you can change speeds without stretching the belt.

But whatever speed you choose, Technics lets you choose it precisely. Because all three models have an illuminated stroboscope and servo-controlled variable pitch controls for both 33 $\frac{1}{3}$ and 45 rpm.

And whether you're playing oldies or newies, your records are in good hands with a Technics tonearm. Especially since its gimbal-suspension S-shaped design offers minimal bearing friction and precise lateral balance. There's also viscous-damped cueing. An anti-skating control for all types of styli. And front-panel controls that can be operated even with the dust cover down.

How do you improve your stereo? It's easy when you give it a good belt. A Technics belt-drive turntable.

How do you improve your stereo system? Give it a good belt.



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