AMAZING NEW VIDEO DISKS!

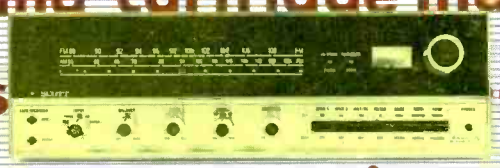
The Authoritative Magazine About High Fidelity

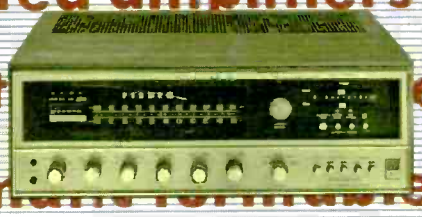
AUDIO

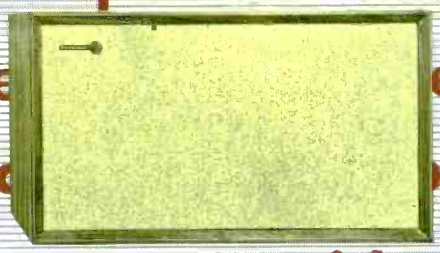
September 1970

60¢

1971 HHFI PREVIEW DIRECTORY







PLUS: our regular features

POWER and purpose are implicit in its every distinctive line...

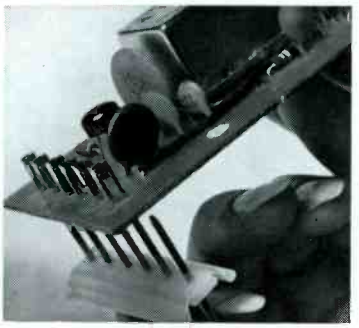
Never before has there been a receiver like the 387. Power and purpose are implicit in its every distinctive line . . . from its bold new high-visibility dial face to the sweep of its comprehensive control panel. And just wait until you experience the 387's effortless performance! A new kind of receiver power is yours to command — instantaneous, undistorted, unmatched for flexibility and responsiveness.

Inside, the 387 justifies its advanced exterior. Here are tomorrow's electronics . . . Integrated Circuits, Field Effect Transistors, solderless connections, and electronic safeguard systems to keep the 387's 270 Watts of power totally usable under all conditions.

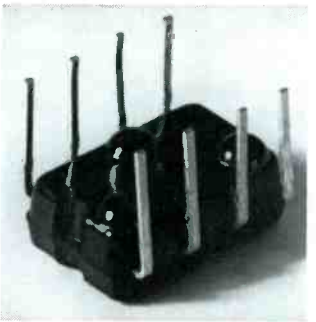
Decades of manufacturing experience and engineering skill have gone into the 387. But to really appreciate how its designers have totally rejected the ordinary, you must see it and hear it.

SCOTT 387 AM/FM STEREO RECEIVER

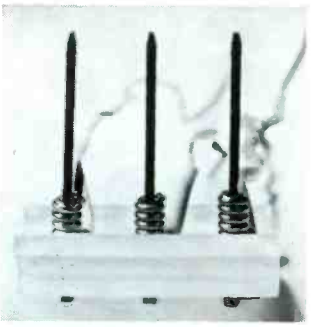
Computer-activated "Perfectune" light: Perfectune computer decides when you're tuned for the best reception and lowest distortion, then snaps on the Perfectune light.



New Modutron Circuit Board Exchange Policy: Takes over after your warranty expires; insures quick, inexpensive replacement of any plug-in printed circuit board for as long as you own your Scott unit.



Ultra-reliable Integrated Circuits: Seven IC's are included in the 387 . . . totalling 91 transistors, 28 diodes, and 109 resistors.



New solderless connection techniques: Tension-wrapped terminal connections plus plug-in circuit modules result in the kind of reliability associated with aerospace applications.

387 SPECIFICATIONS

AMPLIFIER SECTION: Total power (±1 dB) 270 Watts @ 4 Ohms; IHF music power, 220 Watts @ 4 Ohms; 140 Watts @ 8 Ohms; Continuous output, with one channel driven, 100/100 Watts @ 4 Ohms; 63/63 Watts @ 8 Ohms; Continuous output, with both channels driven, 85/85 Watts @ 4 Ohms; 55/55 Watts @ 8 Ohms; Harmonic distortion, 0.5% at rated output; IHF power bandwidth, 10 Hz — 38 kHz; Hum and noise, phone, —70 dB. TUNER SECTION: (FM); Usable sensitivity (IHF), 1.9 uV; Stereo separation, 40 dB; Capture ratio, 2.5 dB; Signal/Noise ratio, 65 dB; Cross modulation rejection, 80 dB; Selectivity, 42 dB. TUNER SECTION: (AM); Sensitivity (IHF), 4 uV @ 600 kHz; Selectivity (IHF), 32 dB.

Price: $449.95 Accessory case, extra.

Prices and specifications subject to change without notice.

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For detailed specifications, write:
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"We have never tested a recorder at this price level that could match the 1200U. Its only real competition would seem to come from the $500-and-up class of recorders."

— STEREO REVIEW, 1969

When it comes to performance, our A-1200U is the only professional-quality machine on the market for less than $300. And we wouldn't con you pros.

True, this deck isn't set up with professional rack mountings, studio output lines or N.A.B. reels – it's designed for home use. But it's right at home with a lot of pros we know. And some of them insist on taking it to work in professional broadcast operation, too.

Why not? This model meets most of the accepted broadcast standards. If you heard one on the air, you'd never know the difference between the 1200 and a pro deck with all those fancy fittings.

It's our kind of craftsmanship, your kind of cost. Plenty of unique features, too, including everything it takes to make a TEAC.

So play it by ear. You'll like what you hear. And hearing is believing.

TEAC

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2000 Colorado Avenue
Santa Monica, California 90404

A-1200U

- Triple-motored drive system
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- Mike-line mixing
- 4 independent preamplifiers
- Automatic tape lifter
- All-pushbutton controls
- Stereo echo for special sound effects

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AUDIO

Successor to RADIO, Est. 1917

SEPTEMBER 1970 Vol. 54, No. 9

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AUDIO (title registered U. S. Pat. Off.) is published by North American Publishing Co., I. J. Borowsky, President; Frank Nemeyer, C. G. McProud, and Roger Damio, Vice Presidents; R. Kenneth Baxter, Production Director; Nate Rosenblatt, Promotion Director; Mary Claffey, Circulation Dirrctor. Subscription rates—U.S. Possessions, Canada, and Mexico, $5.00 for one year; $9.00 for two years; all other countries, $8.00 per year. Printed in U.S.A. at Philadelphia, Pa. Second class postage paid at Phila., Pa.

REGIONAL SALES OFFICES: Jay L. Butler and Sanford L. Cahn, 41 East 42nd St., New York, N.Y. 10017; Telephone (212) 687-8924.
Jay Martin, 15010 Ventura Blvd., Sherman Oaks, Calif. 91403; (213) 981-7852.

REPRESENTATIVES: United Kingdom: H. A. Mackenzie and Peter E. Holloway, 4a Bloomsbury Square, London W.C.1. Tel. HOL-3779.
Continental Europe: John Ashcraft, 12 Bear St., Leicester Square, London W.C. 2. England. Tel. 930.0525. For Benelux & Germany; W. J. M. Sanders, Mgr, Herengracht 365, Amsterdam, Holland. Tel. 24.09.08.
Japan: Matsushita Inc., Highness Takanawa, Room 405, 8-33 Takanawa 4-chome, Minato-ku, Tokyo, Japan 108.

AUDIO Editorial and Publishing Offices, 134 N. 13th St., Philadelphia, Pa. 19107
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Why an automatic turntable from Swindon, England has made it big in the States.

At the risk of seeming immodest, we've had a smashing success in the United States.

There are more Garrards being used in component stereo systems here than all other makes combined.

Even *we* find this a curious fact.

But the die was cast thirty-odd years ago.

Not parity, but superiority

H. V. Slade, then Managing Director of Garrard Limited, decreed, "We will sell a Garrard in the U.S. *only* when it is more advanced than any machine made there."

H.V. Slade, O.B.E.

A commitment to, not parity, but absolute superiority.

Spurred by it, Garrard of England has been responsible for every major innovation in automatic turntables.

In the thirties, Garrard pioneered the principle of two-point record support. Still the safest known method of record handling. Oddly, still a Garrard exclusive.

In the forties, we introduced the aluminum tone arm. Today, widely used by makers of fine equipment.

By 1961, increasingly sensitive cartridges had led us to adapt a feature originally developed for professional turntables: the dynamically balanced tone arm, with a movable counterweight to neutralize the arm and an adjustment to add precisely the correct stylus tracking force.

In 1964, we added an anti-skating control, and patented the sliding weight design that makes it permanently accurate.

Then, in 1967, Garrard engineers perfected the Synchro-Lab motor, a revolutionary two-stage synchronous motor.

The induction portion supplies the power to reach playing speed instantly. The synchronous section then "locks in" to the 60-cycle frequency of the current to give unvarying speed despite variations in voltage.

"We're bloody flattered"

This year one of our competitors has introduced a copy of our Synchro-Lab motor on its most expensive model.

To quote Alan Say, our Head of Engineering, "We're bloody flattered.

"After all, being imitated is a rather good measure of how significant an innovation really is."

The new Garrard SL95B features still another development we expect will become an industry standard.

Garrard's viscous damped tone arm descent—originally offered to provide gentler, safer cueing—now operates in automatic cycle as well.

It seems only logical. Yet, for the present at least, it is another Garrard exclusive.

Other 1970 Garrard refinements include a counterweight adjustment screw for balancing the tone arm to within a hundredth of a gram. A window scale on the tone arm for the stylus force gauge. And a larger, more precise version of our anti-skating control.

Un-innovating

At the same time, we've eliminated a feature we once pioneered. A bit of un-innovating, you might say.

Garrard's disappearing record platform is disappearing for good.

We've replaced it with a non-disappearing record platform. A larger, stronger support with an easy-to-grasp clip that fits surely over the stack.

A small thing, perhaps.

But another indication that H.V.'s commitment remains with us.

$44.50 to $129.50

Garrard standards do not vary with price. Only the degree of refinement possible for the money.

There are six Garrard component models from the SL95B automatic turntable (above) for $129.50 to the 40B at $44.50.

Your dealer can help you arrive at the optimum choice for your system.

Garrard

British Industries Co.,

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Coming in October

STEREO RECEIVER LEXICON:

Len Feldman continues his very informative article which tells you all you want to know about receiver specifications.

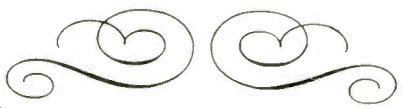
SOUND REINFORCEMENT:

Don Davis concludes his article on the use of a computer to design Sound Installations

EQUIPMENT PROFILES include:

Marantz Model 30 Amplifier
Electro-Voice Model 100 Compact System
B & O Stereo Cartridge Model SP-12

PLUS
Record and Tape Reviews and all the regular features.



About the cover: Reading from left to right we have the **Sony-Superscope 850** tape recorder, **Scott 387** high-power receiver, **Fisher 701** 4-channel receiver, **Garrard SL75B** turntable, **Rectilinear VI** loudspeaker, **Teac A-24** stereo cassette unit, **RCA HK-98** microphone, and **Koss PRO-4AA** dynamic headphones—which adds up to a nice set of equipment!

Audioclinic

JOSEPH GIOVANELLI

Television Interference

Q. I live within 200 feet of an aircraft control tower. Any time I am watching television, and when this tower is transmitting instructions to aircraft, the television sound is completely blocked out. What I do hear are such things as: "Clear to land." "Report left down wind."

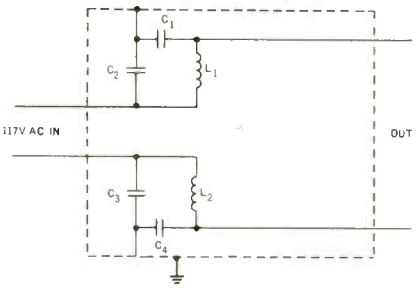
What corrective action can be taken to eliminate this source of interference?

Sp/5 John Hauron, APO San Francisco, California.

A. I am not sure that I can help solve this interference problem. The front-end circuitry of television receivers has never been what it ought to be in terms of selectivity. Therefore, strong, off-frequency signals simply enter the set and overload its front end.

Disconnect the antenna from the set and note if the interference is still present. If it is, there are two courses of action which must be tried.

First, you will have to try filtering the a.c. line, inside the receiver itself. Small



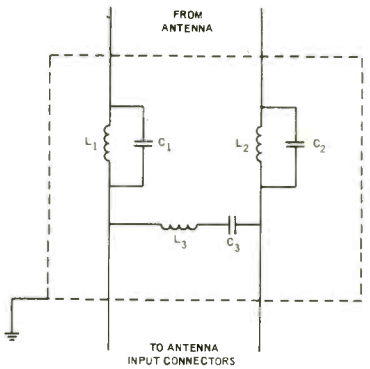
$C_1C_2C_3C_4$ 500 pF mica.
L_1L_2 20 turns #18 enamelled wire on ½-inch dia. form, close spaced.

Fig. 1—Line filter.

r.f. chokes can be placed in series with each side of the line, and all four sides of the r.f. chokes should be bypassed to chassis ground. See Fig. 1. The capacitors used should be mica and their values should be at least 500 pF. I repeat that the components making up this filter should be mounted inside the set, preferably in a shielded box, with the shield grounded. If the components are mounted outside the television set, it is extremely likely that the lead between the line filter and the set itself will be sufficiently long as to pick up signal, and passing it into the receiver.

If the interference is not caused by linecord pickup, it is probably the result of insufficient shielding of the TV set's circuitry. Line the entire cabinet with tinfoil and return this foil to chassis ground at several places. Be sure to wedge some foil around the channel selector knob. I have observed that this shaft is sometimes not at r.f. ground potential, and can act to pick up unwanted signals.

Of course, if disconnecting the antenna does eliminate the interference, you will



Circuits tuned to interfering signal.
Fig. 2—Interference trap.

need another approach. Parallel resonant circuits should be inserted in series with each antenna lead. A series resonant circuit should be shunted across the antenna circuit. See Fig. 2. If the antenna circuit employs a simple monopole, or whip, only one parallel circuit is required. The series resonant circuit is connected between the antenna and ground.

These resonant circuits should be placed as close to the actual TV tuner's input terminals as possible. This is necessary in order to eliminate unwanted pickup by the length of lead between the TV tuner and the interference traps.

These circuits are tuned to the frequency of the control tower's transmitter.

The resonant circuits should be placed in a metal box, with this box grounded to the television set's chassis. Some experimentation might be necessary in order to locate the best ground point—making the shield most effective.

It is possible that interference may be introduced into your television set not by just one, but by a combination of the various factors dealt with in this discussion. Therefore, to eliminate this interference, you would have to employ a combination of the remedies suggested in this article. Æ

When you're #1 in tape recorders, you don't make the #2 tape.

If you've got a few hundred bucks tied up in a first-quality tape recorder, you're not going to want to gum up the works with second-rate tape. Especially when just a few extra pennies buy the finest Sony professional-quality recording tape.

Not only will Sony tape make any recorder sound its best, but it'll keep it sounding that way. Because our tape won't shed or cover tape heads with a performance-deteriorating oxide coating. Head-wear, too, is minimized, thanks to Sony's exclusive Lubri-Cushion process, which impregnates the tape with long-lasting lubricants.

Sony tape comes in all configurations: Open reel. Eight-track. Cassettes.

Open-reel tape is available in 3¼", 5", and 7" sizes. The new Sony SLH-180 low-noise, high-output tape is available on 7" reels only. And "Easy-Threader" tabs make every Sony open reel self-threading.

Our professional-quality tape is also available in eight-track stereo cartridges plus new Easy-Matic cassettes for both functional and stereo units, with 60, 90, or 120 minutes' recording time.

To hear the best, play the best. Sony Professional-Quality Recording Tape. From the people who offer the number-one line of tape recorders–Sony/Superscope.

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You never heard it so good.®

180 WATTS of SANSUI POWER

SANSUI 5000A

180 (IHF) watts of Sansui power are built into the 5000A—an AM/FM stereo receiver that has been created for the connoisseur who demands the ultimate in tonal magnificence and clarity of sound. The Sansui 5000A *features a new FM Pack with linear tuning for greater selectivity and pin-point station selection* . . . All-Silicon AM tuner for maximum stability . . . inputs for three separate sets of speaker systems . . . records up to 4 tape decks simultaneously . . . just a few of the features which will make the Sansui 5000A the nucleus of your most comprehensive hi-fi music system for years to come. At your Sansui Audio Dealer. $399.95

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Video on Disk

First public demonstration of a new video disk took place in Berlin on June 24. This remarkable achievement is the result of more than seven years work by a team of engineers from Telefunken, British Decca, and AEG. The new techniques evolved will almost certainly revolutionize present-day disk recording methods and may lead to new thinking on quadraphonic records. Video disks, *per se* are not really new—John Baird the British pioneer, recorded TV on 78-rpm records as long ago as 1927. But his system used only 30 lines and definition was pretty poor, as I well remember. Picture size was around one or two inches and if you saw anything recognizable you were lucky! However, modern high-definition TV is another story and recording it on a disk poses almost insurmountable problems.

Biggest headache is the wide bandwidth involved—more than 3 megahertz against a mere 15 kHz used for audio recording. This problem was eventually solved by several ingenious methods. First, a new recording system (hill and dale—back to Edison!) was designed which cuts 130 grooves per millimeter—10 times as many as used by conventional disks. Then a lower recording amplitude was adopted which still gives a signal/noise ratio of 40 dB. The third innovation was the use of an FM recording system that enables all frequencies to be cut at the same amplitude so the grooves can be packed closely together with minimum spacing.

(Continued on page 96)

JVC introduces the New Super Naturals

Fabulous new features plus Advanced SEA* add up to the ultimate listening experience — Super Natural Sound! Yours to enjoy in four exciting new models from JVC. Check them out at your dealer today. Or write us direct for color brochures and the name of your nearest dealer.

JVC Model 5010. Moderately priced AM/FM multiplex stereo. Has Advanced SEA with knobs that click up or down in 2db steps within a range of ± 12db, just like the more expensive models. 40 watts total dynamic power. Five IF stages. New FET reachs out for distant FM stations. 1% IM distortion. Accommodates 2 speaker systems simultaneously. Wood cabinet.

JVC Model 5020. Superb AM/FM stereo with Advanced SEA. Automatic FM. 75 watts dynamic power. FM linear scale dial. FET ultra-reliable circuitry. Separate pre-and main amplifier sections. 1% IM distortion at rated power. 30-30,000 Hz bandwidth for crisp, clean sound. Wooden cabinet at no extra cost.

JVC Model 5030. Sophisticated beauty. AM/FM multiplex stereo with automatic FM and Advanced SEA. Brilliant 140 watts output. FM linear scale dial pinpoints stations on crowded FM band. IC modules plus new ultra-sensitive FET frontend. 15 to 30,000 Hz bandwidth. Infinitesimal 0.8% distortion. Built in pre-and main amplifiers. Wood cabinet.

JVC Model 5040. 200 watts concert hall quality AM/FM stereo. Advanced SEA. 0.8% distortion at full output. Handles 3 stereo speaker systems. Automatic FM. IC modules for near perfect reliability. Separate pre-and main amps. Computer designed FET. 10 to 30,000 Hz bandwidth. Hand rubbed wood cabinet.

JVC Catching On Fast

JVC America, Inc., 50-35, 56th Road, Maspeth, New York, N.Y. 11378

***Stereo Review** acclaims JVC's exclusive Sound Effect Amplifier (SEA) as "the most effective tone control system ever devised." Advanced SEA divides up the sound spectrum into 5 channels, gives you control of each for out of this world sound.

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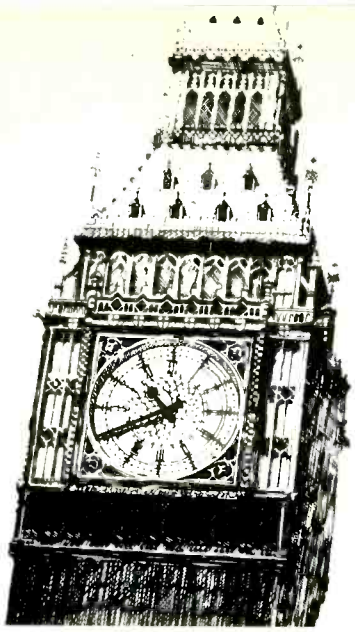


London Letter

Donald Aldous is a well-known British authority on Hi-Fi. He is Technical Editor of *Record Review* and an Editor of *Hi-Fi News*.

By way of introduction to this first newsletter from England, may I offer a sort of critic's credo? I believe that sound recording and reproduction has come a long way towards the goal of perfection—whatever that means in this connotation—since I started writing about the subject in 1934, but today even with so-called "state-of-the-art" systems, we still have a long way to go to achieve that pinnacle of fidelity. I have brooded long and hard on the subtleties of music reproduction, whether its purpose is to bring the performers into the listeners' homes or should the listeners be transported into the concert hall environment? So we come into the areas of spatial, ambient, and stereophonic perception, leading on to the aesthetics of listening, touching on the psychology—indeed, some say the psycho-pathology—of the hi-fi addict! I have peered into the ceramic ball—the crystal ball is outmoded—and I am not appalled by what I have seen for the audiophile and music lover of the future. Some enthusiasts may still be listening to the music to hear the loudspeakers, whilst others tolerate the loudspeakers to hear the music, to paraphrase Peter "Quad" Walker, but the expanding availability of simple high-quality methods (tapes, cassettes, cartridges, disks, and the latest electronic techniques enveloping video, in addition to audio programmes) is not anathema to me, as it appears to be to some old-school musical purists.

I agree with John Culshaw (formerly Decca Record Company producer, now Head of Music, BBC Television), as he says in his book, *Ring Resounding*, "Mass communication by means of records and television and radio does not, as some Jeremiahs predict, necessarily mean a lowering of standards; on the contrary, over a long enough period, standards are bound to rise. The better is still the enemy of the good, and the general accessibility of art in all forms is a fine thing, even in its unconscious effect on those who profess to have no interest in it."

Sound should make love to one's ears, as a Swedish friend remarked to me years ago, and this sonic enchantment remains with me, despite the subject being a profession. If that magic ever dies, I shall give it up—and stop eating!

* * *

Talking of Sweden reminds me that I had the pleasure recently, with a few other technical journalists, to go over to Stockholm to get a briefing firsthand on the plans of the Sonab organization to launch a range of loudspeakers and allied equipment in the hi-fi world. Guided by the executive director of the new British company, Sonab Ltd. Derek Cheney (formerly with Bang & Olufsen and Hanimex (Toshiba Division) in UK), we were intrigued to learn that the organization is now fully Government owned, and is a subsidiary of Stratsforetag AB, a huge nationalized group of 24 different companies, having many interests in forestry, pharmaceuticals, shipbuilding, chemical, mechanical and electronic engineering. The share capital of the group is around SKr: 1,700 million ($340 millions) and, at present, the Sonab hi-fi equipment are the only "nationalized" consumer products, as all the other items are made for commerce or industry. Sonab GmbH. in Dusseldorf, West Germany, has also been established recently, with Hans Wagner, as the overall President. We met Mr. Wagner during our tour and if dynamism and forward-thinking produces success, this new Sonab project will help the company attain its 1975 target of a turnover figure of about 19 million dollars. This expanded programme, of course, covers the whole field of communications, not merely hi-fi, and it is planned to recruit 45 development engineers by the end of 1970.

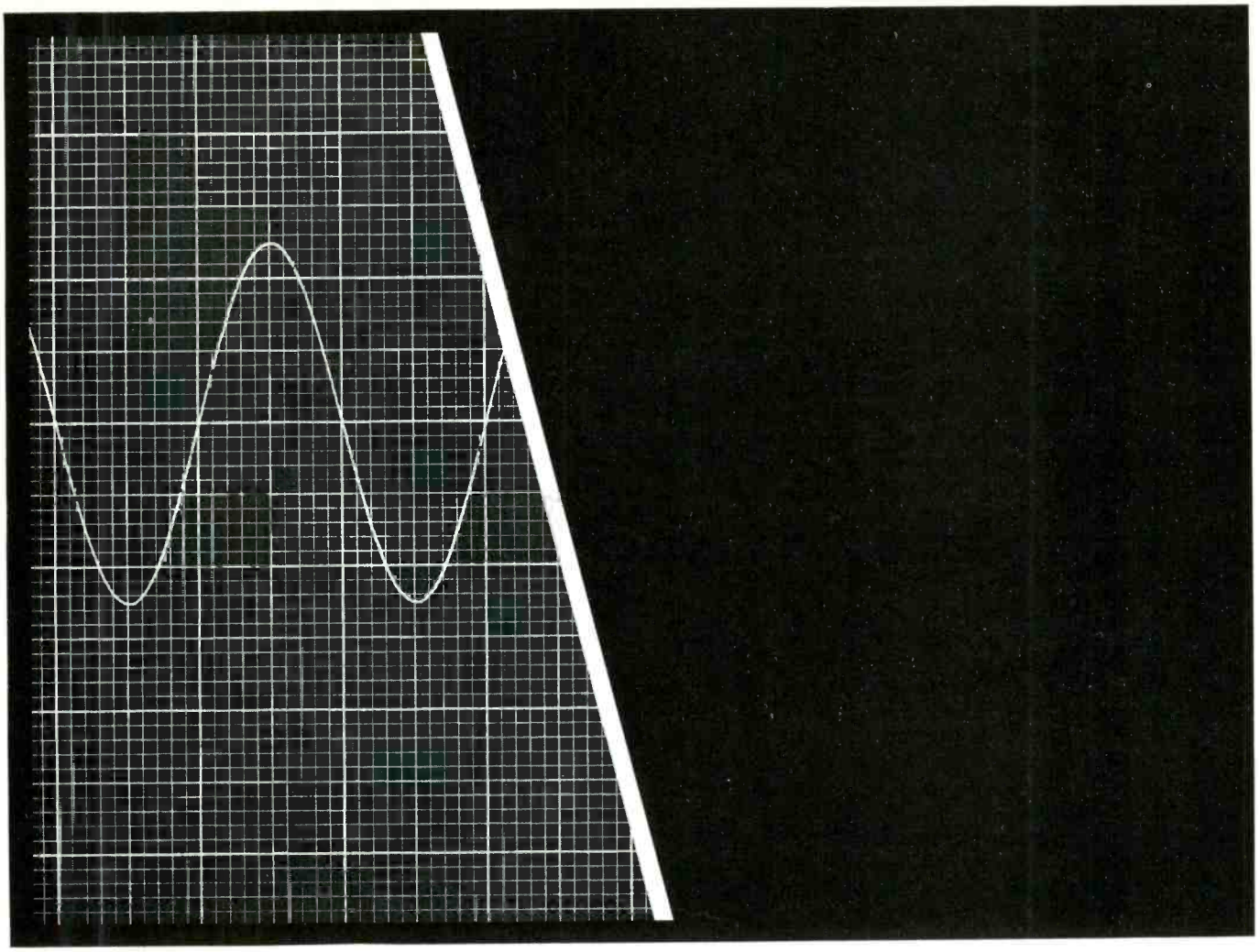
All the Sonab loudspeakers are in the upper price bracket and, with one exception, employ a multi-unit array mounted to radiate upward and outward omni-directionally. The enclosures are of the bass reflex type, and the most expensive model—which will sell in UK for the equivalent of some $380—for which it is claimed that "no other speaker, only the original sound itself, can compete."

Six units are fitted, comprising an 8½ in. bass driver and an 8½ in. wide-range mid-register unit (both made by Philips) and four 2 in. tweeters.

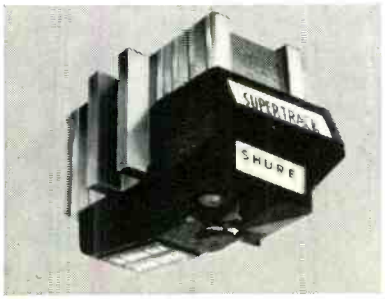
The other items from Sonab include an advanced FM tuner-amplifier and a sophisticated record turntable unit. The tuner-amplifier R.7000 delivers 35 W rms per channel into 8 ohms, with harmonic distortion, at 1 kHz less than 0.02% at 8 ohms. Tuner section sensitivity is 1.4 μV (DIN) and 1.5 μV (IHF). Features include rumble filter (5 dB at 100 Hz) and three h.f. filters. The turntable unit, 70S, is operated by only two buttons, and is powered by a four-pole synchronous two-speed motor, through a belt drive. The pickup arm is mounted on a ball-bearing and is claimed to be completely free from "torsion resonance." A Shure M75MG type II cartridge is fitted. These products are manufactured in Japan, by Yamaha, to Sonab specifications.

* * *

Audio fairs, festivals, exhibitions, and other gatherings of the audio clans are proliferating in the UK. We had one show in Manchester lately at which musical instruments, sound amplification, and "pop" groups were assembled under one roof, culminating in a cacophonous bedlam and a sharp rise in sale of aspirins and ear-plugs. Apart from the long-established Audio Fairs (organized by Cyril Rex-Hassan), the 1970 version of which will be held in the large



Finally! A visually perfect sine wave!



The sine wave above was generated by Shure's design computer—it looks like the sine wave that was generated by the *Shure V-15 Type II Improved* Super Track Cartridge in the Hirsch-Houck testing laboratories . . . "the first cartridge we have tested to have done so," according to their published report. This perfect sine wave was generated during the playing of the heavy bass bands on the Cook Series 60 test record at ¾ gram, and the 30 cm/sec 1,000 Hz band of the Fairchild 101 test record at 1 gram. They were impressed, and we were pleased. And we'll be pleased to send you the full Hirsch-Houck Report on the "trackability champion." Shure Brothers Inc., 222 Hartrey Ave., Evanston, Ill. 60204.

SHURE

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BEHIND THE SCENES

BERT WHYTE

BOBBY HACKETT is a short, slight, puckish man with a thin mustache and thinning hair. He is generally conceded to be one of a handful of great trumpet players (although he prefers the cornet) in this country. Often known as a "musician's musician," he combines phenomenal technique and control with a golden, lambent tone that is instantly recognizable and as distinctive as his signature. What is less well known about Bobby is that he is an audiophile of long standing. Recently I had the pleasure of visiting Bobby at his home in Queens, New York. At the rear of his home, what was once a large, solidly built brick garage had been converted to a stereo listening room and a place where he could practice. Bobby has air-conditioned the place and acoustically treated the ceiling and back wall. At one end of the room he has his stereo system. The rest of the place is a fascinating melange of cornets hanging on the wall, piles of records and tapes, bongo drums, music scores, a rack from which are suspended dozens of audio cables in every kind of configuration, a table with dozens of mouthpieces, and bric-a-brac too numerous to mention. Bobby is a pleasant man to talk to, singularly free of the pretensions and mannerisms affected by many top artists. The old cliche, "modest and unassuming," is in this case an apt description. I made a recording of a conversation with Bobby and he has kindly consented to my putting it in print.

Bobby Hackett (with his new Benge cornet) and Vic Dickenson

BW—*Bobby, I believe you've been in the music business over 40 years. Is that correct?*

BH—Yes, and I'm going to stay in it "till I get it right."

BW—*What was the first "name" orchestra in which you played?*

BH—Oh, that would be Horace Heidt. I was one of his "Musical Knights." I stayed with him for a year and then I got time off for good behavior.

BW—*You spent some time with what we called the Big Bands. Who were some of the leaders with whom you were associated?*

BH—I was with Paul Whiteman for about 15 years, and played with Glenn Miller for a few years. But all during that time I had my own small groups, and for the most part, that's what I've been doing ever since.

BW—*You mean by small groups, the famous quintets and sextets you have formed over the years, and through which most people are familiar with your playing?*

BH—Yes, I feel more comfortable with a quintet made up of really top players. We develop a style and feeling and eventually the rapport that is so important to good music making.

BW—*Would you compare a jazz quintet as an analagous thing with a classical string quartet? I mean that in the sense of the musicians wanting to play for the fun of it, for the dedication that comes with such intimate, personal playing.*

BH—I see your point. Yes, there is no doubt the really top guys like to play in small groups. You know, they dig each other, there is more freedom of expression, everybody stays loose and the result is good jazz.

BW—*Bobby, I suppose with your various groups you must have played in every night club in this country and abroad as well.*

BH—Well, I may have missed a few.

BW—*I understand Vic Dickenson, who was a frequent member of your quintets, is now with the group called the "World's Greatest Jazz Band."*

BH—Yes, Vic has gone from Bobby Hackett to Bobby Haggert. Actually Vic and I have worked on and off with each other for some 30 years.

BW—*Didn't you and Vic make some of the very earliest pre-recorded jazz tapes? I believe they may have been issued by Livingston.*

BH—If we did I don't remember. Vic did make some tapes with Rudy Braff, which I think were put out by Vanguard. I think he made some with Muggsy Spanier, too.

BW—*Is that so? I recorded Muggsy years ago for Paul Weathers—we called the album "Dynamic Dixie," and at the time, it was recorded with some fancy mikes called Telefunken.*

BH— I remember that album, because they were using it for demonstration at one of the early Audio Fairs.

BW—*Bobby, when did you first get interested in audio?*

BH—It was a long time ago, really at the inception of hi-fi. I remember using some early Fisher equipment and some Altec.

BW—*Most of us figure hi-fi as we know it got underway about 1946 or so.*

BH—I had one of the original Brush Soundmirror recorders. Anyhow, it all started long ago and I'm a hopeless case. I'm hooked. I just love good sound.

BW—*Do you remember the equipment you had in what you consider as your first really good hi-fi system?*

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RCA Recording Tape

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BH—Let me see . . . I had a Fisher tuner, McIntosh pre-amp and amp, and I recall I was very partial to the Jensen Triaxial speaker. When stereo tapes arrived on the scene, I acquired a Wharfedale speaker and even though it didn't match with the Triaxial, it wasn't too bad and I sure enjoyed the stereo. Speaking of stereo let me tell you a story. As you know when stereo tapes first came out, they were spectacular things for big symphony orchestras—things like the "Firebird" and similar stuff. There was virtually no jazz on stereo tapes.

BW—*Well, you know whose fault that was . . . the musician's union.*

BH—Oh, yeah! That was when they wanted a double fee to record because stereo was on two tracks!

BW—*Yes, and that is when I went to Petrillo's office with the portable Magnecord stereo equipment and headphones and played classical and some bootleg pop stereo tapes for him. He listened for awhile, then ripped the phones off his head and roared that with canned music that good, musicians would soon all be out of business. When I pointed out that none of the old recordings could be converted to stereo, and this meant that even the old warhorses would have to be recorded in the new process, he calmed down. Shortly afterward the union gave the green light for stereo recording at the prevailing rates.*

BW—*Fortunately it wasn't long after the introduction of classical stereo that pop and jazz started to appear. First we had the Vanguard tapes I mentioned earlier, then the dam really broke and we had all sorts of tapes, like the Dick Shory percussion spectaculars, and all those "ping-pong" tapes of pop music.*

BW—*You feel the recordings are great training and teaching tools?*

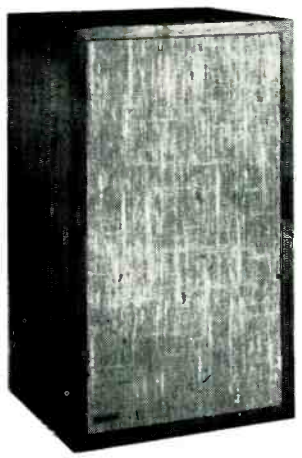
BH—Just fantastic. You know, when we are up on the bandstand, we're concentrating on playing and entertaining the customers. We are doing things that we are totally unaware of until we play the tapes back.

BW—*Doing these recordings also allows Bobby Hackett, recording engineer, to indulge in his favorite avocation?*

BH—I'm a frustrated engineer, and I just love recording.

BW—*You've got to be a pretty good recordist. Those tapes you played for me earlier were of superb quality, and all the more remarkable since you are obviously working under a handicap in most night clubs.*

(Continued on page 106)



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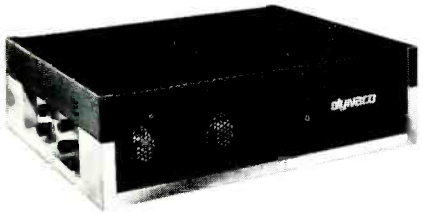

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Tape Guide

HERMAN BURSTEIN

Engine noise, fading etc.

Q. Would you be so kind as to answer the following three questions concerning tape recording:

1. I now have installed in my automobile a 4-track auto tape playback cartridge machine. I installed the speakers for the machine in the rear seat area, using standard zip cord to connect them with the machine, which is mounted under the dashboard. I am experiencing noise mixed with the tape program while the engine is running; apparently the source is the alternator or other part of the ignition system. I realize that shielded speaker leads and/or ignition noise-suppression devices installed in the engine compartment are probably the answer to my problem, but do not know how the shielded leads should be connected, or what type of suppression devices are required. Please advise.

2. In an electronics publication I noticed a simple gadget that was suggested as an improvement for tape recorders. It is a simple pot connected so that the erase head of the recorder could be put into operation gradually. The suggested use was at the end of a recording, so that a gradual fadeout could be accomplished. Would you recommend installation of this device in my tape recorder, which is a semi-professional machine costing $600? Or would the problems that I might run into outweigh any advantage that might be gained?

3. I am very interested in learning more about tape recording, leading possibly to a career in this field at a later date. However, I know of no sources for information concerning the practical aspects of professional recording. Do you know of any textbooks or sources that are offered on the subject? I have learned of some broadcast engineering courses offered by correspondence institutes. Would these be worthwhile? — Richard L. Wayner, North Palm Beach, Florida.

A. (1) I doubt that your ignition noise is picked up by the speaker leads. More likely it is picked up by the tape electronics, and you would go about eliminating this pickup in much the same way as for a car radio. If I am wrong and the speaker leads are the culprit, you could use microphone cable as the speaker leads. Three-wire cable (two inner conductors) *might* work better; the outer (ground) wire would be connected to ground of your tape machine.

2. I am dubious about making any serious modification of an expensive tape machine, such as you mention in connection with a fadeout device. You might try installation of the device, note whether performance deteriorates in any way, and remove the device in case performance does deteriorate. I suspect that changing the amount of oscillator current reaching the erase head will affect the amount of bias current reaching the record head, and in turn performance will be affected in terms of treble response, distortion, and signal-to-noise ratio.

3. I cannot advise you on correspondence courses having to do with recording. As for texts, I suggest you consult your library. There is an index of textbooks, by subject, which you might find in your library. One book of professional caliber on magnetic recording is that of W. Earl Stewart, *Magnetic Recording Techniques*, McGraw-Hill Book Company, Inc., New York, N.Y.

Tape Prices

Q. I can get 1800 feet of 1-mil polyester tape for $1.25 a reel, or similar tape for $2.25 a reel. Which is the best value, or are both tapes not worth buying? (George Katzmarek, Jr., Warren, Michigan)

A. You tend to get what you pay for. Chances are that the more expensive tape will be better lubricated, more precisely slit (and thereby avoid skewing

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DC300 Laboratory standard basic amplifier. 300 watts per channel RMS, complete output protection, extreme purity, shown in walnut cabinet

D40 The ideal monitor amplifier. 40 watts per channel RMS, compact, low distortion, shown in walnut cabinet.

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Tape Guide (cont.)

or sticking), have better magnetic characteristics (frequency response, distortion for a given recording level, etc.), have more uniform characteristics throughout the reel and from one reel to the next, and so forth. True, one does sometimes come across a good buy in "unbranded" tape, but the tape which may be a good buy one day may not be so at another point of time.

Recording Bias

Q. I have read that ". . . a specified value for bias voltage across the record head more nearly assures a constant bias field than a specified current." Is this true? (C. J. Woodcock, Chicago, Illinois)

A. This statement is new to me, both in terms of what appears elsewhere in the literature and my own experience. The usual professional way of measuring bias current through the record head is by measuring the voltage across a small resistor in series with the ground leg of the head. The resistor is much smaller in value than the impedance of the head at the bias frequency, and therefore has negligible effect on bias current. Current through the head is calculated by Ohm's Law, based on measured voltage and resistor value: I=E/R.

D. C. Bias

Q. With reference to the use of d.c. bias in recording, just how linear is it? (C. J. Woodcock, Chicago, Illinois)

A. I don't know that d.c. bias produces more distortion than a.c. bias. The principal objection to d.c. bias, so far as I know, is that it results in more noise than a.c. bias and tends to magnetize the tape heads. The amount of distortion depends upon the amount of bias current and upon the level of the audio signal.

Computer Tape

Q. I have access to high-quality digital and analog computer recording tape. I would appreciate comments on the subject. (Dr. John R. Sturgul, Tucson, Arizona)

A. Tape made for computers may have substantially different frequency-response characteristics than tape made for audio, requiring changes in bias current and equalization. Æ

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 134 North Thirteenth Street, Philadelphia, Pa. 19107. All letters are answered. Please enclose a stamped, self-addressed envelope.

LONDON LETTER

(Continued from page 10)

Olympia hall from October 19th (tradeday) to 24th, a successful audio show, called Sonex '70, was staged a few months ago at the Skyway Hotel, adjacent to London Airport. This is not a ridiculous site, as the soundproofing of the rooms made listening conditions acceptable, although accommodation of not more than 12 to 14 people was the maximum possible. Acoustic Research's first British demonstration of four-channel stereo, variously known as "quadraphonic" or "quadrosonic," mounted by Bell & Howell's representatives, led by Manager Denis Wratten and Martin Borish (AR, in USA) attracted tremendous interest, not all favourable, but the system has a future, I think, when tastefully used. Seating position in relation to the four loudspeakers is important, even critical, but the effect of being immersed in sound—particularly on audience applause—and the simulation of the concert-hall environment I found most impressive.

Loudspeakers continue to attract designers, and many types and sizes of reproducer were seen and heard at this show. John Wright's Monitor and Studio models, employing the "transmission line" principles, originated by Arthur Radford and Dr. Bailey, although in his own manner in the Transmission Electronics Company speakers. Irving "Bud" Fried is handling this product in the USA, with other top-grade British audio items. Yet another loudspeaker, incorporating the acoustic transmission line approach, has been developed by Bert Webb for Cambridge Audio. This has an l.f. driver in damped tapered labyrinth, and the h.f. driver in a damped tapered pipe, plus two pressure h.f. drive units. Frequency range from 25 Hz to 25 kHz with crossover frequencies at 400 Hz, 3 kHz and 10 kHz.

Quad (Acoustical) remain the only firm here manufacturing a full-range electrostatic loudspeaker, and rumours are streng that a Mk.II version is under development, but no release date known. A trend would seem to be the marketing of do-it-yourself loudspeaker assembly kits, which offer the advantages of reducing packing and transport costs, and the cabinet finish can be in any preferred styling. Firms offering these kits in England are KEF, EMI, Heathkit (Daystrom), Wharfedale, and Richard Allan. Rola-Celestion produce three loudspeakers, with the two bigger models, Ditton 15 and 25 having an auxiliary bass radiator (ABR) that helps to produce a most pleasing sound. Donald Chave (Lowther) demonstrated his new "Auditorium" sound, a combined forward/rearward speaker system that certainly locates the sound within a frame, as it were.

Rogers Developments had a demonstration in which their new Ravensbrook 3-speaker system was fed from a single Ravensbrook stereo amplifier or six such amplifiers connected in cascade. This illustrated the high performance of the overall system and confirmed the fact that transformer coupling in these models does not impair performance. With six amplifiers, the signal is amplified through twelve transformers, but virtually no audible quality change was apparent, with a switchover from the single channel.

Cambridge Audio is part of an electronics' group that has created a remarkable amplifier, model P.4D, which has an exceptional input overload characteristic that cannot, in fact, be overloaded by any known recording. Mr. J. E. Sugden has another unconventional amplifier design which employs a Class A output stage, which means lower efficiency, but the distortion is reduced as the volume level drops.

FM tuners abound here (covering the range 88-108 MHz) with variable or pre-set tuning, although the big influx of models from Germany, Denmark, Japan, and the USA leaves little scope for the indigenous designer, unless he can develop a model suitable for an overseas market. This means creating a high-sensitivity and -selectivity circuit, with many pre-set buttons (the UK has only three groups of FM/VHF transmissions), and finding a style of presentation acceptable to a world-wide market. We saw the Leak "Stereofetic," the Rogers Ravensbrook, and a model from J. E. Sugden, as well as a very sophisticated prototype from Cambridge Audio. Still only in the laboratory stage, it is a "tracking filter" design, a phase-sensitive system, with a signal-amplitude display that simplifies aerial alignment and signal selection. The r.f. gain control gives good linearity in areas of high local-station interference. The unit has AOS (acquisition of signal) and stereo transmission lights to simplify accurate tuning. It is said that later models (when and if actually produced) will include an optional digital clock station selector, and digital read-out of frequency to eliminate tuning-dial errors. This unit will be expensive, perhaps more than $240.

Although not actually exhibiting at this Sonex '70 exhibition, we did meet our old friend Alec Rangabe, designer of the Trutrack radial arm (with mercury contact float chamber which he has high hopes will be marketed this year. More news soon. *D.A.* Æ

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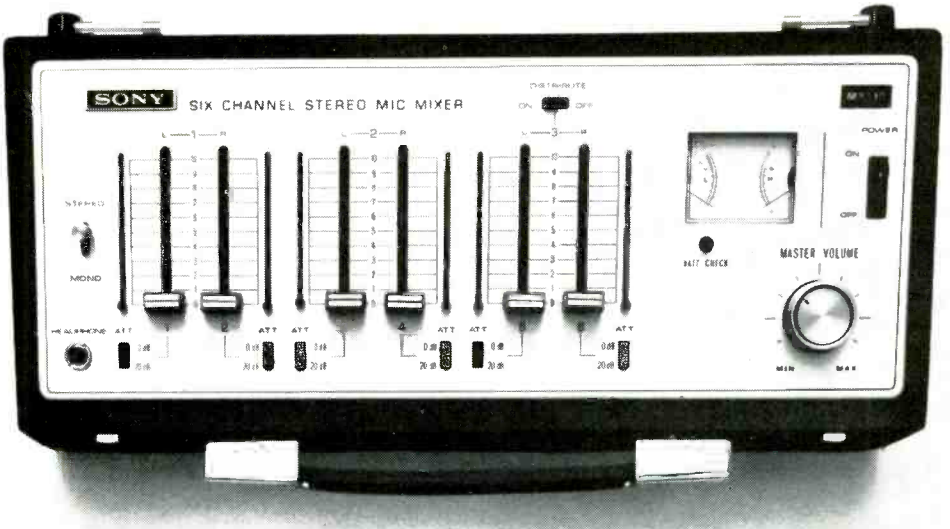

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2&3. When you want to hook up one tape recorder to another, Sony adapters make the operation simple. The PC-1 Plug Adapter converts Phone Plugs to Mini Jacks and the PC-2 Plug Adapter converts Mini Plugs to Phone Jacks. Priced at just $2.75 a pair.

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7&8. Two Sony accessories are designed to combat the effects of long usage, keeping your Sony tape recorder performing like new. The Sony CLH-1 Head-Cleaning Pen makes maintenance quick and easy. The high flux-density HE-2 Head Demagnetizer eliminates residual magnetism in recording heads at the flip of a switch. The Pen is just $1.95; the Demagnetizer is less than $12.95.

6. For your convenience, the Sony FS-5 Foot Switch provides remote foot-operated stop/start control for those Sony tape recorder models which do not have a built-in microphone. A stop/go mike can be plugged into the FS-5 and controlled by foot while recording.

9. When you add Sony accessories to Sony tape recorders, you can open your mind wide for creation and experimentation. And if you don't like what you come up with, the BE-7 Cassette Bulk Eraser will make everything on the tape disappear instantly. Requires neither AC power nor batteries. Less than $24.95.

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Editor's Review

As predicted, the main interest at the recent Consumer Electronic Show was on quadraphonics, and the majority of the exhibitors (in the audio field) were playing 4-channel sound of some kind or another. Both Wollensak and Philips had quad cassette players—the latter using 8-mil tracks! Track width on the Quad-Eight format is 20 mils and when you realize that the speed is twice that of cassette machines—to quote Bert Whyte "You don't have to be a genius to figure out which gives the best sound." Philips say their decision to use such a small track width is in the interests of standardization and this configuration gives 4-tracks in each direction . . . Several new reel-to-reel machines were on show and more "under the counter." Most of the tapes played were from the Vanguard range but JVC had some of the new Enoch Light Project 3 series tapes. One I heard featured bongos and other instruments from left and right, front and rear, in a frenetic 4-channel *tour-de-force* (fours?). I thought this gimmickry very much overdone—certainly unmusical, but I must say many of the audience seemed to enjoy it. Ampex made their own tapes—so did Teac's Arne Berg who put on the most convincing 4-channel demonstration of the Show. He had obviously taken a great deal of trouble in making the tapes which ranged from Mahler 3 to some fascinating street scenes. Both Harman-Kardon and Dynaco attracted a great deal of interest with their respective systems but the general impression was that they lacked the impact, the excitement of "genuine" 4-channel sound. I heard the Harman-Kardon processor (developed by Robert Orban) in Los Angeles and I was most impressed by the way it lent a sense of spaciousness that really gave a new lease of life to old mono records. Sansui used a system of indicator lights to explain their "psycho-acoustic" synthesizer but I did not hear an actual demonstration. Louis Dorren used a small FM transmitter to show off his MPX system which is not unlike the Halstead-Feldman arrangement—without the compromises. In other words, all four channels have a response up to 15 kHz. More about this system later. Meanwhile, yet another MPX system has appeared on the scene. This one is from the other side of the Atlantic and is described on page 26.

* * *

Advertising humor—or *per degree ad astra*

From Magnavox ". . . sound in the round, . . . 360 degrees of smooth, rich bass and perfect treble channeled onto an aspirator with 7000 little openings to release the music in all directions." And Electrophonic ". . . built-in cross-over networks recreate all the vibrant lows, mellow mid-ranges and vivid highs . . . sensitive upper and lower cones expand and circulate a double-peak stereo performance that's 720 degrees of sound." Let's hope the copywriter gets paid for a 48-hour day! . . .

* * *

You-read-it-first-in-Audio dept: The video disks mentioned in the February issue have now been demonstrated and we have managed—at the last minute—to squeeze in some details on pages 10 and 86. (Sorry, Sherwood W. and Edward C!) The fantastic new recording techniques will probably make a tremendous impact on the recording industry—but time will tell.

Leonard Carduner

As we go to press, we were very saddened to learn of the untimely passing of Leonard Carduner, President of British Industries Corporation, who was only 57. He had suffered from a heart ailment for some years and had an operation in 1965. Born in New York, Leonard Carduner originally worked in the advertising world and he joined his brother, William, in 1937 in a manufacturers' agency which was to become the British Industries Corporation, agents for Garrard, Wharfedale, and other prominent British companies. He was certainly one of the pioneers of the High Fidelity Industry and was responsible for much of its progress. Gilbert Briggs, of Wharfedale, in one of his books said, "You can see from Leonard Carduner's photograph that I was dealing with a man of his word." A fine tribute, but one that can be confirmed by all who had the pleasure of knowing him.

He leaves his wife, Harriet, and two sons, Andrew, age 30, and Stewart, 27

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STANTON

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Stereo Receiver Lexicon

With the stereo AM/FM receiver component firmly established as the most popular single piece of electronic equipment used for putting together a home music reproducing system, the business of "choosing the right receiver" becomes a fairly complex process. Since a receiver is really three components in one (tuner, preamplifier and amplifier), the prospective purchaser is often faced with a multitude of specifications (since each section requires a complete and defining set of specs) and unfamiliar terms which are intended by the manufacturer to describe fully the features and performance of his product. There have been suggestions that manufacturers of high fidelity component receivers abandon the time-honored tradition of including technical language in consumer-oriented sales literature and join the "package goods" or furniture console makers in their advertising approach. Generally, this approach consists of a full color brochure, including photographs of slinky models leaning voluptuously on radio phonograph cabinets with facial expressions of ecstacy. Surrounding these tableaus is a minimum of meaningless verbiage, including such pat phrases as, "Super-powerful amplifier," "Wide-Range Heavy-Duty Speakers," "Ultra Sensitive Tuner," or (and this one really amuses us by its very combining of unrelated terms) "Powerful Tuner Circuits!"

In an effort to dissuade the long-suffering, legitimate high fidelity component manufacturers from following this "cop-out" course, we present, herewith, a brief (and, we hope, succinct) lexicon of terms used in describing high fidelity receivers. These, arranged alphabetically, will include both specifications and physical-feature terms and phrases. Armed with this pocket dictionary (it is pocket sized, if you fold these pages a sufficient number of times), you can walk into any high fidelity dealer, read any manufacturer's specification literature and, hopefully, select and buy the right receiver for your needs and budget.

As already mentioned, the terms are arranged alphabetically. In addition, those which are considered to be SPECIFICATIONS will be capitalized, while

Len Feldman

those which represent features other than specs will appear in lower case letters. We have attempted to cross-index as many of the terms as possible, since some of you may attempt to look up "Separation, Stereo," while others may try to find the definition under "Stereo Separation" and still others may seek the same information under "FM Stereo Separation." We promise that at no time will you be asked to look up "Controls, Tone" after first attempting to find it under "Tone Controls," and then be told to refer again to "See Tone Controls." One other thing. For those who prefer pictures to words, wherever possible we have set alongside the most important specifications a graph designed to show you how a particular spec works out in practice and what we consider to be good numbers for that spec. Such graphs are necessarily subjective (on our part) and the demarkation lines between "Poor," "Fair," "Good," and "Excellent" should not be taken as the last word. They are, rather, a suggested guide for quality selection of receivers and can be tempered by budget considerations as well as the advancing state of the art.

Finally, where conventional dictionaries tell you whether a word is a noun, adjective, adverb, etc., we have substituted the abbreviations (A), (P), and (T). The appearance of (A) after a term means that the term is primarily associated with power amplifiers. A (P) appearing after a term means that the term relates to the preamplifier section of a receiver, while a (T) denotes a term related primarily to tuners or tuner performance.

Antenna Input Impedance (T). This term describes the type of transmission line or "lead-in" cable that should be used with a given tuner input. The two most popular impedances are 300 ohms (for which twin-lead, flat antenna wire similar to that commonly used for TV sets is used) and 75 ohms (in which case co-axial cable—one conductor inside a shielded outer conductor—is used). Some tuners feature *both* popular impedances so that either type of transmission line can be used. In the event that you must use, say, 75-ohm cable to connect to a 300-ohm antenna input on a receiver (or vice versa), some diminution of signal transfer will occur, but in all but the most fringe-signal areas, the mismatch is not terribly severe.

Balance Control (P). See Volume and Balance Controls.

Bandwidth, Power (A). See Power Bandwidth.

CAPTURE RATIO (T). The ability of an FM tuner to select the stronger of two FM stations when both are transmitting at the *same* frequency. While the FCC does not normally assign identical

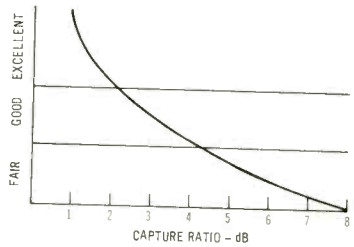

Fig. 1—Capture ratio ratings

frequencies to closely located stations in a given geographical area, a strong station many miles away might produce a signal strength at the antenna terminals of a tuner which is not much weaker than that of a low-powered local station which you may want to hear. Therefore, the less difference in strength between two stations required for the stronger station to obliterate the weaker, the better the capture ratio of the tuner. Capture

ratio is expressed in dB, and the lower the figure, the better the capture ratio. See Fig. 1 for qualitative ratings.

CONTINUOUS POWER (A). See RMS POWER (A).

DAMPING FACTOR (A). The modern power amplifier, by virtue of the large amounts of negative feedback applied to it, is considered to be almost a "constant-voltage" source. This is another way of saying that it's internal or "looking-back-into" impedance is very low. Damping factor is simply the ratio of the loudspeaker impedance to the "looking-back-into-the-output" impedance of the amplifier. Thus, if an amplifier has an internal impedance of 0.5 ohms and is to be used with a loudspeaker having an impedance of 8 ohms, the damping factor of this combination will be 8/0.5 =16. High damping factors generally result in "tighter" bass reproduction, since the low impedance across the terminals of the loudspeaker tends to limit any undesired "overshoot" on the part of the loudspeaker cone. The use of overly long speaker wires between amplifier and speaker (of insufficiently heavy gauge) can seriously reduce the effective damping factor, since the loudspeaker then "sees" the combination of amplifier internal impedance *plus* the series resistance of the speaker wires themselves.

DISTORTION (A, T). See IM Distortion and THD (TOTAL HARMONIC DISTORTION).

Equalization (P). In making recordings, a deliberate amount of frequency response alteration is introduced. The bass or low-frequency region of the spectrum is always under-recorded to prevent unduly large groove undulations (bass energy is greater than mid- or high-frequency content) from destroying groove walls. Conversely, higher frequencies are deliberately emphasized to improve the signal-to-high-frequency surface noise of the resulting disk. In the playback process, inverse frequency correction must be built into the preamplifier section, so that the net frequency response will be "flat." Standard amounts of correction should conform to the so-called RIAA curve, as shown in Fig. 2. RIAA stands for the Record Industry Association of America. A similar technique is used in FM broadcasting, in which the high frequencies are deliberately emphasized during transmission and de-emphasized during reception to improve the relative signal-to-noise between the program content and the high-frequency background noise common to wide-band FM. The term DE-EMPHASIS, rather than equalization, is used in describing this FM equalization technique, and the characteristic curve is shown in Fig. 3.

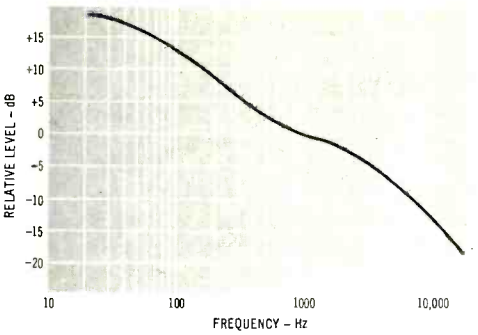

Fig. 2—Standard RIAA playback curve

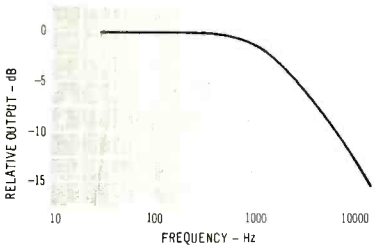

Fig. 3—FM de-emphasis curve

Filters (P, T). High-frequency and low-frequency filters are often incorporated in the preamplifier section of receivers. The former generally cut out high-frequency response at a steeper rate than do conventional tone controls. It is thus possible to eliminate record scratch and high-frequency hiss more effectively with less sacrifice of program content. Low-frequency filters are similarly constructed to eliminate such problems as turntable rumble without seriously affecting bass response required for proper musical reproduction. Recently, band-pass filters have appeared in the i.f. circuits of FM tuner sections, replacing previously used dual-tuned interstage transformers. Such crystal and ceramic filters (as well as multi-pole inductive-capacitive filters) are said to provide better control over the bandpass characteristics of the i.f. section of the receiver.

FM De-emphasis (T). See Equalization.

FM Limiting (T). See Limiting, FM.

FM STEREO SEPARATION (T). The degree to which an FM tuner is capable of rejecting "left-channel" information from its right-channel output and "right-channel" information from its left-channel output is called FM Stereo Separation. It is stated in dB. Because the stereo FM decoding process is quite complex, separation is usually not uniform at all audio frequencies. It tends to be best at mid frequencies, falling off somewhat at low frequencies and even more so at high frequencies. See Figs. 4 and 5 for qualitative ratings. Most manufacturers state stereo FM separation at mid-frequencies such as 400 Hz or 1000 Hz, though some present complete separation curves or plots, such as that shown in Fig. 6.

FREQUENCY RESPONSE (P, A, T). One of the most fundamental descriptive specifications for all parts of the receiver, frequency response is usually stated as the extremes of frequency at which response is uniform within a stated number of dB. Thus, "Uniform from 20 Hz to 20,000 Hz within ±1.5 dB" might be a typical statement of this specification. The greater the frequency extremes and the *lower* the "±dB" figure, the better the response. There are two schools of design philosophy with respect to amplifier frequency response, however. Some maintain that the wider the response, the better, and feature such specifications as "5 Hz to 100,000 Hz," while others maintain that the response should be limited to the total range of human hearing, namely 20 Hz to 20,000 Hz, and that increased bandwidth beyond that contributes no improvement and may even be disadvantageous in certain respects. With respect to FM tuners, it should be noted that broadcast transmissions are limited to a top frequency of 15,000 Hz. Thus, the publication of a tuner frequency response which is limited.

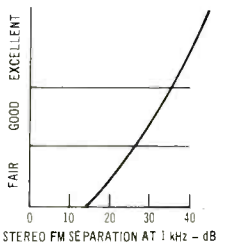

Fig. 4—Stereo FM separation at mid-frequencies

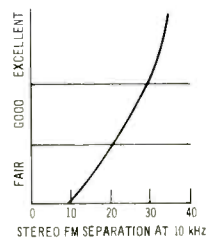

Fig. 5—Stereo FM separation at high frequencies

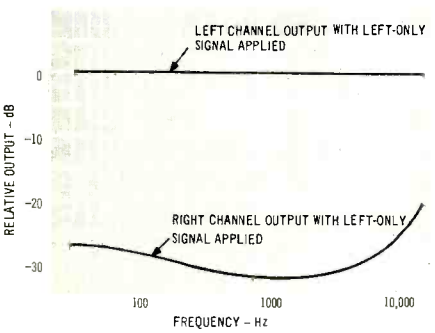

Fig. 6—Typical stereo separation curve

to this top frequency in no way denotes an inferior product. Because of the above-mentioned differences in opinion regarding frequency-response requirements in high fidelity, no qualitative rating is presented for this specification here.

Fuses (T, P, A). Protective fuses may be found in power lines of receivers as well as in speaker output circuits of the amplifier portions of such receivers. Placed in the power-line circuit, fuses prevent costly burn-outs of expensive components in the event of power supply failures etc. Placed in speaker lines, fuses protect output transistors in modern, solid-state receivers. They are meant to "blow" if excessive current is drawn from output circuits—as for example, when speaker leads inadvertently cause a short circuit across the output terminals of a receiver. More recently, protective relays and thermal circuit breakers are finding increased use in such applications. In replacing any fuse, always replace with a fuse of identical rating. To do otherwise voids most manufacturer's warranties and is an invitation to costly repairs and damage to the receiver.

Headphone Jack (P). A popular feature of nearly all stereo high fidelity receivers, the stereo headphone jack enables listeners to enjoy stereo in complete privacy, without disturbing other members of the family. Usually, a selector switch enables the listener to turn off the loudspeakers entirely while using the headphones. In some receivers, the insertion of the headphone plugs into the headphone jacks accomplishes the loudspeaker disconnect. Normally, little power is required for loud-level listening via headphones as compared with speaker listening. Suitable headphones are sold in a wide range of price categories. Two characteristics to watch for when purchasing this accessory are wearing comfort and fidelity. Low-frequency response can be a function of tightness of fit around the ears, and since not all ears are "built alike," headphones should be tried for fit and comfort as well as tonal performance.

HUM (P, A). See *NOISE and HUM.*

I.F. REJECTION (T). The ability of a tuner section to reject signals of the intermediate frequency (generally 10.7 MHz, in the case of FM tuners). Conceivably, there may be transmissions by radio sources at these frequencies (short wave, etc.), which should *not* be detected by a good FM tuner. Measured in dB, the higher the i.f. rejection specification the better. A qualitative rating is shown in Fig. 7.

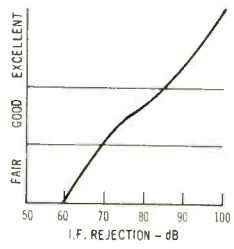

Fig. 7—Ratings for FM i.f. rejection

IHF SENSITIVITY (T). The number of microvolts of FM signal which must be applied to the antenna terminals of an FM tuner so that the program peaks heard will be 30 dB louder than any background noise and distortion. This number will be lower in better sets, higher in inferior sets. While 30 dB of signal-to-noise-and-distortion ratios do not constitute a *good* listenable signal, this measure is used to denote the *least usable* signal and is the most significant comparison spec that can be applied for tuners. Do not confuse this specification with "Quieting Sensitivity," an older spec which only required that the *noise* be 30 dB lower than the signal and did not take into account the resulting distortion level—which is of equal or perhaps even greater importance. Figure 8 presents a qualitative rating chart for IHF sensitivity of modern tuner sections. IHF stands for the Institute of High Fidelity, which promulgated this and related specifications and ratings for tuners and amplifiers. The IHF consists of manufacturers who specialize in high-quality high fidelity component product design and manufacture.

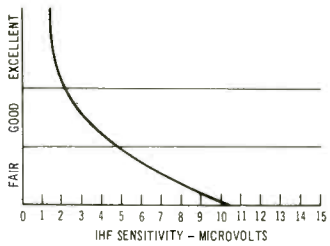

Fig. 8—Ratings for IHF sensitivity

IM DISTORTION (T, P, A). While there are many forms of audible distortion that can be produced by electronic amplifiers or tuners, the one thought to be the most objectionable to the listener is called IM, or intermodulation distortion. This form of distortion consists of the reproduction of sum and difference frequencies arising from the non-linear mixing of two desired frequencies. As an example, the frequencies of 60 Hz and 7,000 Hz, present simultaneously in a given audio program, may produce small amounts of 7060 Hz and 6940 Hz which are *not* present in the original program. IM distortion is expressed as a *percentage* of the total audio information present, so that the lower the percentage, the better the equipment. See Fig. 9 for a qualitative rating of IM.

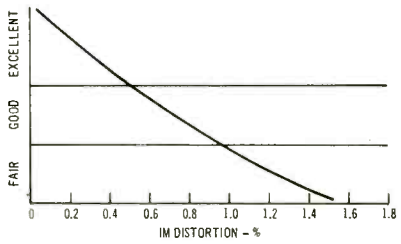

Fig. 9—Ratings for IM distortion

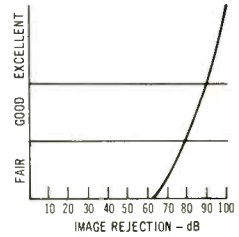

Fig. 10—Rating for image rejection

Image Rejection (T). In an FM tuner, the local oscillator is tuned 10.7 MHz above the incoming signal. When the incoming signal beats with the local oscillator, the desired 10.7 MHz i.f. signal is created for subsequent amplification and detection by the i.f. system of the tuner. Take, for example an incoming signal at 100 MHz. When the tuner is tuned to this signal, the local oscillator will be at 110.7 MHz and the required 10.7 MHz will be derived. However, an incoming signal at 121.4 MHz (10.7 MHz *higher* than the local oscillator) might also "beat" with the local oscillator to produce a signal at 10.7 MHz. While 121.4 MHz is outside the FM frequency band, it *is* within certain aeronautical frequency-band assignments and you don't want to hear airline pilots' conversations mixed in with your FM musical listening. Image rejection is the ability of a tuner to *reject* undesired frequencies which have a mathematical relationship to the i.f. so that they might be present in the output of the receiver. Expressed in dB, the higher the figure, the better the specification. See Fig. 10 for a qualitative analysis of this specification.

Impedance, Antenna (T). See Antenna Impedance.

Indicator Light, Stereo (T). See Stereo Indicator Light.

Input Impedance (P, A). The various input impedances listed in connection with the input facilities of a receiver are of an informational nature, designed to help you in the selection of matching components, such as cartridges, tape players, etc. Generally stated in "ohms," the input impedance is usually stated for phono, aux, and tape inputs on a receiver. For example, the magnetic phono cartridge input impedance on most receivers is characteristically designed at 47,000 ohms, because most magnetic cartridges work best into that value of impedance. If, for example, you were considering the purchase of a phono cartridge and found that it requires an input impedance of, say 100,000 ohms for best response, you could expect some deterioration in frequency response if you attempted to plug that cartridge into a phono input having a 47,000-ohm impedance.

INPUT SENSITIVITY (P). This specification is provided as an aid in selecting matching components that will work compatibly with the receiver of your choice. The auxiliary inputs of your receiver may have an input sensitivity of 250 millivolts. If you planned to feed the output of a tape deck to this input, you would choose a tape deck having a similar output. If, for example, your tape deck only provided 100 millivolts of output, you would never be able to drive the amplifier section of your receiver to full power output. Input sensitivities are usually given for all available inputs located at the back of the receiver, such as phono, tape, aux, and so forth. Phono inputs have sensitivities of the order of a few millivolts and are considered "low-level" inputs. Inputs such as tape and auxiliary will have sensitivities of the order of fractions of a volt and are referred to as high-level inputs.

Limiting, FM (T). It is the limiting characteristic of an FM tuner circuit that largely makes FM the "static-free" program source that it is. Limiting is accomplished by circuits called "limiters," which literally "slice off" the upper and lower extremities of the r.f. or i.f. signals after sufficient amplification has been accomplished. In FM, the ultimate amplitude of the signal is unimportant. It is the changing frequency which determines audio recovery, so that limiting the amplitude of the signal prior to detection serves as a means of removing any amplitude variations which might have been present. Most noise and static is of an amplitude nature and the limiting action therefore slices off this noise as well. While only a few manufacturers describe the limiting characteristics of their products as a published specification, this characteristic is of extreme importance and can have as much to do with superior FM performance as IHF sensitivity. Limiting, when stated, will be in number of microvolts required for "full" limiting (or, sometimes, for "1 dB limiting"—which means that the signal amplitude is within 1 dB of its final, highest value). The lower the figure, in microvolts, the better the characteristic. A qualitative chart of this characteristic is shown in Fig. 11.

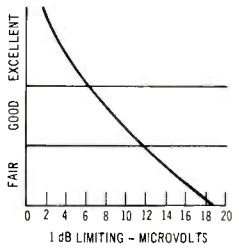

Fig. 11—Rating for full limiting

Loudness Control (P). Human hearing tends to fall off at the extreme low- and high-frequency ends of the audio spectrum. The effect is more pronounced when we listen to music at low loudness levels —or lower than in original performance. Since much of our home listening is done at lower levels than would be experienced in a concert hall, a loudness control (sometimes called loudness-contour control) serves to compensate automatically for this hearing deficiency at low levels. When the control is advanced to high settings, little or no compensation is afforded. As the setting is reduced, more and more compensation is added. Since levels of program sources differ and the degree of compensation in different people's hearing also differs, most loudness controls are equipped with a switch enabling the listener to defeat this feature and to restore the control to its more usual function as a regular volume control.

Low Frequency Filter (P). See Filters

Meters (T). Many of the better receivers are equipped with one or more tuning meters, to assist the user in accurately selecting desired FM (or AM) stations. Two types of meters are commonly used: the peak-reading tuning meter and the center-of-channel tuning meter. The former is used by tuning in to the desired station and finding the highest reading of the meter. The reading often provides a fair indication of signal strength when used this way. The center-of-channel meter has its pointer normally resting at mid-scale. As a station is approached, the meter will swing widely to one side. As center of channel is reached, the meter will once again be at mid-scale and, if the center of channel is passed over, the needle will swing to the other side of the meter scale. This type generally enables the user to tune more accurately to center of channel than does the peak-reading type, but it gives no indication of actual signal strength, nor is it applicable to AM tuning, as is the peak-reading type. Some modern receivers are equipped with both types of meters. Still other designs make dual use of one meter (the peak-reading type) enabling the user to read relative multipath interference (see Multipath) and adjust his antenna orientation for minimization of this form of distortion.

Monitor, Tape (P). See Tape Monitor.

Multipath Distortion (T). While not, strictly speaking, a "feature" or a "specification" of receivers, multipath is an important term whose significance should be understood by owners of stereo FM receivers. It is completely analogous to "ghosts" in TV reception. Reflected signals (from nearby man-made or natural structures) arrive at the receiver's antenna terminals a small fraction of a second later than the direct FM signal. The result is a form of distortion (particularly noticeable when listening to stereo FM) which is characterized by sibilant "s" sounds in speech, loss or wandering of stereo separation, and often even added harmonic distortion (see THD). Multipath distortion can be minimized by careful orientation of an outdoor directional FM antenna.

MUSIC POWER (A). One of two accepted forms of statement of the power output capability of the power amplifier section of a receiver. This specification is sometimes called IHF power and means the same thing as Music Power. Musical crescendos are often of very short duration and most amplifiers can deliver somewhat more power for short periods of time than they can for long, continuous periods. Since most listening is musical, it is felt that the "Music Power" rating has somewhat greater bearing on the useful power capability of an amplifier. Prior to the development of this modified power specification, all power was quoted as Continuous Power or R.M.S. Power. (See R.M.S. Power.) There is no direct correlation between continuous power and music power, except that the latter will generally be somewhat higher than the former. The difference depends in large measure upon the design or ruggedness of the power supply used in a particular receiver. The better the regulation of this supply, the closer the two ratings will be.

(To be continued)

The QUART Broadcasting System

by MICHAEL GERZON

THERE SEEMS TO BE no doubt that in the long run, multi-channel stereo will become the standard for Hi-Fi. The real problem to be solved is how multi-channel sound can be recorded or broadcast cheaply and efficiently. The original Vanguard quadraphonic tapes cost $14.00 each for the usual LP length —which is too much. (Prices will come down with a rush when the demand increases). RCA have just announced that they will release a number of 4-channel tapes in August using the standard 8-track cassette but no prices are available as we go to press. Much work is going on behind the scenes to develop disk and tape systems which will be inexpensive and compatible and just what system will be finally adopted is anyone's guess at the moment.

One proposal involves the addition of two coded signals at 72 kHz and 92 kHz. The main objections to this method are a rather low modulation level on all channels and a high noise level, poor frequency response (up to only 9 kHz) on the rear channels plus the difficulty of avoiding high-frequency chatter distortion. It seems to have been overlooked that there is sufficient room in the ordinary FM multiplex system to squeeze in a third or fourth channel without affecting the performance of present-day receivers. It is well known that the present method of broadcasting stereo does not allow audio frequencies above 19 kHz to be transmitted. Thus, the combined frequency range theoretically required by both left and right channels should be 2×38 kHz. However, stereo multiplexing uses up a range of 3×19=57 kHz for each half of the spectrum. (In the U.S., the figures would be 53 kHz+53 kHz—ignoring SCA requirements, Ed.) It is in this 'surplus' 19 kHz that a third or fourth channel can be squeezed. The writer of this article has taken out a patent on such a system which is called QUART—meaning Quadrature Ambience with Reference Tone for 3 or 4 channels. First let us see how a 3-channel QUART is squeezed into a 'pint pot.'

In order to transmit two channels with a single transmitter (i.e., ordinary stereo), a rapidly operating electronic switch

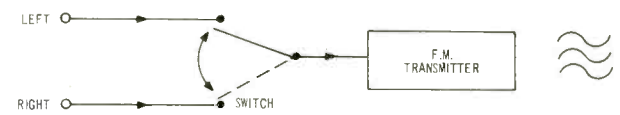

Fig. 1a—Stereo transmission

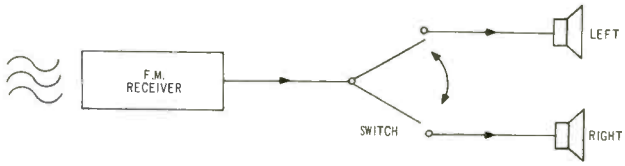

Fig. 1b—Stereo receiver

switches the left channel, then the right, then the left and so on, into the transmitter. See Fig. 1a. This switch operates at a very high rate (4 times 19,000, or 76,000 times per second) so that if the left- and right-channel electrical signals are as in Figs. 2a and 2b, then the switched signal fed into the transmitter might look like Fig. 2d. This is called the stereo multiplex signal. Figure 2c shows a square waveform which represents the way the switch is operating at each moment of time—the switching signal. As the switch in the transmitter functions at a high speed a listener picking up the broadcast with an ordinary mono receiver just hears the average of the two channels—a good mono signal. But in a stereo receiver there is a switch operating exactly in step with the one in the transmitter that switches the left and right signals into the two channels. How does the receiver switch keep in step? This is obviously very important and it is accomplished by a 19-kHz sine wave called the pilot tone which is transmitted by the station and the circuit is so arranged that the pilot tone keeps the switch synchronized (like an electric clock).

The QUART system adds a third channel using a system called "quadrature modulation" because it involves an additional switch operating exactly one quarter of a cycle out of step with the switch just described. A similar technique is used to convey color information in some TV systems. Consider a third rear-channel audio signal which we will call the "ambience" signal as in Fig. 3a. Let the switching signal for stereo multiplex be represented by Fig. 3b. Now consider a second switching signal in quadrature with the first, i.e., a quarter of a cycle out of step with switching signal number one as shown in Fig. 3c. At the transmitter end, the ambience signal is made to modulate the quadrature switching signal; in other words at each moment we give the quadrature switching signal an amplitude proportional to the value of the ambience signal. If the ambience signal happens to be negative (as at time T in Fig. 3a) we then reverse the polarity (or the sign) of the quadrature switching signal also. By this means, we obtain a quadrature switching signal modulated by the ambience signal as shown in Fig. 3d.

Figure 6 shows the usual stereo signal plus the ambience-modulated quadrature switching signal as transmitted. To see how a receiver reacts to this complicated signal, consider a stereo receiver picking up a quadrature signal modulated by the ambience as in Fig. 6a. The switch in the receiver operates in step with the usual switching signal of Fig. 6b and the outputs of the left and right channels will be as shown in Figs. 6c and 6d. It will

be seen that both these outputs are of a high frequency and will therefore contain no audio frequencies. Thus an ordinary stereo receiver picking up a QUART transmission will ignore the modulated quadrature switching signal and will respond only to the normal stereo signals.

A three-channel receiver using the QUART system will be similar to a conventional stereo receiver—plus a device to recover the ambience channel. The detector for the third channel will use switching similar to the switching used for stereo, except that it will take place in quadrature (i.e. a quarter of a switching cycle out of step) with the stereo switching (see Fig. 5). As before, a pilot tone of 19 kHz is also transmitted to synchronize the receiver's switches with those at the transmitter. In the QUART system a low-level signal of 38 kHz in step with the stereo switching signal is also transmitted. This is called the *reference tone* and it helps in the synchronizing process as well as providing a signal to switch on a light for 3-channel indication. While the QUART system is a little complicated to describe, it does have quite a few worthwhile advantages over other methods of adding a third channel. The most obvious advantage is that no frequencies over 57 kHz are transmitted in the multiplex signal—just as with ordinary two-channel stereo. This leaves plenty of room at higher frequencies for the broadcasting of yet more channels. As the ambient channel uses frequencies in the 19- to 57-kHz range the amount of noise is much less than in other systems which use frequencies around 76 kHz for this channel. Calculations indicate QUART three-channel transmissions should only be about 3 dB worse than conventional two-channel stereo.

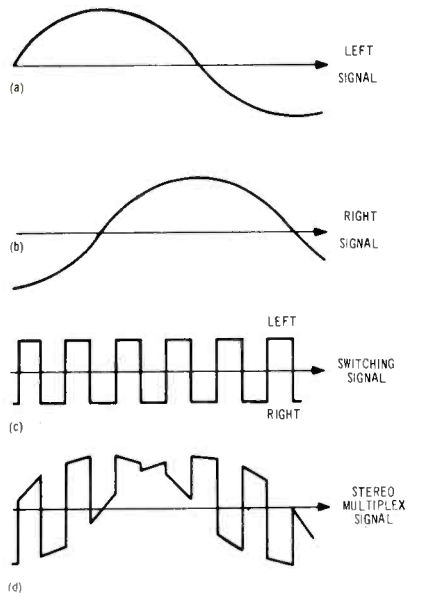

Fig. 2—Stereo multiplex signals

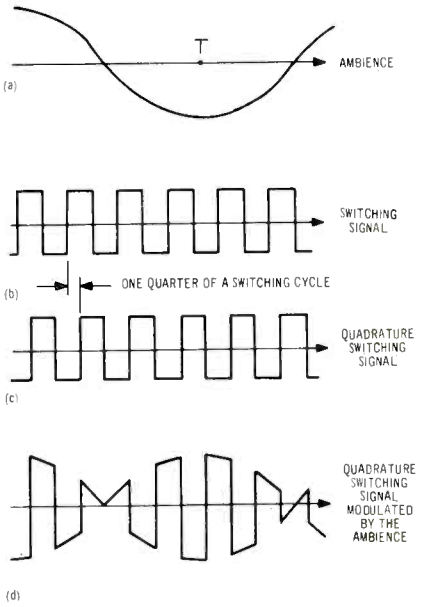

Fig. 3—Quadrature Ambience modulation

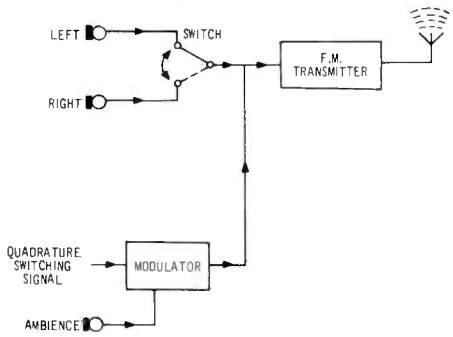

Fig. 4—QUART three-channel MPX transmitter

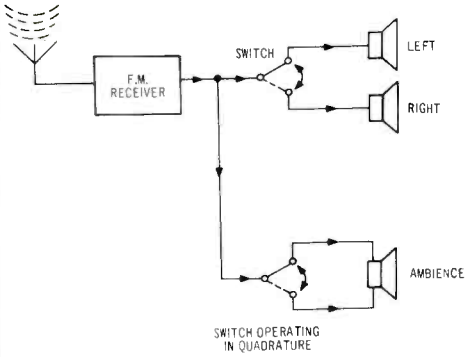

Fig. 5—QUART three-channel receiver

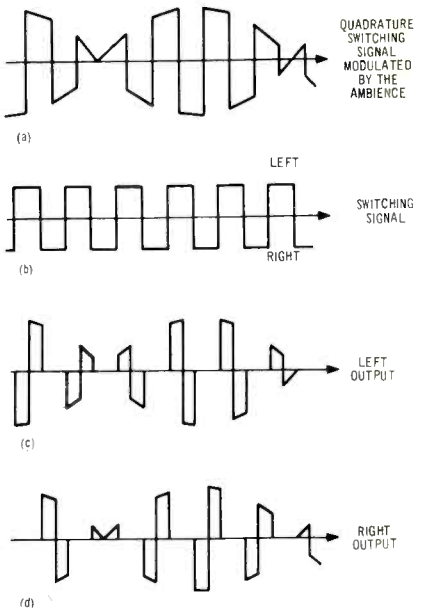

Fig. 6—Stereo reception of Quadrature Ambience

4-Channel QUART

By modulating frequencies around 76 kHz, it is possible to add a fourth channel and by careful adjustment of the various parameters it should be possible to ensure that the degradation of signal to noise is no worse than 7.5 dB—smaller than in any other system known to the author. For those whose mathematics is good, the three-channel signal can be represented as follows:

$$\frac{L+R}{2} + \propto \sin 2\pi\, ft + \left(\frac{L-R}{2} + \gamma\right) \sin 4\pi\, ft + A \cos 4\pi\, ft$$

where L = the left channel signal, R = the right channel, A the ambience signal, f = 19,000, t = time in seconds; $\propto$ and γ are constants. The 4-channel system can be represented as follows:

$$\frac{L+R}{2} + \propto \sin 2\pi\, ft + \left(\frac{L-R}{2} + \gamma\right) \sin 4\pi\, ft + \frac{U+V}{2} \cos 4\pi\, ft + \frac{U-V}{N2} \sin 8\pi\, ft$$

where U and V are rear left and rear right channel signals respectively. Æ

This article has also appeared in the British "Hi-Fi News" and the author will welcome any correspondence on the subject of quadraphonic sound. The address is—Michael Gerzon, Mathematical Institute, St. Giles, Oxford, OX1 3LB, England.

AUDIO's 1971 Hi-Fi PREVIEW DIRECTORY

The twelfth product directory follows as is the usual custom in the September issue. The specifications presented are in the tabular form which was first used in 1965 to facilitate comparisons.

Dashes in the columns indicate that the characteristics do not apply to the product; a blank space indicates that manufacturers did not supply AUDIO with the information. Letter codes are employed in some instances for purposes of clarity or to simplify the listings. For example, the letter (B) preceding an amplifier listing indicates that it is a basic power amplifier; (T) indicates that the product is tubed rather than solid-state construction; turntable and tape recorder speeds are similarly indicated by letter codes which are shown on the respective charts.

Readers should bear in mind that these specifications are those supplied by the manufacturers—they are **not** the result of our tests or measurements. Measurement methods may differ from manufacturer to manufacturer, but in general the performance may be considered to be as shown.

For more information on any product, or on other products which are not listed, the reader may write the manufacturer directly, and the companies' addresses are listed on page 34. Trade names which are different from the manufacturers' names are cross referenced for your convenience. If the company is an advertiser in this issue, you may turn to the page number shown in a circle under the product name for further information or to find the Reader Service Card Number which you may check on the card found opposite page 114. This card is postage paid by us, and the inquiries are forwarded to the manufacturer. You will have to write the manufacturer direct if his company is not an advertiser in this issue, or if he chooses not to use the Reader Service Card for inquiries.

Obviously, not all products of each manufacturer are listed. Some items had to be eliminated because of space; some manufacturers did not provide us with the necessary information.

Even with these limitations, the Preview Directory should be of value to readers throughout the year as a condensed catalog of the important hi-fi equipment due on the market during the coming months.

AMPLIFIERS — Basic and Integrated

BIC/LUX 71/4A

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) Basic power amplifiers have model number preceded by (B)
(3) "K" indicates kit price; "W" indicates wired price

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	IHF Power/Chan, W	RMS Power/Chan, W	THD at Rated Power, %	THD at 1 Watt, %	IM at Rated Power, %	IM at 1 Watt, %	Power Bandwidth, Hz to kHz	Freq. Response at 1 Watt, Hz ±1 dB	Rated Output S/N, dB	Phone Sensitivity, mV	Phone Overload, mV	Tape Head Input, mV	High-Level Input, V	Output Z, Ohms	Damping Factor	Dimensions, in. W x D x H	Weight, lbs	Price	SPECIAL FEATURES
ACOUSTIC RESEARCH (67)	AR	–	60	0.5	0.5	0.25	0.25	–	–	65							15¹¹⁄₁₆ x 10 x 4⁹⁄₁₆	19	250.00	
	A AU	–	50** 60*	0.5	0.5	0.25	0.25	14-44K	20-20K ±1	75 (57)	2.5 adj.	100	–	0.2	–	40	15⅜ x 10 x 4½	19	250.00	Wood case opt., $15.00; spkr cables opt., $6.00; 2-year guarantee. **8 ohms; *4 ohms.
	Univ.	Same as above except for 100, 120, 220, 240 V., 50-60 Hz																		
BIC LUX (3)	71/4A		(110) 75	0.3	0.15	0.4	0.4	15-30K	10-50K	80	2.0 8.0	100	1.8	0.1	(4) 8	50	18½ x 12½ x 6		337.00	Var. tone-contr. turnovers; lo and hi filt., 2-pos.; 2 spd. tape-head inputs. (4 ohms)
	71/6A		(30) 25	0.2		0.4		15-30K	10-50K	70	4.0	100	–	0.1	(4) 8	35	16½ x 9 x 5		179.00	Filter, loudness, spkr. (4 ohms)
CROWN (17)	D-40	80 (4Ω)	30 (8Ω)	0.05	0.05	0.25	0.12	5-50K ±1	5-100K ±0.5	–105 (typ.)	–	–	–	0.68	4-16	200	19 x 7⅞ x 13⅜	8¼	229.00	Low dist., low noise, and exc. stab. in a slim package, front-panel head-phone jack. Opt. 2-C. Wal cab, $29.00
	D-150	200 (4Ω)	75 (8Ω)	0.04	0.01	0.1	0.1	5-20K ±1	4-100K ±1	–115 (typ.)	–	–	–	1.2	4-16	200	17 x 9 x 5¼	16	429.00	New ext.-stable IC cir. fea. full elec. short-protection. (No fuses except AC line). Opt. 5-D cab. $33.00
	DC-300	400 (4Ω)	150 (8Ω)	0.03	0.008	0.05	0.02	0-20K +0.1	0-100K +0.5	–115 (typ.)	–	–	–	1.75	4-16	200	19 x 9¾ x 7	40	685.00	DC design for perfect stab. and zero L-F phase shift. Short and mis-match protect. Opt. 7-C cab. $37.00.
DYNACO (15)	SCA-80	50	40	<0.5	<0.2	<0.5	<0.1	6-50K	15-50K ±0.5	80	3	80	–	0.13	8	>40	13 x 10½ x 4	16	169.95K 249.95W	Essentially similar to the PAT-4 plus stereo 80; includes cover.
B	Stereo 120	60	60	<0.5	<0.2	<0.5	<0.1	5-50K	5-100K ±0.5	95	–	–	–	1.5	8	>40	13 x 10½ x 4	20	159.95K 199.95W	Modular constr.; fully reg. power supply, elec. protective circuits, inc. cover.
B	Stereo 80	50	40	<0.5	<0.2	<0.5	<0.1	6-50K	15-50K ±0.5	95	–	–	–	1.3	8	>40	13 x 9 x 4	13	119.95K 159.95W	Similar to Stereo 120, but lacking reg. pwr. supply, cur. limiting protect; incl. cover.
T	SCA-35	22.5	17.5	<1.0	<0.2	<1.0	<0.1	20-20K	20-20K ±0.25	80	4	150	2.5	1.0	8, 16	>10	13 x 10½ x 4	20	99.95K 139.95W	Includes cover.

Your next speaker systems should be ready for 2 or 3-channel multi-amp stereo when you are.

Pioneer's two new 3-way multi-amp speaker systems permit you to improve your stereo system at your own pace. Initially they can be used as conventional full-range speaker systems. Then, with a flick of a switch, they can be converted for 2 or 3-channel multi-amp stereo use. Both units have the necessary inputs for the changeover.

Employing Pioneer's newly developed Free Beating cone paper, both the CS-A500 and CS-A700 produce exceptionally clear, clean sound with lower distortion and higher efficiency. You'll note a distinctive separation of lows, midrange and highs. And you can adjust the tone of the middle and high frequencies to suit any room. It's simple with the twin level controls on the CS-A700 and the single tone control on the CS-A500.

Specifically designed with low crossover frequency points for distortion-free sound and superb directivity, both systems incorporate Pioneer's advance design speakers in a handsome, oiled walnut cabinet with latticework grille. Hear them today at your Pioneer dealer.

Pioneer Electronics U.S.A. Corp., 140 Smith Street, Farmingdale, N. Y. 11735

PIONEER®

	CS-A500	CS-A700
System	50 watt, 3-way multi-amp	60 watt, 3-way multi-amp
Speakers	10" cone woofer 4¾" cone midrange; 3" cone tweeter	12" cone woofer; 4¾" cone midrange; multi-cell horn tweeter
Response	40-20,000 Hz	35-20,000 Hz
Impedance	8 ohms	8 ohms
Dimensions	22½"x13"x12¾"	26"x12¾"x15"
Price	$149.00	$179.00

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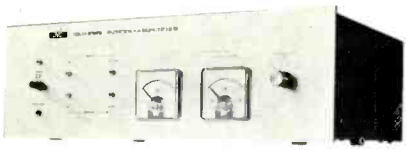
AMPLIFIERS — Continued



JVC 5012

Heath AA-15

Fisher TX-1000

Marantz Model 30

H-K Citation Twelve

Kenwood KA-6000

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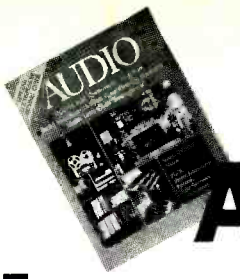
EICO	3080	16	11	0.5	0.3	1	0.3	50-25K	20-40K ±3	60	2.7	90		0.2	4-16	40	12 x 7 x 3 1/8	7	69.95K 109.95W	Incls. cab. w/molded end caps.
	3070	35	20	0.7	0.15	2	0.6	20-30K	10-40K ±2	70	4.2	90		0.27	4-16	30	12 x 7 3/4 x 3 1/8	7 1/2	99.95K 149.95W	Incls. vinyl-clad metal cabinet.
	3150	75	50	0.15	0.1	0.6	0.2	20-30K	10-40K ±2	80	4.2	90		0.28	4-16	50	14 3/4 x 8 5/16 x 3 1/8	16 1/4	149.95K 225.00W	
ELECTRO-VOICE	EV 1244	32 1/2	18	1.0				20-20K	20-30K ±1 1/2	70	3.0		–	0.25	4, 8, 16		8 3/4 x 10 1/4 x 3 1/8	18	132.30	
FISHER (31)	TX-2000	60	50	0.5	0.2	0.8	0.2	22-24K	20-40K ±1.5	90	2.0 7.5	40	1.8	0.2	4	> 10	15 1/8 x 12 3/4 x 4 13/16	24	349.95	Mic, tape hd inputs, hi filt. 1 and 2, Lo filt.
	TX-50	28	20	0.5	0.2	1.0	0.3	25-25K	20-25K ±2	85	2.5	45	–	0.22	8	> 10	15 1/8 x 9 x 4 13/16	13 1/2	149.95	4-way spkr., mode.
GROMMES	270	50 @ 4Ω 30 @ 8Ω		0.5	0.1	0.5	0.1	20-20K	15-50K ±1	75	2	60	–	0.15	4, 8, 16	40	13 1/2 x 11 x 4 3/8	–	189.50	
HARMON-KARDON (B)	Citation Twelve	–	60	0.2	.05	0.15	.05	5-35K	< 5 to 70K +0.5	100	–	–	–	1.5	4-16	40	12 5/16 x 12 5/8 x 5 7/16	30	295.00 225.00K	Twin power supplies, mechanical and elect. circuit protection.
HEATH (33)	AA-15	75	50	0.5	0.2	0.5	0.2	6-30K	8-40K ±1	60	2.2	155	–	0.2	8	45	16 7/8 x 12 1/2 x 4 3/4	21.5	179.95	Indiv. input-level contrs; main and rem. spkr. sws; tone-flat sw; phone jacks.
	AA-14	15	10	0.5	0.5	1.0	–	15-50K	12-60K ±1	60	4.5	–	–	0.3	4-16	50	12 x 10 1/4 x 3	8.5	67.95	Clutched vol. contr; tandem bass and treble contrs; phone jack; edge-lighted panel.
JVC (9)	5012	80	60	.07	.03	0.2	0.1	10-100K	6-120K ±1	115	–	–	–	1.0	–	80	19 x 13 x 6	36	699.95	2 overload indicators. 2 output level meters.
KENWOOD (39)	KA-6000	85 90*	58 64*	0.5	0.1	0.3	0.1	15-50K	20-50K ±1	77	0.05 0.5 2.0	65	2.3	0.2	4-16	28	16 1/4 x 11 x 5	25	249.95	*4-ohm, 7-pair input; 2-lo and hi filt., 2 dB/step tone controls and tone mode.
	KA-4002	29 40*	24 33*	0.5	0.2	0.5	0.2	18-30K	20-40K ±1.5	75	2.5 2.5	65	–	0.15	4-16	28	13 x 9 1/2 x 5	13	139.95	*4-ohm, step tone conts, 6-pair input, lo and hi filters, phone and dubbing jack.
	KA-2002	19 23*	17 19*	0.8	0.2	0.8	0.2	20-30K	20-30K ±2	70	2 2	65	–	0.15	4-16	28	13 x 9 1/2 x 5	12	99.95	2 pairs of phono inputs, step tone conts, tape monitor. *4-ohm.
LAFAYETTE	LA125TA	62 1/2	–	< 1	0.2	–	–	20-40K	22-20K ±1	75	2.2, 7, 80	–	–	0.27	4-16	–	13 x 9 1/4 x 3 7/8	16 1/2	129.95	Auto o'ld protection; front panel mic/musical jack.
	LA-750	40	–	< 1	0.7	–	–	15-30K	20-20K ±1	75	2.3, 80	–	–	0.5	4-16	–	12 x 9 1/8 x 3 3/4	12	79.95	Fused outputs; front and rear tape output jacks.
	LA-324A	20	–	–	0.7	–	–	35-30K	20-20K	75	2.3, 80	–	–	0.5	4-16	–	10 3/8 x 8 3/8 x 3 1/2	9	59.95	Fused outputs; front panel headphone jack.
LEAK	Stereo 70	50	35	0.1	0.1	0.3	–	–	20-30K	66	2	30	2	–	8	40-1	13 x 8 1/2 x 4 1/2	12 1/2	299.00	Bass, treble, vol. and bal. contrs. 7 contrs: monitor, filter, loudspeakers, power, head-phone output.
MARANTZ (58) (59)	(B) 16	150	100	0.1	–	0.1	–	–		90	–	–	–	–	–	100	15 5/8 x 8 x 5 3/4	30	450.00	
	30	90	60	0.15	–	0.15	–	–		60	1.0	–	–	–	–	–	15 3/8 x 14 x 5 3/4	27	450.00	
	(B) 32	90	60	0.15	–	0.15	–	–		100	–	–	–	–	–	100	15 3/8 x 9 5/8 x 5 3/4	21	295.00	
NIKKO	TRM-1200	60	45	0.3	0.1	0.3	0.1	15-30K	13-50K ±1	85	2.0		220	0.2		30	15 1/4 x 12 1/4 x 4 1/2	20	249.95	2 ICs; 2 mic jks; 2 mtrs; 2 spkr sys. avail. sis; tone-flat sw; time-delay muting.
	TRM-50	25	18	0.6	0.2	0.6	0.5	20-30K	10-70K ±1	75	2.4		300	0.3			13 x 9 1/2 x 3 3/8	11.4	129.95	All IC constr; plug-in cct board; dual function contrs; triple cct brkr protection.
	TRM-40	20	13	1.0	0.5	1.5	0.8	30-15K	15-20K	65	2.8		1.8	0.2			12 x 8 1/2 x 3 3/8	10	109.95	Rumble and scratch filters; cct brkr protection; dir. input for tape head.



AUDIO magazine is probably the world's toughest critic of audio equipment.

Here's what AUDIO says about the Fisher 500-TX:

- "The Fisher 500-TX is a top-grade receiver...."
- "The flexibility normally associated with Fisher products has been expanded in completely new directions...."
- "In addition to an ample quantity of controls, this new receiver features *four* ways in which to tune in desired FM stations."
- "...the optional remote control (Model RK-30, $9.95) enables the user to change stations from his chair without approaching the receiver itself."
- "Station lock-in is flawless. That is, when the auto-scan [AutoScan] stops on a station it stops on the exact 'center' of that channel."
- "...AutoScan is probably more accurate in tuning to [the] center of [the] desired channel than can be accomplished manually..."
- "Usable sensitivity was everything we could have desired and limiting took place at a remarkable 1.5 μV. Ultimate signal-to-noise ratio was 65dB, as claimed. Stereo FM performance was excellent."
- "We can confirm the power output specification, as given in terms of r.m.s., as actually exceeding the 65 watts per channel claimed... Rated distortion (0.5%) is achieved at 66 watts, while IM reaches 1% at 68 watts. Power bandwidth extended from 8 to 38,000 Hz, based upon 65 watts per channel..."
- "The Fisher 500-TX is a top-grade receiver...wonderful tuning convenience features...powerhouse of an amplifier ...excellent transient response... truly 'big', clean sound."

Mail this coupon for your free copy of The Fisher Handbook, 1970 edition. This 72-page full-color reference guide to hi-fi and stereo also includes detailed information on all Fisher components.

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AMPLIFIERS — Continued

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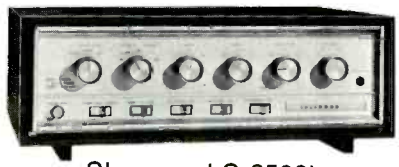
Sansui AU-999

Sony TA-3120

Scott 499



Sherwood S-9500b

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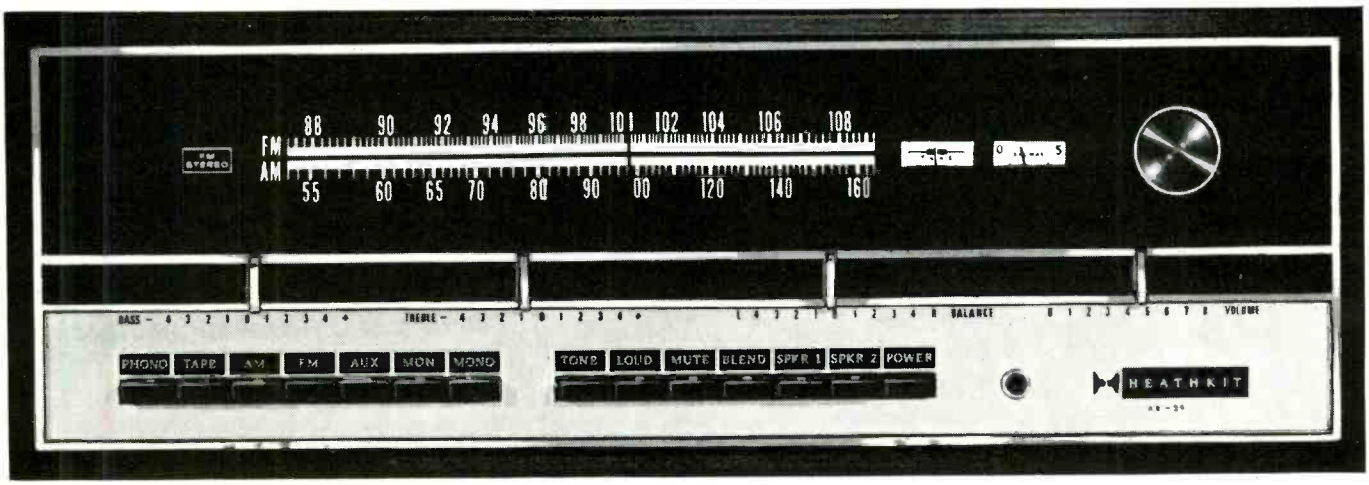
NORELCO (89)	591	38	28	0.3	0.15	0.3	0.3	20-20kHz	20-20kHz ±0.5	85	3.5	60		0.13	8	80	16½ x 10 x 3⅜	12½	199.95	Switchable scratch filter, contour, and presence controls.
PIONEER (29) (45) (57)	(B) SM-100	100	85	0.5	0.1	0.5	0.1	10-30K	5-100K	110	–	–	–	1.0, 2.0, 5.0	4-16	1.5, 7.50	16½ x 11¾ x 6¾	30	375.00	Damping factor contr; 5– and 20–H- lo filter * at 4 ohms.
	SA-900	100*	64*	0.3	0.08	0.5	0.1	20-50K	20-50K ±1	95 Aux	3.1	90	1.8	0.18	4-16	67	15 5/16 x 13 11/32 x 5½	27	259.95	Step tone contr; muting sw; pre-and main amps can be used independently. *at 4 ohms.
	SA-700	60*	31*	0.5	0.08	0.5	0.2	15-60K	20-40K ±1	100 Aux.	3.0	90	–	0.2	4-16	40	14 9/16 x 12 5/16 x 4⅝	17	199.95	as above.
	SA-500	22*	12*	0.5	0.1	0.8	0.3	20-40K	20-50K ±1	90 Aux	2.5	80	–	0.2	4-16	40	13 x 12 9/16 x 4⅝	13	109.95	as above.
	(B) SM-700	60*	31*	0.5	0.08	0.5	0.2	15-60K	15-60K ±0.5	100	–	–	–	0.5, 1.0 2.0	4-16	40	14 9/16 x 12 9/16 x 4⅝	16	129.95	Spkr phase rev. sw; input level selector.
SAE (35)	(B) VIII	–	400	<0.1	<.05	<0.1	<.05	8-50	3-100K +0, –2	>100	–	–	–	1.0	8-16	>150	17 x 18 x 9	90	1,500.00	Four separate power supplies; VU meter; forced cooling; 24 pwr. transitors.
	(B) III	–	120	<0.1	<.05	<0.1	<.05	8-50	3-100K +0, –2	>100	–	–	–	1.0	4-16	>140	17 x 18 x 5¾	45	700.00	Split power supplies; level and meter contr. ea. chan.; 12 pwr. transistors.
	(B)	–	60	<0.15	<0.15	<0.15	<0.1	8-50	3-100K +0, –2	>110	–	–	–	1.0	4-16	>150	15 x 12 x 4	21	300.00	Unconditionally stable with any or no load, incl. ESL's
SANSUI (7) (41)	AU999	90	70	<0.4	0.1	<0.4	0.1	10-30K	5-100K ±1	>100	2.0		2.0	0.2	4-16	45	18 x 11⅜ x 6	38½	299.95	Triple tone controls; step controls; 3 spkr. systems; 11 inputs, 7 outputs.
	AU555-A	43	33	<0.5	0.2	<0.5	0.2	20-40K	20-40K ±1	>100	2.0		1.5		4-16	50	15½ x 11 x 5	17½	169.95	Triple tone controls; step controls, NF ampl. cir., 7 inputs, 5 outputs.
	AU222	23	18	<0.8	0.3	<0.8	0.3	20-20K	20-30K ±1	>80	2.0		1.5		4-16	>20	11½ x 10½ x 4¼	12¾	119.95	NF ampl. circuitry; 6 inputs.
	(B) BA90	45	32	<0.3		<0.3		15-50K	15-100K ±1	>80	–	–	–	–	–	10 & 50	7½ x 14⅛ x 4⅛	16½	149.95	Damping factor set switch; aural null bal. sw; level adj. Phase sw; phone jack.
SCHOBER (99)	(B) TR-2	50	40	0.75	0.5	1.4	0.9	20-20K	20-20K ±0.5	83	–	–	–	0.1	4, 8, 16		5½ x 11¼ x 7½	14	75.00 Kit	Fan cooled; short circuit protected.
SCOTT Cover II	499	–	35*	5	0.1	0.5	0.2	10-38K	15-30K	70	3.0, 6.0	–	1	0.6	8	20	18½ x 11⅞ x 6⅛		599.95	*4-Channels driven
SHERWOOD	S9500C	58	45	0.9	0.15	0.6	0.1	8-35K	2-20K ±0.5		1.8	100	–	0.18	4-16	30	14 x 10½ x 4	16	199.95	
SINCLAIR (111)	Z-50* Project 60	–	30	.02	.02	<0.3	<0.3	20-30K	20-300K ±1.5	70	3.0		–	1.0	3-20	>100		8	104.95	*2, with PZ-8 pwr. sup.; 40 w @ 4Ω; module form.
	Z-30* Project 60		15	.02	.02	<0.3	<0.3	20-30K	20-300K ±1.5	70	3.0		–	1.0	3-20	>100		8	84.95	*2, with PZ-6 pwr. sup.; 20 w @ 4Ω; module form.
	Neoteric 60		15	.02	.02	<0.3	<0.3	20-80K	20-300K ±1.5	70	3.0		–	1.0	3-20	>100			179.95	Contemp. style pwr/amp; bar-type sel. contrs; protective cctry; will run ES spkrs & phones.
SONY (37) (54) (55)	TA1120A	60	50	.05	.01	0.2	.02		5-200K +0, –2	110	1.2	100	1.2	0.15		180	15⅜ x 12⅛ x 5⅜	24.3	449.50	
	TA-1144	50	30	0.2	.05	0.2	.05		15-100K +0, –2	90	1.2	90		0.15		70	16⅝ x 12⅝ x 5 13/16	17	219.50	
	TA-1010	22	15	0.5	0.2	1	.03		30-30K +0, –2	90	1.2	–	–	0.25		25	14⅞ x 16⅝ x 9 11/16	10	119.50	
(B)	TA-3200F	145	100	0.1	.03	0.1	.03		5-200K +0, –2							200	15⅜ x 12⅜ x 5⅞	26.15	349.50	
(B)	TA-3120	60	50	.05	.01	0.2	.02		5-200K +0, –2							180	5¾ x 7⅛ x 17½	17	249.50	
(B)	TA-3060	50	30	0.1	.02	0.1	.03		5-100K +0, –2							180	5⅞ x 7⅞ x 12 7/16	12, 13	159.50	

"How well does the Heathkit AR-29 perform? Very well indeed!"..."No other receiver in its price class can compare with it!"

Julian Hirsch, Stereo Review magazine



Here's Why...

Here's what Mr. Hirsch says about Sensitivity: "Its FM tuner had an IHF sensitivity of 1.75 microvolts, placing it among the finest in respect to sensitivity."

About FM Frequency Response: "Stereo FM frequency response was extremely flat, ±0.25 dB from 30 Hz to 15,000 Hz."

About Power Output: "We found the audio amplifiers to be considerably more powerful than their rated 35 watts (rms) per channel. With both channels driven at 1000 Hz into 8-ohm loads, we measured about 50 watts (rms) per channel just below the clipping level."

And this is what he writes about Distortion: "Harmonic distortion was under 0.1 per cent from 0.15 to 50 watts, and under 0.03 per cent over most of that range. IM distortion was about 0.1 per cent at any level up to 50 watts. At its rated output of 35 watts per channel, or at any lower power, the distortion of the AR-29 did not exceed 0.15 per cent between 20 and 20,000 Hz. The distortion was typically 0.05 per cent over most of the audio range, at any power level."

About Input Characteristics: ". . . the AR-29 can handle any modern cartridge without risk of overload, and provide low distortion and an excellent signal-to-noise ratio."

About Hum & Noise: "Hum and noise were extremely low: -90 dB at the high-level auxiliary input and -71 dB on phono, both referenced to a 10-watt output level."

About Assembly: ". . . the AR-29 construction made a positive impression." ". . . assembly has been markedly simplified."

Says Mr. Hirsch about overall performance: "The test data speaks for itself." ". . . no other receiver in its price class can compare with it."

Additional Features That Make the AR-29 The World's Finest Medium Power Receiver

• All solid-state circuitry with 65 transistors, 42 diodes and 4 Integrated Circuits • 7-60,000 Hz frequency response • Transformerless, direct-coupled outputs • Greater than 70 dB selectivity • Factory assembled, aligned FET FM tuner • Mute Control attenuates between-station FM noise • Blend Control attenuates on-station Stereo FM noise • Linear Motion controls for Volume, Balance, Bass & Treble • Individually adjustable input level controls for source switching without volume changes • Switches for 2 separate stereo speaker systems • Center speaker capability • Exact station selection with two tuning meters • Stereo indicator • Stereo headphone jack • Swivel AM rod antenna • 300 & 75 ohm FM antenna inputs • Massive, electronically regulated power supply • Modular plug-in circuit board construction

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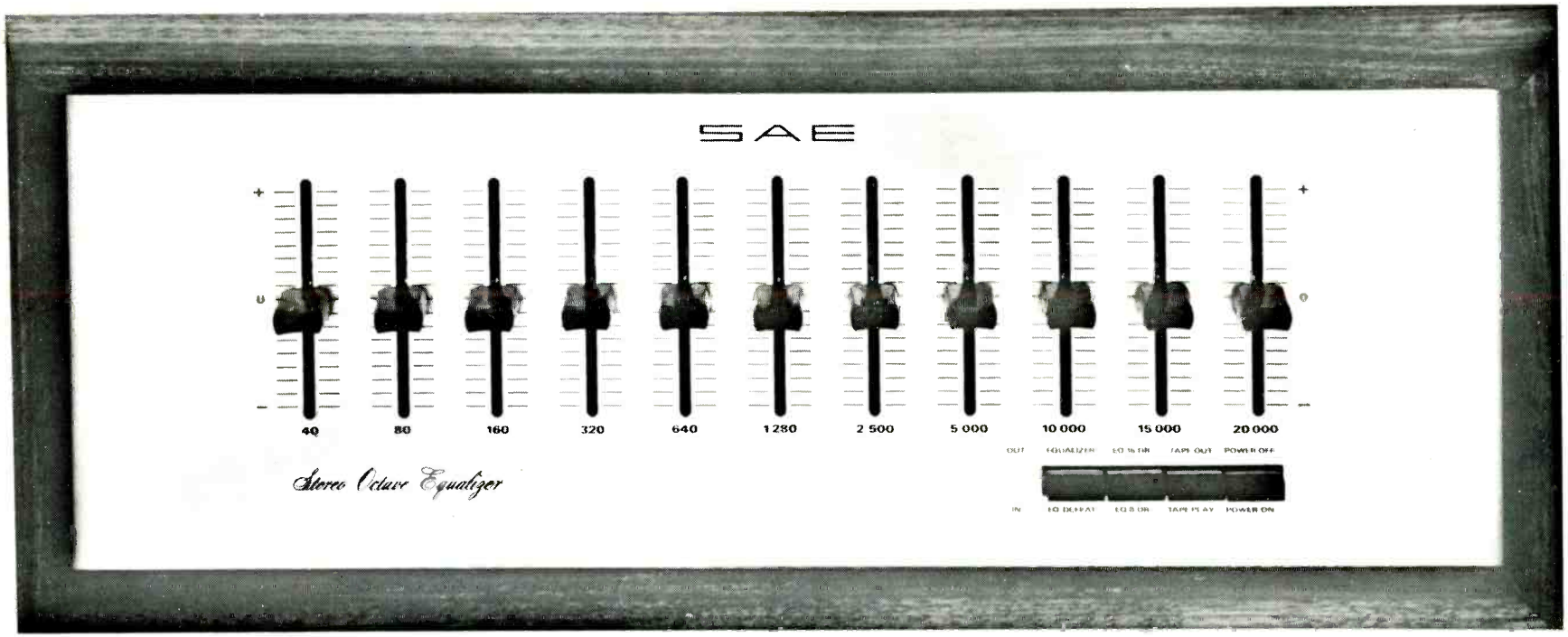

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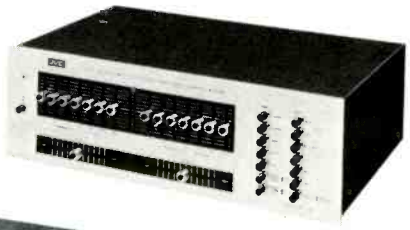
PREAMPLIFIERS

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) "K" indicates kit price; "W" indicates wired price

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	Frequency Response, Hz ± 1 dB	Rated Output, V	THD at Rated Output, %	IM at Rated Output, %	S/N at Rated Output, dB	Phono Sensitivity, mV	Phono Overload, mV	Tape-Head Sens., mV	High-Level Sens., V	Tape-Monitor Z, Ohms	Dimensions, In. W x D x H	Weight, lbs	Price	SPECIAL FEATURES
CROWN OF AMERICA (17)	IC-150	3-100K ±0.6	2.5 (10 peak)	res.	0.01	80 phono, 90 hi-level	0.8-8 adjustable	33-330 adjustable	–	0.22	600	17 x 8⅛ x 5¼	10	239.00	Cascode phono preamp; low phase shift; remote contr. muting; stereo-mono-rev "panorama" contr; tone contr cancel button; loudness, rumble, scratch, tape-mon sws; Optional 5C wal encl, $33.00.
DYNACO (15)	PAT-4	10-100K ±0.5	2	0.03	0.05	70* 85	4	80 400	2	0.2	400	13 x 8 x 4	10	89.95K 129.95W	Front panel in and out jacks. Dual audio outputs (one switched by front panel headphone jack). Incls. cover. Matches FM-3.
	(T)PAS-3X	10-40K ±0.5	2	0.05	0.05	72* 85	2	200	1.5	0.2	1000	13 x 8 x 4	11	69.95K 99.95W	Blend control, 7-KHz filter. Incls. cover. Matches FM-3. *phono input, all models.
	(T)PAS-2X	10-40K ±0.5	2	0.05	0.05	72* 85	2	200	0.2	0.2	1000	13 x 8 x 4	11	59.95K 99.95W	Same as PAS-3X with different panel and knobs.
	(T)PAM-1	10-40K ±0.5	2	0.05	0.05	72* 85	4	200 1.0V	–	0.2	1000	12 x 6 x 3	7	34.95K 59.95W	Reqs. ext. pwr. source, as from socket on Dyna tube ampls; mono; d.c. heaters.
HARMON KARDON	Citation Eleven	5Hz-125kHz ±0.5	6	0.05	0.05	90	1.5	115	–	150		16 13/16 x 12 x 4¾	20	295.00	2 tape mons; 2 tape outputs; lo-Z phone jack; spkr sel. sw; audio equalizers.
JVC AMERICA (9)	5011	10-100K +0, –5	3.0	0.05	–	96	3.2 1.0	135	1.2	0.12	100K	19 x 13 7/32 x 6	24	699.95	7 pos. graphic tone contr for ea. chan.
MARANTZ (58) (59)	33	20-20K ±0.25		0.02	0.02	100	1.0	100	–		600	15⅜ x 5¾ x 8¾	12	395.00	12dB/oct hi and lo filters.
PIONEER (29) (45) (57)	SC-100	5-50K ±1	5.0	0.2	0.2	70 phono	0.15 3.5	120	1.5	0.2	150K	16¾ x 11⅜ x 6¾	14	375.00	Stepped tone and volume control; input impedance switch for phono 2; –15 and –30 dB muting switch Low and high filter sw.
	SC-700	10-60K ±1	4.0 2.0	0.5 0.05	0.2	100 Aux.	4.0	90	–	0.25	220K	11¾ x 10 x 4½	13	129.95	Stepped tone control. Headphone output –20 dB muting switch.
SAE (35)	Mk-I	10-100K ±0.25	2.5	0.05	0.1	85	2.2	200	–	0.25	600	17 x 10½ x 5	18	550.00	Four-frequency equalizer switches for both l.f. and h.f.; variable amounts on each; tape copy facility
SONY (37)	TA-2000	12-150K	1	.03	.05	90	1.2 .06	100	1.2	0.12 adjustable		15⅜ x 12¼ x 5¾	19.4	329.50	2 VU mtrs; stepped tone contrs. tape mon sw; dual selector sw.

Dynaco PAT-4



JVC 5011

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Marantz Model 33

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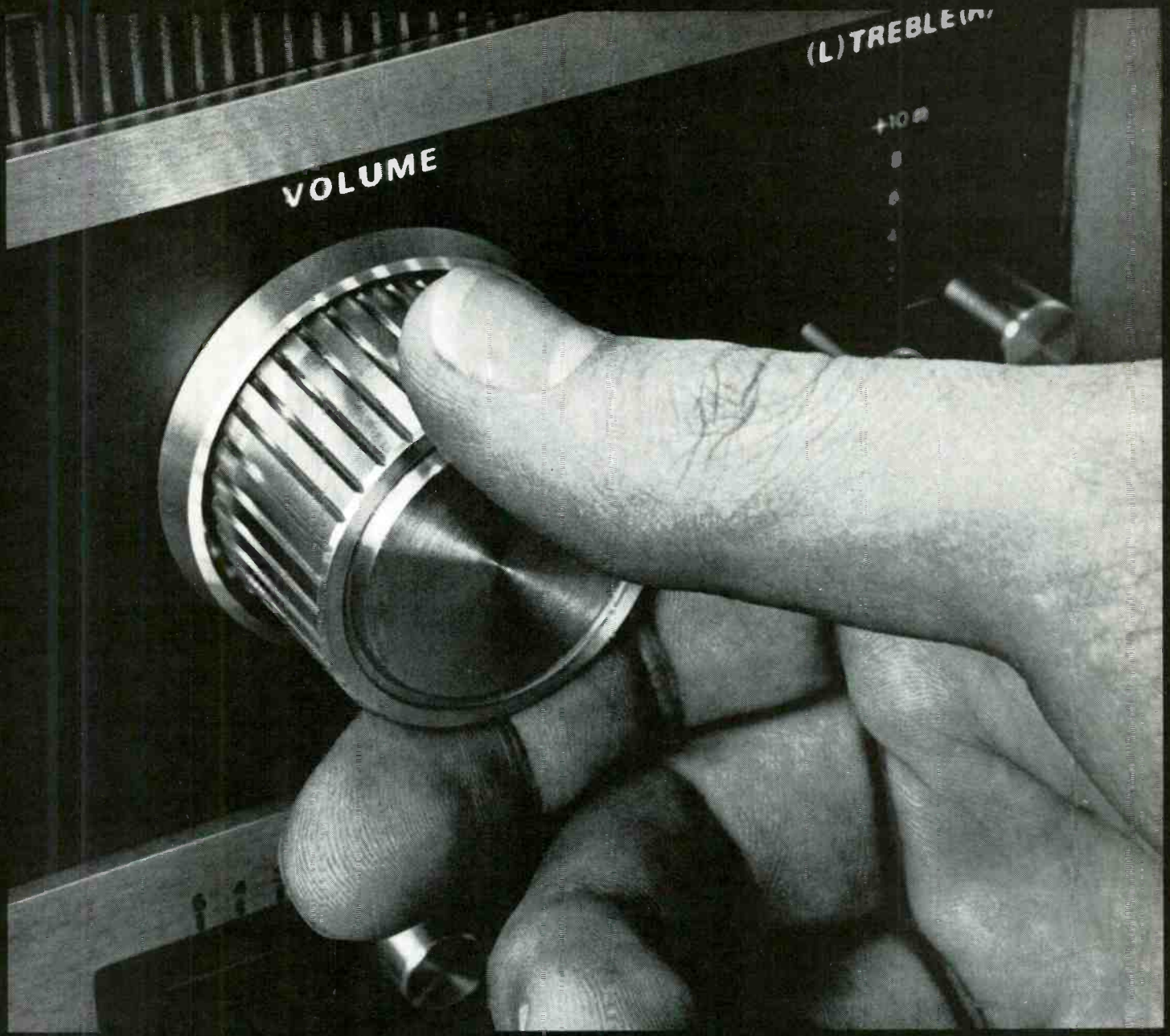

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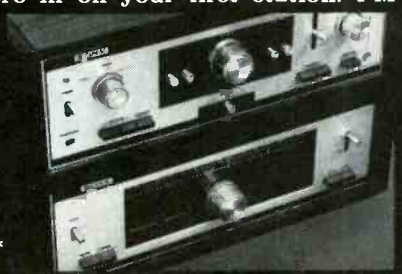

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TUNERS

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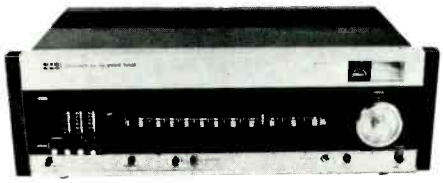
MANUFACTURER (Circled numbers indicate adv. page)	MODEL	IHF Sensitivity, μV	THD, Mono, 100% Mod., %	Capture Ratio, dB	Alt. Chan. Selectivity, dB	Frequency Response, Hz, ±2 dB	AM Suppression, dB	Stereo Separation, 1000 Hz, dB	Stereo Separation, 10 kHz, dB	THD, Stereo, 100% Mod., %	Tuning Indicator	S/N, dB	Dimensions – in. W x D x H	Weight, lbs.	Price	SPECIAL FEATURES
BIC/LUX (3)	71/5T	1.2*	0.2	2.5		20-15K ±1	80	40		0.5	Meter	60	18½ x 12½ x 6		322.00	* 30 dB S/N; center-tune ind. light; 3 FM pre-sets; incls. AM
	71/7T	2.2*	0.5	4.0		20-15K ±1	70	30		0.7	Meter	50	16½ x 9 x 5		179.00	*30 dB S/N; hi & lo Z phone jack; incls. AM.
DYNACO (15)	(T) FM-3	4	0.5	5	54	10-15K +0.5	63	30	17	1.0	Eye	70	13 x 8 x 4	13	99.95K 154.95W	Auto stereo switching; matches PAS-3X and PAT-4 pre-amp and SCA-35 and SCA-80 amps; incls. cover.
	(T) FM-1	4	0.5	5	54	10-40K +0.5	63	–	–	–	Eye	70	13 x 8 x 4	12	74.95K 109.95W	Mono tuner; incls. cover; MPX can be added with FMX-3 kit @$29.95.
EICO	3300	3.5	1.75	4	20	40-15K ±1	40	33	25	1.75	Meter	60	12 x 7 x 3⅜	6	69.95K 109.95W	FET; wideband cct. des; pre-assembled front end, mpx, i.f.'s.; incls. cab.
ELECTRO-VOICE	EV-1255	2.5	1.0	2.5		30-15K ±1		30		1.5	Meter	60	8⅜ x 10¼ x 3⅜		147.60	Movable station markers; afc.
GROMMES	108A	2	0.5	3	45	20-15K ±1	45	35	25	0.5	Meter	65	13½ x 10 x 4⅜		199.95	
HEATH (33)	AJ-15	1.8	0.5	1.5	70	20-15K ±1	50	40	25	1.0	2 Meters	70	16⅞ x 12½ x 4¾	11½	189.95	Xtal filters; IC i.f., FETS, phase adjust; stereo-only mode; auto noise operated squelch; black panel styling
	AJ-14	5.0	1.0	3.0		20-15K -3, +0	40	30				50	12 x 9¾ x 3¼	4.5	57.95	Pre-built, pre-aligned front end; stereo/mono switch; stereo phase contr.; stereo indicator light.
KLH	18	2	0.5	3.0	35	20-15K ±1	50	35	20	0.8	Meter	55	9 x 5⅜ x 4¼	4	129.95	FET front end; 5 i.f.'s; zero-ctr tuning mtr; planetary tuning contr.; mx noise filter; incls. cab.
KENWOOD (39)	KT-7000	1.5	0.3	1.5	60	20-15K +0, -2	60	35	25	0.6	2 Meters	70	16½ x 11 x 5	18	249.95	Xtal filters, IC's, FET's, S-mtr and zero-ctr tuning mtr, multipath output, muting, noise filter, output level control; incls. AM.
	KT-2001	2.0	0.5	4.0	45	20-15K +0, -2	50	30	20	0.7	Meter	60	13 x 9½ x 5	9.5	99.95	FET front-end, IC i.f. stage, stereo noise filter; incls. AM.
LAFAYETTE (101)	LT-725	1.7	0.25	1.5	50			40		0.25	Meter	75	12 x 9⅛ x 3¾	10	99.95	Auto stereo sw; int. FM ant; flex. AM loopstick.
	LT-670	3.5		5	30			30			Lt.	50	10⅜ x 8⅜ x 3½	9	69.95	Auto FM station lock; front panel tape output; int. AM and FM ants.
LEAK	Stereofetic	2		3.5	55	40-15K ±1	50	30	20	0.25	Meter	60	11½ x 7¾ x 4¼	6 3/16	225.00	"Quasi-stereo" sw reduces noise on dist. stas; tuning ind. acts as tuning meter and stereo indicator.



Bic/Lux 71/5T

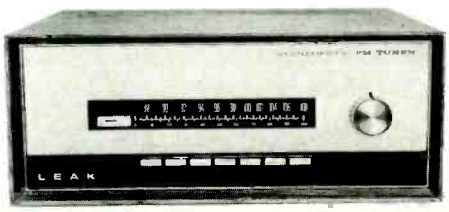
EICO Cortina 3300

Heathkit AJ-15

Dynaco FM-3

Kenwood KT-7000

KLH Eighteen



Leak "Stereofetic"

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The unsurpassed **KR-7070** . . . 350 Watts • FET • IC • XTAL Filter • FM/AM Stereo Receiver with Automatic/Remote Tuning

The amazing **KR-6160** . . . 260 Watts • FET • IC • FM/AM Stereo Receiver with Dynamic Microphone

The magnificent **KW-8077** . . . 6 Heads • 3 Motors • Stereo Tape Deck with Automatic Reverse Record/Playback plus Auto Repeat Playback

The superb **KX-7010** . . . Stereo Cassette Deck with Exclusive Micro-Gap Head for superior sound reproduction

The extraordinary **KS-707P** . . . Stereo Compact with 188 Watts • FET • IC • FM/AM Stereo Receiver • PE 2034 Auto/Manual Turntable

The masterful **KL-5060** . . . 3-Way • 4-Speaker System

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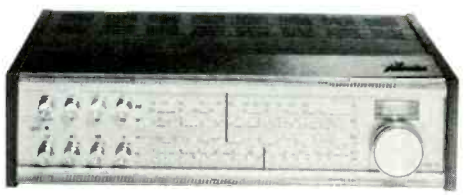
TUNERS — Continued

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) "K" indicates kit price; "W" indicates wired price

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	IHF Sensitivity, μV	THD, Mono, 100% Mod., %	Capture Ratio, dB	Alt. Chan. Selectivity, dB	Frequency Response, Hz ±1 dB	AM Suppression, dB	Stereo Separation, 1000 Hz, dB	Stereo Separation, 10 kHz, dB	THD, Stereo, 100% Mod., %	Tuning Indicator	S/N, dB	Dimensions – in. W x D x H	Weight, lbs.	Price	SPECIAL FEATURES
MARANTZ (58) (59)	20	1.8	0.15	3.5	73	20-15K ±0.5	40	45	35	0.15	Scope	73	15⅜ x 14⅛ x 5¾	24	595.00	
	23	2.4	0.3	2.5	80	20-15K ±1.0	50	40		0.5	2 Meters	70	15⅜ x 12½ x 5¾	16	259.00	
NIKKO	FAM-14	1.8		1.5	60	50-15K ±1	60	40	30	1	Meter	60	13 x 9½ x 3¾	8.8	139.95	Dual-gate FET: cer. filters; muting cct; dial light contr also contrs vol for head-phone ampl; plug-in modules; cct brkrs.
	FAM-12	1.8		3.0	55	50-15K ±1	50	40	30	1	Meter	60	12 x 10 x 3¾	7.7	119.95	FET's in FM and AM front end; noise filter; A.F.C.; muting circuit.
NORELCO (89)	697	3.0	1.0	4	46	20-15 ±2		30	28	1.5	Meter	58	14 x 10 x 3¾	7.5	179.95	2 shortwave bands 2.2 – 7.3 and 9.5 to 22 MHz; includes AM broadcast band.
PIONEER (29) (45) (57)	TX-900	1.7	0.3	1.5	65	50-15K ±2		38	20	0.5	2 Meters	67	15⅝ x 14 x 5½	17	259.95	3-FET front end; 2 crys. fltrs and 4 ICs in i.f. unit; mpx fltr; muting sw; sep level contrs for AM and FM; incls AM.
	TX-700	2.2	0.5	2.0	35	50-15K ±2		42	20	0.8	Meter	52	13¼ x 10⅝ x 4⅝	12	199.95	FET front end; 2 ICs in i.f. unit; push-button preset; muting and mpx filter sw; incls AM.
	TX-500	2.5	0.5	2.5	40	50-15K ±2		35	17	0.8	Meter	50	13 x 13⅛ x 5	11	109.95	FET front end; incls. AM.
SANSUI (6) (7)	TU-999	1.8	<0.3	1.5	>70		>80	>38		<0.5	2 Meters	>65	17 x 13 x 6	22	279.95	FETs, ICs, crys fltrs; sig. str mtr; zero ctr tng mtr; muting; noise fltr; 300- and 75-ohm ant. input; incls AM.
SCOTT Cover II	312-D-1	1.7	0.6	1.9	46			40			Meter	65			329.95	
SHERWOOD	S2300 FM AM	1.8	0.15	2.0	55	20-20K ±1	45	40	40	0.15	Zero Meter	70	14 x 10¼ x 4	11	199.95	Available mounted on 19" commercial rack panel.
	S3300 FM	1.8	0.15	2.0	55	20-20K ±1	45	40	40	0.15	Zero Meter	70	14 x 10¼ x 4	11	169.95	Available mounted on 19" commercial rack panel.
	S2500 Mono FM/AM	1.8	0.15	2.0	55	20-20K ±1	45	–	–	–	Zero Meter	70	14 x 10¼ x 4	11	159.95	Same as above.
	S3500	1.8	0.15	2.0	55	20-20K ±1	45	–	–	–	Zero Meter	70	14 x 10¼ x 4	11	129.95	Same as above.
SONY (37) (54) (55)	ST-5000F	1.8	0.2	1.5	90	20-15K ±0.5	65	40	30	0.35	2 Meters	70	15⅜ x 12¼ x 5¾	21	449.50	FET front end; 8 element s/s i.f. fltrs.
	ST-5100	2.6	0.3	1.5	80	20-15K ±1	65	40		0.5	2 Meters	70	16⅝ x 12⅝ x 5	15.4	219.50	
	ST-5600	3	0.3	2	50	30-15K ±1	60	38		0.7	Meter	65	16	9	119.50	

Marantz Model 20



Norelco 697

Pioneer TX-700

Sansui TU-999

Scott 312D

Sherwood S-2300

Sony ST-5000FW

SANSUI

HITS THE DECK

If you already own a Sansui receiver, you might be tempted to buy the new SD-7000 tape deck for our name alone . . . but we'd rather you didn't.

Because there are better reasons: for instance, the automatic reverse doesn't just reverse . . . it also repeats if you want to hear the same tape over and over, and it rewinds automatically if you just want to hear the tape's first side. Not only that, it gives you a choice of triggering methods; either foil strip or an "inaudible" 20 Hz. tone signal. And our exclusive Sleep Switch lets you set the Super-Deck to turn your entire hi-fi system off when the tape is over.

We put "inaudible" in quotes back there, because if you can't hear it, it's your speaker's fault — not Super-Deck's.

The SD-7000's frequency response goes down past 20 to 15 Hz. — and up again to 25,000 Hz. at the top end. In point of fact, you'll hear a little more of everything with this deck, thanks to its 60 db signal-to-noise ratio, and its low record-play distortion (only 1.2% at zero VU) . . . most deck manufacturers won't even quote distortion figures for their machines.

Naturally, there's more. All transport controls are feather touch solenoids with logic-circuit delays to prevent tape spill and breakage (remote control optional). Hysteresis-synchronous capstan motor, 4-heads. And lots more. $679.95 worth, in all, and more than enough to fill a four-page brochure full of features, fact and specifications.

But then, could you expect any less from SANSUI?

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SANSUI ELECTRONICS CORP.
Woodside, New York, 11377 • Los Angeles, California, 90007

SANSUI ELECTRIC CO., LTD., Tokyo, Japan • Frankfurt a.M., West Germany **Electronic Distributors** (Canada), British Columbia

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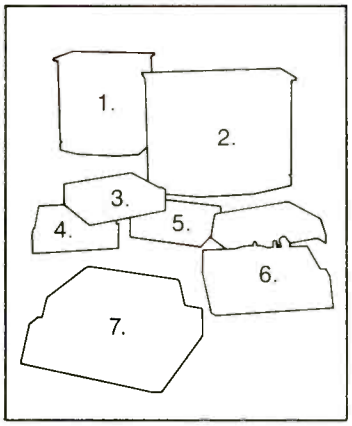
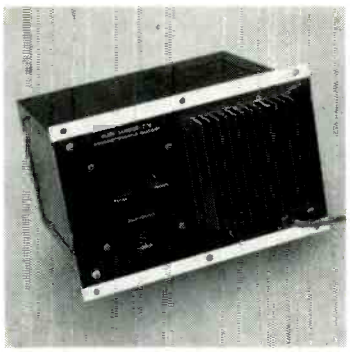
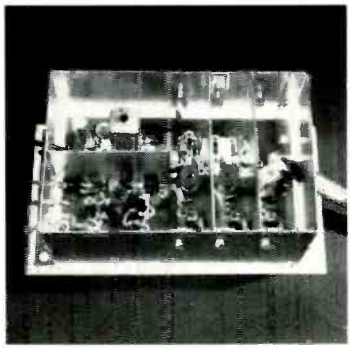


1. Altec's new 2875A Granada Bi-amp Speaker System incorporates the all-new 800 Hz Electronic Crossover Bi-amp which delivers 60 watts RMS to a new Dynamic Force® 15-inch woofer and 30 watts RMS to the high frequency driver.
2. Altec's new 2873A Barcelona Bi-amp Speaker System incorporates a 500 Hz Electronic Crossover Bi-amp and new 411-8A Dynamic Force woofer. Mids and highs are reproduced through a 25" sectoral horn and new Symbiotik Driver.
3. Altec's new 724A AM/FM Stereo Tuner Pre-Amplifier features the new Varitronik® tuner with 4 FET's for the highest sensitivity and stability.
4. Altec's new 725A AM/FM Stereo Receiver is rated 60/60 watts RMS. It includes the new Varitronik FM Tuner with 4 FET's, a combination of Butterworth and crystal filters, all plug-in modular circuitry and 10 other performance features.
5. Altec's new 714A AM/FM Stereo Receiver delivers 44/44 watts RMS (180 watts IHF music power) and features 3 FET's, 2 crystal filters, plus a volume range switch, black-out dial and spring loaded terminals for speakers.
6. Altec's new 911A Stereo AM/FM Music Center has 44/44 watts RMS (180 watts IHF music power). Plus, it incorporates the most sophisticated components including an FM tuner section with 3 FET's, 2 crystal filters and IC's. Garrard's best automatic turntable and a Shure "High Track" cartridge.
7. Altec's new 912A Stereo AM/FM Cassette Music Center delivers 44/44 watts RMS (180 watts IHF music power)—more power than any other music center on the market. Plus, this model features a front-loading Staar cassette tape recorder for stereo playback and recording from any source.

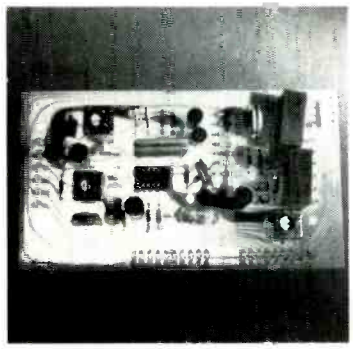
Exclusive Dynamic Force Concept
Altec has developed a new type of low frequency speaker. It features a long voice coil with edge wound pre-flattened copper ribbon wire and a magnetic structure of extremely high flux field. (Note this unusually strong magnetic field controls the motion of the cone to an extent not normally found in infinite baffle systems.) This uniquely designed unit is capable of producing a Dynamic Force of up to 16 lbs. With this unusually large force capability, as much as twice the compression can be produced than is normal in acoustic suspension speakers. The result is greatly improved low frequency transient performance, better linearity, extended low frequency response and reduced distortion while maintaining medium efficiency.



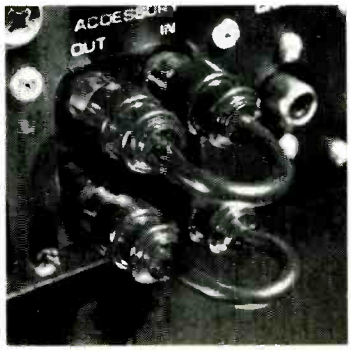
Altec's 770A Electronic Crossover Bi-Amplifier
This highly sophisticated electronic component features a very fine bass amplifier rated at 60 watts RMS electronically crossed over at 800 Hz or 500 Hz to an equally fine high frequency amplifier rated at 30 watts RMS. The use of any passive crossover is eliminated and thus the damping effect of each amplifier is utilized to its utmost. The result is a much tighter transient response and an improved overall sound quality. Note also that with the 770A, IM distortion is inherently decreased to its lowest possible point—virtually unmeasurable under the normal IHF method.



Exclusive Varitronik Tuner
This new tuner uses 4 FET's (field effect transistors). Three of them provide amplification while the fourth operates as an oscillator. By using FET's, any cross modulation problems experienced with bi-polar transistors is eliminated. The exclusive Varitronik tuner also uses 4 double Varicaps instead of the conventional mechanical tuning capacitor to achieve a better balanced circuit performance. Mechanical to electronic conversion required for Varicap tuning is achieved by a specially designed potentiometer which provides linear tracking and accurate calibration of the FM scale. Low distortion, high stability and high sensitivity are also characteristic of this new tuner.



Altec Direct-Plug-in Modular Circuitry
The use of plug-in modular circuitry is incorporated into the design of each and every new Altec stereo component. In addition to the obvious benefits of simpler production and faster servicing, the maximum use of plug-in modular circuitry allows the highest possible degree of consistency and uniformity in performance from product to product. Maximum reliability is inherent in its design simplicity. And a new high in quality control is achieved.



The Altec Acousta-Voicette Stereo Equalizer
The new Altec Acousta-Voicette accurately "tunes" the frequency responses of your complete component system *and even your listening room* to a flat acoustical response at your ears. By utilizing 24 full-adjustable, critical bandwidth rejection filters per channel, it puts all frequencies into perfect balance. For the first time, you can hear the original acoustic environment of the recording hall—and not the acoustics of your listening room. Altec's new stereo components are especially designed to work with the new 729A Acousta-Voicette, and they're built with separate accessory jacks as shown to the left.

For a free copy of the new Altec catalog, write to Altec Lansing, 1515 S. Manchester Ave., Anaheim, CA 92803.

MANUAL TURNTABLES and ARMS

SPEEDS (use letter code)

A – 33, 45, 78
B – 33, 45
C – 33 only
D – 16, 33, 45, 78
E – 16, 33, 45
F – Cont. variable

MANUFACTURER (Circled numbers indicate adv. page)	TURNTABLES										TONE ARMS												SPECIAL FEATURES
	Model	Speeds (see letter code)	Wow and Flutter at 33⅓, %	Rumble (NAB) dB	Motor Type	Platter Diameter, in.	Platter Weight, lbs.	Drive	Arm Mounting Provision	Dimensions, W x D x H, in.	Weight, lbs.	Model	Overall Length, in.	Pivot-stylus dist., in.	Vertical Bearing	Lateral Bearing	Stylus Force Method	Max. Tracking Error, deg.	Cart. Weight Range, gms.	Arm Resonance, Hz	Stylus Force Range, gms.	Weight, if sep., oz.	Price	
ACOUSTIC RESEARCH (67)	XA	B	0.5	–38	24-P Sync	11¾	4	Belt	Integ.	16⅜ x 12⅜ x 5⅛	13½	–	12	9	Cone Point	Ball	Counter Balance	0.35° in.	–	10-15	0.5-8.0	–	87.00*	*Includes stylus-force gauge, base, cover, oil overhang gauge.
	TA	C	0.5	–38	24-P Sync	11¾	4	Belt	Integ.	16⅜ x 12⅜ x 5¼	13½	–	12	9	Cone Point	Ball	Counter Balance	0.35° in.	–	10-15	0.5-8.0	–	84.00*	Same as above.
	XA UNIV.	Same as XA, except usable on 100–120 or 220–240 W., 50–60 Hz.																					87.00*	Same as above.
BSR (107)	MP60 X	D	.08	–42	Sync Ind.	11	3¼	Idler	Integ.	13⅛ x 11¼ x 6 15/16	13	–	10¾	6.474	Pivot	Ball	Balance and Spg.	1.2	5-20	10	1-6	–	69.50	Avail. as turntable ensemble includ. base and dust cover $82.50.
BOGEN	B 111	B	0.1	–45	Sync	12	2	Belt	Integ.	17⅝ x 6⅛ x 13¼	15												99.95	Spec. features: belt prot; auto shut-off; vis. damped cueing; wal base w/bal. dust cover; plug-in heads; anti-skating.
EMPIRE Cover IV	598	A	.01	–55	Hys.	12	7	Belt	Integ.	17½ x 15⅛ x 8	30	990	12	9	Ball	Ball	Balance and Spg. (cal.)	0.7	5-15	6	0-6	1	234.95 incls. cover	Prices include TT, arm, base.
	489A	A	.05	–48	Hys.	12	6	Belt	Integ.	17½ x 15½ x 8	25	980A	12	9	Ball	Ball	Balance and Spg.	0.7	2-20	7	0-8	1	199.95	Same as above.
	398A	A	.05	–48	Hys.	12	6	Belt	Integ.	17½ x 15½ x 8	12	980A	12	9	Ball	Ball	Balance and Spg.	0.7	2-20	7	0-8	1	199.95	Same as above.
												990	12	9	Ball	Ball	Balance and Spg.	0.7	5-15	6	0-6	1	74.95	
NORELCO (89)	202	A	0.6	–36	d.c. Servo	11¼	2½	Belt	Integ.	15½ x 14¼ x 5 5/16	10.5		10½	9	Sleeve	Sleeve	Balance and Wt.	1.8	4-18	7	½-4		129.50	Elect. speed contr; ± 2% pitch adj; photoelect auto motor shutoff; hydraulic cueing lever.
ORTOFON (41)												RMG-212	12	9	Ball	Ball	Balance and Spg.	1.19	7-19	8	0-4½		90.00	
												RMG-309	16	12	Ball	Ball	Balance and Spg.	0.83	7-19	8	0.7		75.00	

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Norelco 202

BSR McDonald MP60/X

Ortofon RMG-212

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If you know any 2-speed manual turntable that costs $129.95 and also gives you automatic operation . . . two motors . . . belt drive precision . . . drift-free plug-in shell tonearm . . . lateral tonearm balancer for equalized stereo sound . . . high compliance magnetic cartridge with diamond stylus . . . oiled walnut base . . . hinged dust cover . . . 12" dynamically balanced platter . . . automatic stylus protection lead-in device . . . automatic stop, return, repeat . . . oil-damped cueing . . . adjustable stylus tracking force — then buy it.

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MANUAL TURNTABLES and ARMS — Continued

SPEEDS (use letter code)

A – 33, 45, 78
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E – 16, 33, 45
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MANUFACTURER (Circled numbers indicate adv. page)	TURNTABLES										TONE ARMS												SPECIAL FEATURES
	Model	Speeds (see letter code)	Wow and Flutter at 33⅓, %	Rumble (NAB) dB	Motor Type	Platter Diameter, in.	Platter Weight, lbs.	Drive	Arm Mounting Provision	Dimensions, W x D x H, in.	Weight, lbs.	Model	Overall Length, in.	Pivot-stylus dist., in.	Vertical Bearing	Lateral Bearing	Stylus Force Method	Max. Tracking Error, deg.	Cart. Weight Range, gms.	Arm Resonance, Hz	Stylus Force Range, gms.	Weight, if sep., oz.	Price	
PANASONIC	SP 10	B	Wow .03% Flutter .02%	–60	DC Motor	12		Direct		14 x 14 x 4	20												299.95	
PIONEER (45)	PL-41A	B	.08		Hyst. Sync	12	4	Belt	Integ.	19 11/16 x 15 15/16 x 7 11/16	24	–	13	9.5	Ball	Ball	Static Balance	1			0.5-5.0	–	220.00	Magnetic auto lead in; anti skating reject with separate motor.
	PL-A-25	B	0.1		Hyst. Sync	12	2.5	Belt	Integ.	17 5/16 x 13 3/8 x 6 13/16	16	–	12	9	Ball	Ball	Static Balance	1.5			0.5-5.0	–	129.95	Same as above.
RABCO												SL8-E	14	7	Cone	Cone	Cntr Weight	0.16	0-18	10	0-5	Arm 1 oz. Unit 3 lbs	169.50	Straight-line servo-driven; auto cueing.
SME (11)												3009		9	Knife Edge	Ball	Rear Weights		3-20		1/4-5		117.50	Adj. anti-skating; viscous damping; cueing.
												3009 HE		9	Knife Edge	Ball	Rear Weights		3-20		1/4-5		123.75	As above; horizontal cable entry.
												3012		12	Knife Edge	Ball	Rear Weights		3-20		1/4-5		128.00	Same features as 3009.
SONY (37) (54) (55)	PS-1800	B	.08	–41	DC Servo	12	3	Belt		19 5/16 x 16 1/4 x 7 1/16													199.50	Complete w/arm, base, and dust cover.
	TTS-3000A	B	.05	–47	DC Servo	12	3	Belt		15 x 14 5/16 x 5 1/8	14												149.50	
												PUA-286	15 1/8	11 1/4	Ball	Ball	Balance			8			99.50	
												PUA-237	13 1/8	9 11/12	Ball	Ball	Balance			9			85.00	
THORENS (63)	TD 125 AB	E	.08	–48	Sync	12	8½	Belt	Integ.	18 x 14 x 5	32												300.00	Also avail. as TD-125 LB on large base for 16" arms; can be mtd. on CE-509 molded mtg. frame for custom insts.
	TD 125	E	.08	–48	Sync	12	8½	Belt	Indep.	18 x 14 x 5	32												205.00	
	TD 150 MK II	B	.09	–37	Sync	12	7	Belt	Integ.	15 1/8 x 12 7/8 x 5													130.00	

Panasonic SP-10

SME 3009

Sony PS-1800

Pioneer PL-A25

Thorens TD-125

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Feature for feature PE automatic turntables stand alone: Dial-a-Matic vertical tracking angle adjustment . . . Gentlest, fingertip cueing action . . . One-Lever Control . . . Fail safe stylus protector . . . Automatic record scanner. Awarded "DIN" Seal of Excellence for PErfection in PErformance. Get a demonstration on the world's gentlest automatic turntable at your PE dealer, or send for details: Elpa Marketing Industries, Inc., New Hyde Park, N.Y. 11040.

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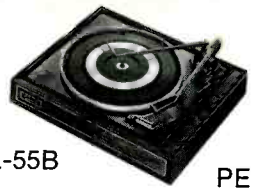
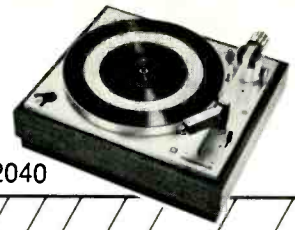
AUTOMATIC TURNTABLES



Garrard SL-55B



PE 2040

SPEEDS (use letter code)

A – 33, 45, 78	D – 16, 33, 45, 78
B – 33, 45	E – 16, 33, 45
C – 33 only	F – Cont. variable

MANUFACTURER (Circled number indicates adv. page)	Model	Speeds (See Letter Code)	Platter Diameter, In.	Wow and Flutter at 33⅓, %	Rumble (NAB) dB	Max. Tracking Error, Deg.	Pivot-Stylus Dist., In.	Arm Type	Cart. Weight Range, Gms.	Arm Resonance, Hz	Max. Stack Records	Change Cycle at 33⅓, Secs.	Clearance Below Board, In.	Clearance above Board, In.	Overall W x D, In.	Overall Height, In.	Weight, Lbs.	Price	SPECIAL FEATURES
BSR (105)	610	D	11	.08	-42	1.2	6.474	Counter-balance	5-20	13	6	5	2 7/16	3 7/8	13 1/8 x 11 1/4	6 15/16	13	79.50	Avail. as "total turntable" w/base, Shure M-93G ctg. and dust cover, 141.95.
	510	D	11	.08	-42	1.2	6.474	Counter-balance	5-20	13	6	5	2 7/16	3 7/8	13 1/8 x 11 1/4	6 15/16	10	64.50	Avail. as "total turntable" w/base, Shure M-75 ctg and dust cover, 100.00
	310	D	11	0.12	-40	1.25	6.474	Balance & Spring	5-14	14	6	5	2 7/16	3 7/8	13 1/8 x 11 1/4	6 15/16	10	44.50	Avail. as "total turntable" w/base, Shure M-75 ctg and dust cover, 80.00
	210X	D	8	0.15	-40	1.25	7.071	Balance & Spring	5-14	16	6	5	2	3 1/8	11 7/8 x 8 3/8	5 1/8	8	59.50	Incls. base, dust cover, ctg, and 45-rpm adapter.
DUAL (50) (51)	1219	A	12	0.05	-45	0.4	8 3/8	Balance & Spring	1-12	8-14	6	13	3	5	14 3/8 x 12	8	15 1/2	175.00	4-point gimbal tonearm suspension; adj. vert. tkg angle; 6% pitch contr; sync motor; 12" platter; cueing.
	1209	A	10 5/8	0.08	-45	0.5	8 1/4	Balance & Spring	1-12	8-14	6	11	2 5/8	5	13 x 10 3/4	7 5/8	10	129.50	6% pitch contr; anti-skating cal for conical and elliptical styli; cueing; sync motor; cast platter.
	1215	A	10 5/8	0.08	-45	0.5	8 1/4	Balance & Spring	1-8	8-14	6	11	2 5/8	5	13 x 10 3/4	7 5/8	9 1/3	99.50	6% pitch contr; synchronized tkg force and anti-skating; cueing.
GARRARD (3)	SL-95B	A	11 1/2	.07		0.75	8 1/4	Balance	0.15	8	6	10	3	4 3/8	16 1/16 x 14 9/16	7 3/8	11	129.50	Synchro-lab motor, low mass viscous-damped tone arm; 2-point record support; oversized platter; anti-skating, control; slide-in cartridge clip.
	SL-75B	A	11 1/2	.07		0.75	8 1/4	Balance	0.15	8	6	10	3	4 3/8	15 13/16 x 14 5/8	7 3/8	11	109.50	Synchro-Lab motor, adj. counter weight; viscous-damped arm; 2-pt. record support; anti-skating cont; cart. clip.
	SL-72B	A	10 1/2	.08		0.75	7 1/2	Balance	0.15	8	6	10	3	4 3/8	15 13/16 x 14 5/8	7 3/8	10 1/2	89.50	Synchro-Lab motor; viscous damped arm; anti-skating cont; cart. clip.
	SL-65B	D	10 1/2	.09		0.85	7 1/2	Balance	0-18	10	8	12	2 7/8	4	15 3/8 x 13 1/8	6 7/8	9	79.50	As above.
	SL-55B	D	10 1/2	0.12		0.85	7 1/2	Balance & Spring	0-12	12	8	12	2 7/8	4	15 3/8 x 13 1/8	6 7/8	9	59.90	As above.
	40B	D	10 1/2	0.14		0.85	7 1/2	Balance & Spring	0-12	12	8	12	2 7/8	4	14 7/8 x 12 1/2	6 7/8	9	44.50	Viscous-damped cueing lever, cart. clip; tubular tone-arm; Super-sensitive trip.
JVC (9)	5200	B	12	.02	-38	0.5	7	Oil Damped Dyn. Bal.	0-6 1/2		6	10			16 3/8 x 14 3/8	9 1/2	17.6		Belt drive from 4-p hys motor.
	6102	D	11	.03	-41	0.5	7 1/2	Dyn. Bal.	0-10		6	10			17 1/4 x 13 3/4	9 1/2	23.4		Changer plus 8-track ctg. player in sgl. unit.
LESA	PRF-6	A	11 5/8	.01	-56	1.5		Balance	0-16		8	13	3 1/2	4	17 2/3 x 14 1/2	8	27 1/2	179.95	
	ATT-4	A	11 5/8								8	13	3 1/2	4	14 1/2 x 12	8	27 1/2	129.95	
MIRACORD (49)	770H	A	12	.06 .025	-40	0.5	7 1/4	Balance & Spring	0-15	<8	10	10	3 3/4	5 5/8	14 1/2 x 12 1/2	10	18	225.00	Built-in var. spd. contr; digital readout strobe; ionic stylus-wear ind; vert. tkg angle adj.
	50H	D	12	.06 .025	-40	0.5	7 1/4	Balance & Spring	0-6 1/2	<8	10	10	3 3/4	5 5/8	14 1/2 x 12 1/2	10	18	169.50	Push button operation; adjustable stylus overhang. Hysteresis motor.
	750	D	12	.06 .025	-40	0.5	7 1/4	Balance & Spring	0-6 1/2	<8	10	10	3 3/4	5 5/8	14 1/2 x 12 1/2	10	18	149.50	As above, exc. induction motor.
	630	D	10 3/8	.06 .025	-39	0.5	7 1/8	Balance & Spring	0-6 1/2	8	10	12	2 5/8	5 5/8	13 3/8 x 11 5/8	9	17	129.50	As above.
	620	D	10 3/8	.06 .025	-38	0.5	7 1/8	Balance & Spring	0-6 1/2	8	10	12	2 5/8	5 5/8	13 3/8 x 11 5/8	9	17	109.50	As above.
PE (47)	PE-2040	A	11 1/2	0.1	-58	1.8	8 3/16	Balance & Spring	3-15	10	10	16	3 1/4	6 1/2	14 x 12	8 7/8	15 1/2	145.00	Vert. tkg. angle adj; exclusive stylus protection sys; cont. rec. repeat; auto record scanner; vis. damped cueing.
	PE-2038	A	10 3/4	0.15	-56	1.8	8 1/16	Balance & Spring	3-15	10	8	16	3 1/4	6 1/2	13 x 11	8 7/16	12 1/4	115.00	As above.
	PE-2035	A	10 3/4	0.15	-56	1.8	8 1/4	Balance & Spring	3-15	10	8	16	3 1/4	6 1/2	13 x 11	8 7/16	10 1/2	95.00	As above, without vert. tkg angle adj.
	PE-2010	D	10 3/4	0.17	-56	2.0	8 3/16	Balance & Spring	3-15	10	8	16	3 1/4	6 1/2	13 x 11	8 7/16	9 3/4	75.00	As above.
SHERWOOD	SEL-100	B	11 3/4	.06		1 1/2	9 1/2	Dyn Weight	3-9	8					17 x 13	5 1/2	16 1/2	155.00	2 sync motors, belt drive; integral arm.

Expect the Unexpected
The new Miracord 770H.

The Miracord 770H is the finest record playing instrument ever developed. It shares all the exclusive features of the top-rated Miracord 50H. It takes for granted, all of the features expected from the finest turntables. To these expected features, Benjamin has added several that are unexpected, that never existed before, and that will contribute to new convenience and new enjoyment in record reproduction. Now there are five Miracord automatic turntables, ranging from $109.50 to $225 for the Miracord 770H. See them at your hi-fi dealer today. Benjamin Electronic Sound Corporation, Farmingdale, N. Y. 11735
a division of Instrument Systems Corp.

Benjamin

Check No. 49 on Reader Service Card

Now that you know you want a Dual, the next question is which one?

1215—$99.50

1219—$175.00

1209—$129.50

It's not an easy decision to make. There's such a wealth of precision built into every Dual that even the testing laboratories can measure only small differences in performance among the Dual 1215 at $99.50, the 1209 at $129.50 and 1219 at $175.00.

This raises an interesting question for you to consider: What are the important differences to you among these three Duals?

Let's consider them in turn.

Even our lowest priced turntable, the 1215, boasts features any turntable should have (and few do).

Its low-mass counterbalanced tonearm accepts the most sensitive cartridge available today and tracks flawlessly as low as ¾ gram.

Tracking force and anti-skating settings are ingeniously synchronized, so one setting does for both. The cue control is silicone-damped, and eases the tonearm onto the record more gently than a surgeon's hand.

The hi-torque motor brings the heavy 3¾ pound platter to full speed in less than a half turn, and maintains that speed within 0.1% even if line voltage varies widely.

And it even has a control to let you match record pitch with less fortunate instruments such as out-of-tune pianos.

Even a professional doesn't need more.

But you may want more. In which case the 1209 offers some refinements that are both esthetically pleasing and add something to performance.

For example: its tonearm tracks as low as a half gram. Its anti-skating system is calibrated separately for elliptical and conical styli. Its counterbalance features a 0.01 gram click-stop. And its motor is hi-torque and synchronous.

Now what could the 1219 add to this?

The only true gimbal suspension ever available on an automatic arm. Four identical suspension points, one ring pivoting inside another.

And the Mode Selector, which shifts the entire tonearm base — down for single play, up for multiple play — so that the stylus will track at precisely the correct angle (15°) whether playing one record or a stack.
The tonearm is 8¾" long, and the 12 inch dynamically balanced platter weighs 7 pounds.

So the question really isn't which Dual is good enough, but how much more than "good" your turntable has to be.

If our literature doesn't help, perhaps a visit to your dealer will.

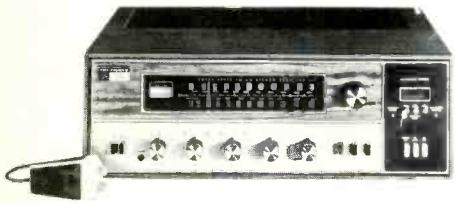
United Audio Products, Inc., 120 So. Columbus Ave., Mt. Vernon, New York 10553. Dual

Check No. 51 on Reader Service Card

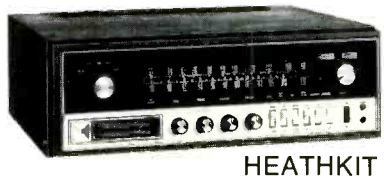
RECEIVERS

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) "K" indicates kit price; "W" indicates wired price

ALTEC LANSING 725A



FISHER 450-T



HEATHKIT AR-15

CONCORD Mark 20

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	AMPLIFIER SECTION: IHF Power/Chan., W	RMS Power/Chan., W	THD at Rated Power, %	IM at Rated Power, %	IM at 1 Watt, %	Power Bandwidth, Hz to kHz	1-Watt Freq. Response, Hz ± dB	Rated Output S/N, dB	Phono Sensitivity, mV	Phono Overload, mV	TUNER SECTION: IHF Sensitivity, µV	Capture Ratio, dB	THD, Mono, 100% Mod., %	THD, Stereo, 100% Mod., %	Stereo Sep., 1000 Hz, dB	Tuning Indicator	Alt. Chan. Selectivity, dB	Dimensions, In., W x D x H	Weight, lbs.	Price	SPECIAL FEATURES
ACOUSTIC RESEARCH (61)	Receiver AAU	–	60	0.5	0.25	0.25	14-44K	20-20K +1db	57 (phono)	2-5	100	2.0	2.0	0.5	0.5	35	Mtr.	> 55	17⅛ x 11⅜ x 6	33	420.00	Wood case opt. $20 spkr. cables opt. $6 2 yr. guarantee.
	Univ.	Same as above except for 100, 120, 220, 240V., 50-60 Hz																				
ALTEC LANSING (42) (43)	725A	–	60	< 0.3	< 0.3	< 0.3	15-25K	20-20K +0.5	60	2.0 5.0	30 60	1.8	1.3	< 0.3	0.5	> 40	2 Mtrs.	70	17⅜ x 16½ x 5	48	699.00	Xtal filters; modular plug-in ccty; lin. scale slide contrs; ind. lts.
	724A	–	–	< .05 @ 1.0V	< .05 @ 2.5V	–	–	20-20K +0.5	60	2.0 5.0	30 60	1.8	1.3	< 0.3	< 0.5	> 40	2 Mtrs.	70	17⅜ x 16½ x 5	42	550.00	Tuner-pre-amp only; otherwise as above.
	714A	45 (4Ω)	22	< 0.5	< 0.5	< 0.5	15-25K	15-45K ± 1	60	2.0 5.0	30 60	1.9	2.0	< 0.5	< 0.5	> 40	2 Mtrs.	48	16⅜ x 13⅜ x 5⅜	34	399.00	Xtal filters; ICs; fets; 4-gang tuning cap; slide contrs; fail-safe ccty.
AMPEX	ASR-100	38 *		0.8			20-25K	20-50K	60			3.0	4.0			35			16½ x 11½ x 4 11/16		249.95	FET front end, muting; afc. switchable; main & rem. spkr. sws; incl. case *± 1 percent.
ADC (16)	1000	50		0.3	0.4	0.2	15-35K	10-60K +2	65	2		2.5	3.0	0.5	0.5	32	Mtr.				289.50	5-pushbutton FM Tuning.
	606A	45		0.3	0.4	0.2	15-35K	10-60K ± 1	65	3		2.5	3.0	0.5	0.5	32	Mtr.		17 x 5 x 9		199.50	Fits standard book shelf.
BIC/LUX (3)	71 2R		75	0.2	0.4	0.4	15-30K	10-50K	80	2.0 8.0	100	1.2*	2.5	0.2	0.5	40			18½ x 13⅜ x 6		580.00	*30dB S/N; 3FM pre-sets; lo & hi filters; var. turnovers; incls. AM.
	71 3R		50	0.2	0.4	0.4	15-30K	10-50K	80	2.0 8.0	100	2.2*	4.0	0.2	0.5	40			18½ x 13⅜ x 6		497.00	Same as above.
BSR McDONALD (107)	McD 40	20	17.5	0.7	1.0	1.4	60-20K	20-20K +1	55	3	2K	2.2	3.5	1.0	1.5	22	Mtr.	31	15 5/16 x 11 11/16 x 4 7/8	15¾	179.95	Auto AFC; headphone jack; stereo beacon; midnight dial.
	McD 78	10	7	1.5	1.3	1.5	60-10K	20-15K	50	85	2K	10	3.8	1.5	1.5	25	Stereo Light	35	22⅛ x 9⅛ x 4⅝	25 7/16 incl. spkrs.	219.95	Incl. speakers; AFC switch; A.C. conv. outlet.
	McD 20	10	7	1.5	1.3	1.5	60-10K	20-15K	50	85	2K	10	3.8	1.5	1.5	25	Stereo Light	35	16 11/16 x 9 4⅞	16 incl. spkrs.	129.95	As above.
BOGEN	BR380	60	43	0.5	0.7	0.35	20-20K	20-35K +2	85	3	60	2.7	1.9	0.3	0.4	35	Mtr.	60	16⅛ x 14 x 4	20	349.95	Ceramic I.F.S.; ICs, FETS; slide contrs; "crescendo control"-expander/compr.
	BR360	50	40	0.5	0.7	0.35	20-20K	20-35K +2	83	3	60	2.7	1.9	0.3	0.4	35	Mtr.	60	16⅛ x 14 x 4	19	299.95	As above.
	BR350	40	30	0.5	0.7	0.35	20-20K	20-35K +2	83	3	60	2.7	1.9	0.3	0.4	35	Mtr.	60	16⅛ x 14 x 4	19	279.95	As above.
	BR340	40	30	0.5	0.7	0.35	20-20K	20-35K +2	83	3	60	2.7	1.9	0.3	0.4	35	Mtr.	60	16⅛ x 14 x 4½	19	249.95	As above, less crescendo control.
	BR320	25	15	0.5	0.7	0.35	20-20K	20-35K +2	80	2.5	50	2.7	1.9	0.3	0.4	35	Mtr.	60	16⅛ x 14 x 4½	19	199.95	As above.
CONCORD (78) (79)	Mark 20	240	150	0.2	0.7	0.4	5-40K	10-35K ± 1	> 65	3	–	1.7	1	0.6	0.7	> 35	Meter	60	17½ x 14 x 5⅛	26	299.79	Slide controls; scratch filter; sep. on/off switch.
	Mark 12	120	90	0.5	0.6	0.5	25-22K	20-25K ± 1	> 65	3	–	1.9	< 2.0	0.6	0.7	> 35	Meter	55	17½ x 12½ x 5⅛	24	239.79	Muting; 75-and 300-ohm antenna inputs.
	Mark 10	80	56	0.5	0.6	0.5	25-20K	20-22K ± 1	> 65	3	–	2.0	< 2.0	0.6	0.7	> 35	Meter	55	17½ x 12¼ x 5⅛	21	199.79	Illuminated front ind-FM, Auto Stereo; incls. AM
EICO	3770	35	20	0.7	2	0.6	20-30K	10-50K	70	270	90	3.5	4	0.75	0.75	40	Meter	45	16 x 9 x 4⅛	14	189.95K 279.95W	Preassembled front end, i.f.'s, mpx; incls cab.
	3780	16	11	0.5	1	0.3	50-25K	20-40K ±3	60	2.7	90	3.5	4	1.75	1.75	33	Meter	20	16 x 9 x 4	10	109.95K 169.95W	FET's; pre-assembled front end, i.f.'s, mpx, incls. cab.
ELECTRO-VOICE	EV-1382	60	40	0.8	–	–	10-40K	10-55K ± 1	75	2.5	140	2.5	3.0	0.8	–	32	Meter	40	18 x 17 x 5⅛	23	299.95	Dual contrs; muting; main-rem. spkr. sw; incl. AM.
	EV-1282	10.5	19	0.8	–	–	20-20K	20-20K ±1.5	70	3.0	–	2.2	2.0	0.8	–	25	Meter	–	14⅜ x 10½ x 3⅜	15	249.30	EV 1281, same less AM. $229.50
	EV-1182	25	19	0.8	–	–	20-20K	20-20K ±1.5	70	3.0	–	2.2	2.0	0.8	–	25	Meter	–	14¾ x 10½ x 3⅜	15	229.50	Incls. AM; EV-1181, same less AM $189.00.

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	AMPLIFIER SECTION: IHF Power/Chan., W	RMS Power/Chan., W	THD at Rated Power, %	IM at Rated Power, %	IM at 1 Watt, %	Power Bandwidth, Hz to kHz	1-Watt Freq. Response, Hz ±1 dB	Rated Output S/N, dB	Phono Sensitivity, mV	Phono Overload, mV	TUNER SECTION: IHF Sensitivity, µV	Capture Ratio, dB	THD, Mono, 100% Mod., %	THD, Stereo, 100% Mod., %	Stereo Sep., 1000 Hz, dB	Tuning Indicator	Alt. Chan. Selectivity, dB	Dimensions, In. W x D x H	Weight, lbs.	Price	SPECIAL FEATURES
FISHER (31)	701 4 Channel	(4) 62.5	(4) 40	0.57	0.87	0.15	20-25K	20-25K +1.5	90	2.7	50	1.7	1.5	0.35	0.35	36	Meter	65	16 13/16 x 14 1/4 x 5 1/4	35	699.95	4 chan. Rcvr; Auto-scan elec. tuning; free remote control.
	500TX	75	65	0.5	0.8	0.15	8-35K	20-25K +1.5	90	2.5 10	45 100	1.7	1.5	0.4	0.4	38	Meter	70	16 7/8 x 14 1/2 x 4 13/16	30	499.95	Auto-scan and Tune-o-matic tuning, XTAL & cer. filt. dual gate mosfets.
	450T	65	55	0.5	0.8	0.15	10-30K	20-25K +2	90	2.5 7.5	4.5 135	2.0	2.5	0.5	0.5	38	Meter	45	15 1/2 x 14 1/4 x 4 5/8	25	399.95	Auto-scan elec. tuning, free remote control.
	250TX	48	35	0.5	1.0	0.2	20-25K	20-20K +2	90	2.5 7.5	45 135	2.0	2.8	0.5	0.5	38	Meter	45	15 1/2 x 12 3/8 x 4 5/8	20	349.95	Tune-o-matic tuning model 210T W/o Tune-o-matic $299.95
	202	40	28	0.5	0.8	0.2	25-20K	25-20K +2	92	2.5 8.0	50 160	2.5	3.0	0.6	0.6	35	Meter	42	15 11/32 x 14 1/4 x 4 3/8	18 1/2	249.95	2 aux. inputs; muting; model 201 with 25 w/ch $199.95.
GROMMES	503A	50 (4Ω)	30	0.5	0.5	0.1	20-20K	15-50K +1	75	2	60	2	3.0	0.5	0.5	35	Meter	45	16 x 13 x 5 1/2	–	349.95	
HARMAN-KARDON	330	35	18	0.6	0.4	0.1		7-70K +1	80	2.5	90	2.5	3.0	0.5	0.6	30	Meter		15 9/16 x 13 x 4 1/4	20	199.95	Function ind lts; tape mon.
	230	17.5	10.5	0.8	0.6	0.2		15-70K +1.5	70	2.5	85	2.7	4.0	0.8	0.8	30	Meter		14 11/16 x 7 9/16 x 3 7/8	14	159.95	AM and FM dial scales separately lighted; tape mon.
HEATH (33)	AR-15	75	50	0.5	0.5	0.2	6-30K	8-40K ±1 dB	60	2.2	155	1.8	1.5	0.5	1.0	40	2 Meters	70	16 7/8 x 14 1/2 x 4 3/8	27	349.95 K	FETs; IC i.f., idness & spkr. sws; stereo-only sw; stereo thresh. & mute-level contrs; incls. AM.
	AR-29	50	35	0.25	0.2	0.1	5-30K	7-60K ±1	75	2.2	155	1.8	1.5	0.5	0.5	40	2 Meters	70	16 3/4 x 14 1/2 x 5 1/8	26.5	285.00 K	FETs; IC i.f.; LC filters; spkr 1 & 2 sws; AM tuner; input level contrs; idness sw.
	AR-19	30	20	0.25	0.25	0.1	5-30K	6-35K ±1	75	2.4	155	2.0	2.5	1.5	1.5	35	2 Meters	35	16 3/4 x 14 1/2 x 5 1/8	26.5	225.00 K	FETs; IC i.f.; spkr 1 & 2 sws; AM tuner; input level contrs; idness & tone-flat sws.
	AR-14	15	10	1.0	1.0		15-50K	12-60K +1	60	4.5		5.0	3.0	1.0		30			15 1/4 x 12 x 3 7/8	14	119.95 K	Afc; phone jack; stereo indicator; stereo phase adj.
	AR-17	7	5	1.0	2.0		25-35K	25-35K ±1	45	5.0		5.0	3.0	1.0		30			12 x 10 1/8 x 3	7	72.95 K	Compl-sym output; stereo phase adj; stereo indicator.
KLH	27	45	30	< 0.5	< 0.5	< 0.25	17-20K	6-25K	65	1.5	105	2.0	3	0.5	0.8	35	Meter	35	13 1/2 x 14 3/4 x 4 1/2	18	319.95	FM/AM; sep. planetary tuning; FETs; 5 stg. IF; MX noise filt.

The emancipation of sound

We have abolished the preconceptions and prejudices of speaker design. Those which have stood between you and the subtle, inner detail of the musical texture.

We have cut the figurative fence, demolished the literal box. We have conceived an utterly unique system. One which is omni-directional and truly gives you the feeling of clear, open sound.

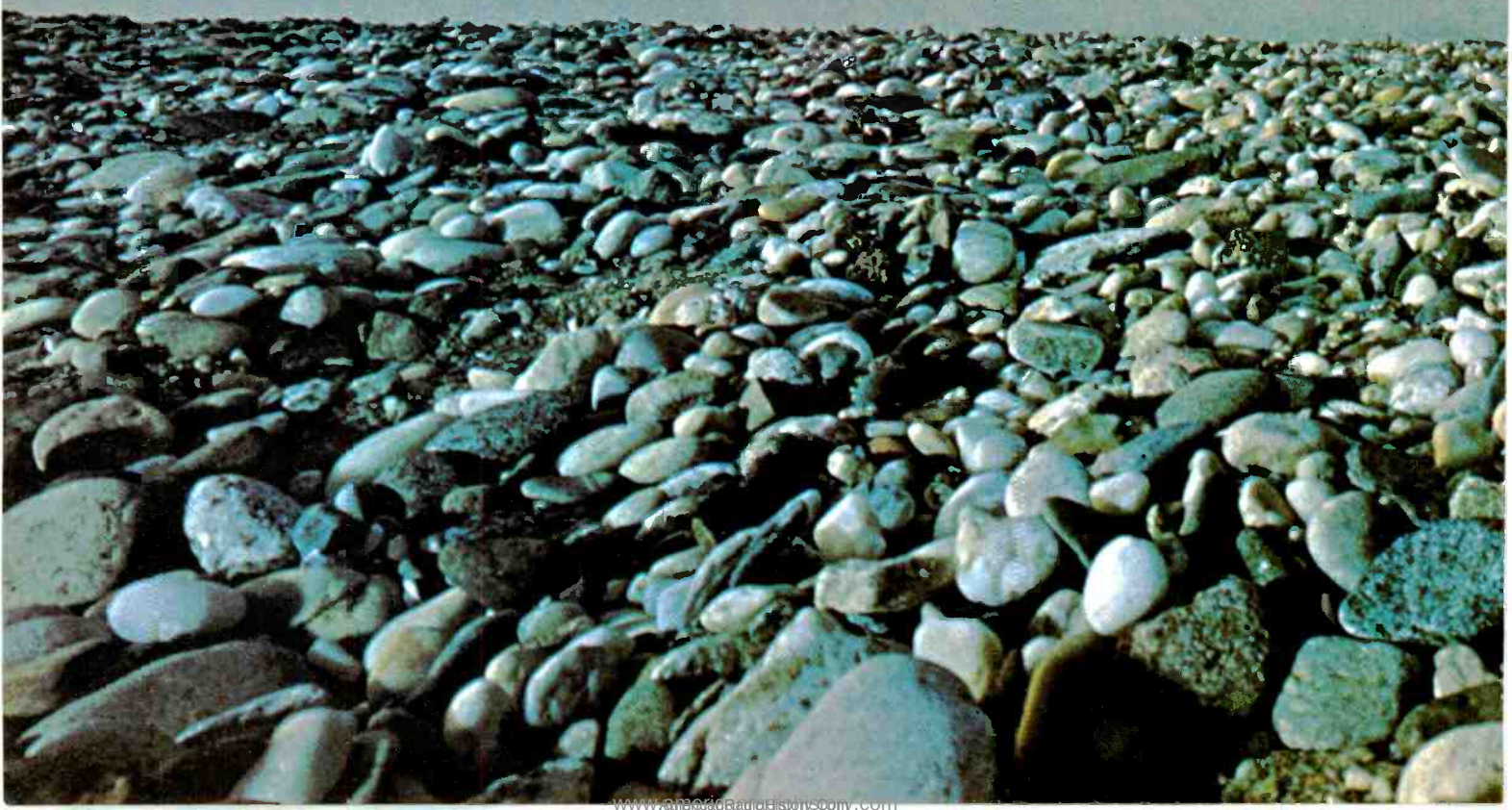
The speakers are the new Sony Omni-Radials. With them, you'll hear the same, ultra-realistic stereo effect no matter where you sit in the room, and no matter where you place them.

And all the sound quality you expect from Sony. Clean, clear powerful bass from six acoustic-suspension drivers with special silicone polymer suspensions (for unusually long, linear cone excursions). An individual dispersion dome over each driver cone distributes the highest frequencies evenly throughout a full 360 degrees and from floor to ceiling.

The compound-curved cabinet contributes to the system's sound quality: its constantly varying diameter prevents build-up of standing wave resonances within the enclosure and provides extra rigidity to prevent panel resonances.

The Sony Omni-Radials are beautiful to behold. Their rich, open-pore ash or walnut finishes blend into any decor. With reversible cushions removed you can use them as convenient end tables; with the cushions in place (black or red side up) they're comfortable seats.
23-5/8 inches high by 15-15/16 inches diameter at middle. Sony SS-9500, $149.50. (Suggested list.)
Sony Corporation of America, 47-47 Van Dam Street, Long Island City, New York 11101.

The new omni-radials from SONY®




SONY

RECEIVERS — Continued

KENWOOD KR-7070

MARANTZ Model 19

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) "K" indicates kit price; "W" indicates wired price

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	AMPLIFIER SECTION												TUNER SECTION									SPECIAL FEATURES
		IHF Power, Chan., W	RMS Power, Chan., W	THD at Rated Power, %	IM at Rated Power, F	IM at 1 Watt, %	Power Bandwidth, Hz to kHz	1-Watt Freq. Response, Hz ±1 dB	Rated Output S/N, dB	Phono Sensitivity, mV	Phono Overload, mV	IHF Sensitivity, µV	Capture Ratio, dB	THD, Mono, 100% Mod., %	THD, Stereo, 100% Mod., %	Stereo Sep., 1000 Hz, dB	Tuning Indicator	Alt. Chan. Selectivity, dB	Dimensions, in., W x D x H	Weight, lbs.	Price	
JVC (9)	5040-2	100 (4Ω)	83 (4Ω)	<0.5	<0.8	0.1	18-30K	20-55K +0, −2	75	1.5	75	1.8	1.2	<0.5	0.2	40	Meter	60	20¾ x 15½ x 5⅞	36	449.95	Snd. effect ampl (SEA) divides range into 5 sep. ±12 dB contr. bands.
	5030-3	70 (4Ω)	50 (4Ω)	0.5	0.8	0.15	25-30K	20-40K +0, −2	70	1.5	75	1.8	2.0	0.5	0.3	35	Meter	50	20 x 13 x 4⅜	30.8	399.95	As above. Linear FM dial scale.
	5020	37 (4Ω)	28 (4Ω)	0.5	0.8	0.2	30-30K	25-40K +0, −2	65	1.5	70	2.5	3.0	0.8	0.35	35	Meter	45	20 x 13 x 4⅛	28.6	299.95	As above.
	5010	20 (4Ω)	16 (4Ω)	1.0	1.0	0.2	30-30K	25-25K +0, −2	65	2.0	70	2.5	4.0	0.8	0.5	33	Meter	45	16 11/16 x 13 x 4½	17.2	229.95	As above.
KENWOOD (39)	KR-7070	110 150*	90 110*	0.5	0.5	0.1	10-30K	12-40K ±1.5	75	0.06 0.6 2.5	100	1.5	1.5	0.4	0.6	35	Meter	75	17 x 15 x 6½	40	549.95	*4-ohms; 3-way tuning-auto, remote, man., incls. AM.
	KR-6160	90 110*	70 90*	0.5	0.5	0.1	12-30K	15-40K ±1.5	75	2.5	100	1.6	1.5	0.5	0.7	35	2 Meters	55	16½ x 12¾ x 5½	30	379.95	FM/AM, FET's, IC, mic mixing w/mic; 3-set spkr output, 3 tone cont.
	KR-5150	55 75*	40 50*	0.5	0.5	0.1	17-30K	20-40K ±1.5	75	2.5	100	1.7	2.0	0.5	0.7	35	2 Meters	55	16½ x 12¾ x 5½	26	329.95	FM AM, FET's, IC's 2-mtrs for FM, 3-sets spkr output, step tone control.
	KR-4140	29 40*	24 33*	0.5	0.5	0.1	18-30K	20-40K ±1.5	75	2.5	100	1.8	2.5	0.5	0.7	35	Meter	55	16½ x 12½ x 5½	23	259.95	FM AM, FET's, IC's; 2-pair phone input, mic input; lo and hi filters.
LAFAYETTE (106)	LR-1500TA	95	70	0.8			18-55K		75	1.8, 4.5, 12.0		1.5	1.25		0.3	40	Meter	50	16¾ x 4⅝ x 14⅛	35	299.95	Auto o'load prot; muting; "Acritune"; auto stereo sw.
	LR-775	40		0.8			15-30K		75	2.3, 80, 250		1.7	1.5		.07	40	Meter		14½ x 4 10¼	15	199.95	Fused outputs; auto stereo switching.
	LR-100	20		0.8			35-30K		75	2.3, 80, 250		2.5	5		0.1	35	Meter	35	14½ x 4½ x 10½	15	129.95	As above.
	LR-75	18		0.7			20-20K		55			3.5	5			30	Meter	35	13 x 4½ x 9⅞	14	109.95	As above.
MARANTZ (58) (59)	19	75	50	0.15	0.15		10-30K					1.8	3.5	0.15	0.15	45	Scope	50	18¼ x 16 x 5⅜		1,000.00	
	22	60	40	0.3	0.3							2.8	3.0	0.3	0.5	34	2 Meters	40	16⅞ x 14 x 5	30	449.00	
	27	45	30	0.3	0.3							2.8	3.0	0.3	0.5	34	2 Meters	40	14⅞ x 15 1/16 x 5⅞		319.00	
	26	21	10	1.0	1.0							3.0	3.0	0.5	0.7	30	1 Meter	40	15½ x 12½ x 3 11/16		219.00	
MARTEL	660A	120	30 30	0.2			20-25K			2			2.5	0.8		35	Meter		17⅝ x 13½ x 5⅞	18.7	279.50	AM-FM-MPX w/i.c.s, FET.
	550A	90	22 22	0.2			20-25K			2			2.5	0.6		35	Meter		16⅝ x 13½ x 5⅞			AM-FM-MPX w/FET.
	330A	60	17 17	0.3			30-17K			3			2.5	0.8		35	Meter		16⅜ x 10¾ x 5⅛			AM-FM-MPX
	88A	20	5 5	0.3			30-15K			3			2.5	1.0		35	Meter		6¼ x 10⅞ x 7½			AM-FM-MPX 3 unit bookshelf model w/spkrs.
MIKADO	2470	35		0.5				20-20K		3.0		2.0	2.5		0.6	38	Meter		19¼ x 15 x 5⅛	21		Incls. AM; blackout dial; FET's.
	2425	30	20	0.5				1-50K		3.0		2.0	2.5		0.6	38	Meter		16¾ x 12 x 4⅜	20		Incls. AM.
	2420	20		1.0				20-40K		2.0 6.0		3.5	5.0		2.0	25	Meter		15 x 11 x 4½	13		As above.
	1917	15		3.0				100-10K ±3		4.0		5.0	5.0		3.0	27	Meter		13½ x 9 x 3			As above.
	2840	20	10	0.5			30-30K	20-35K		3.0		3.0				30						Incls. AM and 8-track ctg. player.
NORELCO (89)	790	34	25	0.2	0.5	0.5	18-30K	20-20K +0.5	80	3.8	60	5.5	4	1.0	1.5	30	Mtr.	40	20½ x 10 x 3¾	20	299.95	Touch tuning of 3 preselected FM sta., shtwve. band 6-18 MHz.
PANASONIC	SA6500	100 (4Ω)	60	0.5	1.0		15-60K −3			3 3		1.8	1.5	0.5*		40	2 Meters		16⅞ x 15⅛ x 5⅞	34 44	399.95	Dual tuning mtr. blackout front direct coupling.
	SA70	90 (4Ω)	32	0.8	1.0		15-70K −3			4 18		2.0	2	0.5		37	Meter		19⅝ x 14 x 5⅛	29 35	349.95	
	SA60	30 (4Ω)	22.5	0.8	1.0		20-50K −3			3.5 10		2.2	2.5	0.6		35	Meter		19⅝ x 14 x 5⅛	25 34	279.95	
	SA40	27½ (4Ω)	12	0.8	1.2		20-50K −3			3.5 10		2.8	3	0.7		35	Meter		16 x 14 x 5	29 20	219.95	

Check No. 57 on Reader Service Card →

The same precision that guides the automatic pilot of a 747 tunes the Pioneer SX-2500.

Just press the tuning bar and the servomechanism takes over. It stops the dial pointer precisely at the zero point of detector. The result is dead center tuning which you can actually see when the tuning needle lights up. And you can tune from twenty three feet away with the convenient remote control unit which also adjusts the volume.

Rated at 340 watts IHF (72/72 RMS at 8 ohms). Pioneer endowed the SX-2500 with extraordinary versatility. It has five inputs and seven outputs, accommodating two pairs of speaker systems. The FM section alone features five IC's and two crystal filters for superb selectivity. Employing three dual gate FET's, sensitivity is a matchless 1.6μV, to pick up even the weakest stations. Or you can flip the Local Station Switch and decrease the sensitivity to pick up the strongest local stations only. When you're looking for stereo programs, the Stereo Selector Switch automatically tunes in those stations broadcasting in stereo only.

Whatever refinement you're looking for in an AM-FM stereo receiver, Pioneer has designed into the SX-2500. There are stepped tone controls . . . loudness contour control . . . adjustable muting . . . center channel output for three dimensional systems. Pre and main amplifier may be used independently with multi-amp stereo systems.

Remote Control Unit

The SX-2500 offers more meaningful features

And in the same way that the 747 offers more conveniences, the Pioneer SX-2500 offers more meaningful features than any comparably priced stereo receiver.

See and hear the SX-2500 at your local Pioneer dealer. Complete with remote control unit, $549.95.

Pioneer Electronics U.S.A. Corporation, 140 Smith Street, Farmingdale, N.Y. 11735.

PIONEER®

WEST COAST: 1335 WEST 134TH ST., GARDENA, CALIF. 90247 • CANADA: S. H. PARKER CO., 67 LESMILL RD., DON MILLS, ONTARIO

The Marantz Component.

Now everybody can afford one.

Until last year the least-expensive Marantz FM stereo tuner you could buy cost as much as $750.00!

Today, Marantz tuners are available in other than very-high price ranges. And so are other Marantz components. True, you can still invest well over $2000.00 in a Marantz system, but now we have components starting as low as $259.

Though these lower-priced models do not have every unique Marantz feature, the *quality* of all models is exactly the same. Marantz quality. And quality is what Marantz is all about.

Take our tuners for example. You will find the Marantz Model 23 AM/FM stereo tuner attractively priced at only $259. Looking for a great Tuner/Preamplifier? Look at the Marantz Model 24 AM/FM Stereo Console. Just $339.

Need a preamp/amp? Consider the Marantz Model 30 Stereo Amplifier Console.120 watts RMS (180 watts IHF). Priced at $450. In the market for a superior power amplifier? Shop for the Marantz Model 32 with 120 watts RMS (180 watts IHF). Only $295.

And for those who want the ultimate Marantz system, we offer: the Model 33 Stereo Console, the Model 16 Stereo Power Amplifier with 200 watts RMS continuous (300 watts IHF), and the Marantz custom-calibrated Model 20 FM Stereo Tuner. Total price—$1440 plus speakers.

Every Marantz component, regardless of price, is built with the same painstaking craftsmanship and quality materials.

Your local dealer will be pleased to demonstrate Marantz systems. Then let your ears make up your mind.

marantz®
Components • Speaker Systems • Receivers

RECEIVERS — Cont.

NOTES: (1) All models solid-state except when model number is preceded by (T)
(2) "K" indicates kit price; "W" indicates wired price

PIONEER SX-990

SANSUI 4000

SCOTT 3800

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	AMPLIFIER SECTION: IHF Power/Chan., W	RMS Power/Chan., W	THD at Rated Power, %	IM at Rated Power, F	IM at 1 Watt, %	Power Bandwidth, Hz to kHz	1-Watt Freq. Response, Hz ±1 dB	Rated Output S/N, dB	Phono Sensitivity, mV	Phono Overload, mV	TUNER SECTION: IHF Sensitivity, µV	Capture Ratio, dB	THD, Mono, 100% Mod., %	THD, Stereo, 100% Mod., %	Stereo Sep., 1000 Hz, dB	Tuning Indicator	Alt. Chan. Selectivity, dB	Dimensions, in., W x D x H	Weight, lbs.	Price	SPECIAL FEATURES
NIKKO	STA-1101	60	40	0.3	0.6		20-30K		75	2		1.5	1.5	0.6	1.0	40	Meter	60	18½ x 14⅜ x 6½	33	399.95	6 FETs; 12 ICs; 2 xtal filtrs; 2 mic inputs; 2 phone jacks; sep. vol contr for rem spkrs.
	STA-701B	35	25	0.8	1.0		20-20K		65	2.8		1.8	3.0			40	Meter		14⅛ x 12¾ x 4½	17	239.95	2 FETs, 3 ICs; AFC; muting; dual tone contrs; cct brkr protection; tape-head input.
	STA-501S	25	18	0.8	1.0		20-20K		65	2.8		1.8	3.0			40	Meter		15⅛ x 12¾ x 4½	17	189.95	2 FETs, 3 ICs; AFC; muting; dual tone contrs; scratch and tumble filters; cct brkr prot.
	STA-301	15	10	0.8	1.0		30-20K		65	28		2.5	4.5			32	Meter		14⅛ x 12¾ x 4½	14	159.95	FETs in front end; 2 ICs in pre-amp sect; cct. brkr prot.
PIONEER (29) (45) (47)	SX-1500TD	90 (4Ω)	70 (4Ω)	0.5	0.5	0.2	15-40K	10-100K +3	100 Aux.	3.3	80	1.7	0.7	0.8	0.8	42	Meter	40	18 3/16 x 14½ x 5 11/16	25	399.95	FET & ICs; pre-amp out and main-amp-in jks; incls wd. cab.
	SX-990	65 (4Ω)	35 (4Ω)	0.5	0.5	0.2	15-40K	10-100K ±3	100 Aux.	3.3	80	1.7	0.7	0.8	0.8	42	Meter	40	18 3/16 x 14½ x 5 11/16	25	299.95	As above.
	SX-770	35 (4Ω)	20 (4Ω)	0.8	0.5	0.3	15-35K	20-40K +3	95 Aux.	2.5	75	1.8	2.0	0.8	0.8	40	Meter	40	16 15/16 x 13⅜ x 5 11/16	21	249.95	FETs and ICs; incls wood cab.
	SX-440	20 (4Ω)	15 (4Ω)	0.8	0.8	0.3	30-20K	20-70K +3	85 Aux.	3.6	80	2.5	2.5	0.8	0.8	35	Meter	40	15 5/16 x 13⅜ x 5 7/16	18	199.95	FET front end; incls wood cab.
ROBERTS	120	50	37½	0.8			20-30K	20-30K	65	3		2	2	0.8		35	2 Meters	50	5⅛ x 17½ x 13 3/16	24.4	299.95	
	50	25		3.0			30-17K	30-17K	73			2				32	Meter		16 x 5 1/8 x 9¼	14	199.95	
	30	15		3.0			30-17K	30-17K	73			2				32	Meter		16 x 5 1/8 x 9¼	14	179.95	
SANSUI (6) (7) (41)	5000A	90	75	<0.8	<0.8		15-30K	10-50K +1	>65	2.5		1.8	1.5		<0.5	>35	Dual Meter	>50	17⅛ x 14½ x 5	29	399.95	Linear tuning, 3 spk. systems.
	4000	80	65	<0.8	<0.8		20-30K	10-50K +1	>70	2.5		1.8	1.0		<0.5	>35	Dual Meter	>50	17¾ x 13⅛ x 5⅛	31	349.95	As above plus wide dial.
	2000A	60	43	<0.8	<0.8		20-40K	10-50K +1	>60	2.5		1.8	1.0		<0.8	>35	Meter	>40	18 x 13½ x 5	27	299.95	As above, except 2 spk. syst. sel. switch.
	1000X	50	35	<0.8	<0.8		20-30K	15-40K +1	>60	2.5		2.0	2.5		<0.8	>35	Meter	>40	16½ x 12 x 5⅛	23	269.95	As above.
SCOTT Cover II	3900		80 120 (4Ω)	0.4	0.5	0.3	10-25K	20-17K ±1	70	3H 5M 9L		1.7	2.5	0.4	0.6	>35	Mtr. cntr. time mtr. mult. pth. mtr.	70	17½ x 15 x 6	35	599.95	Left-right audio balance mtr.
	387	110 140 4W	63 100 (4Ω)	0.5	0.5	0.3	10-38K	20-15K +1	65	4.2H 8.5L		1.9	2.5	0.6	0.8	35	Mtr. perf. tune	40	17½ x 15 x 6		449.95	
	386	625 (4W)	35 42 (4Ω)	0.5	0.5	0.3	15-25K	15-30K ±1.5	65	3H 6L		1.9	2.5	0.6	0.8	35	Mtr. perf.	40	17½ x 14⅜ x 5⅜	22	359.95	
	382C 342C	45 (4W)	30 36 (4Ω)	0.6	0.5	0.3	20-20K	15-15K	65	3		1.9	2.5	0.6	0.8	35	Mtr. perf. tune	40	15⅜ x 11½ x 5	17	382.00C 342.00C	AM/FM 299.95. FM 269.95
	631	25 4W	20 23 (4Ω)	0.5	0.5	0.3	25-20K	20-15K	65	4.5		2.5	2.5	0.7	0.8	35	Meter		14⅛ x 14⅛ x 4 1/8		199.95	
SHERWOOD	SEL-200	113	85	0.2	0.6	0.1	8-35K	20-20K +0.5	80	1.6	100	1.5	1.7	0.15	.30	40	2 Meters	70	18⅜ x 13 x 5⅜	33	599.00	Excl. "Legendre" toroid FM i.f. filt; FET hush circuit.
	S 8900	90	70	0.35	0.6	0.15	12-30K	20-20K +0.5	80	1.6	120	1.7	1.9	0.15	.30	40	Mtr. zero	65	16⅛ x 14 x 5⅛	28	399.95	Ceramic filt; FET hush cir.; avail. w. AM = 439.95.
	S 8500	75	60	0.6	0.8	0.2	18-25K	20-20K +1.0	80	2	65	1.8	2.0	0.15	.30	40	Mtr. zero	60	16⅛ x 12 x 5⅛	23	299.95	Ceramic FM IF filt. avail. w. AM = 339.95.
	S 7100	40	30	1.0	1.0	0.3	25-20K	20-20K +1.0	80	1.5	60	1.9	2.8	0.5	.90	40	Meter	40	17½ x 13½ x 5⅜	30	199.95	Walnut case included.
SONY (37) (54) (55)	STR-6120	75	60	0.2	0.3	.05		15-120 +3	90	1.5	100	1.8	1.5	0.2	0.35	40	2 Meters	100	19 x 15 7/8 x 5 11/16	34	699.50	
	STR-6060	55	45	0.2	0.2	0.15		20-60K +3	90	2.1	90	2.2	2	0.3	0.5	40	Meter	80	17 3/8 x 13 33/16 x 5 15/16	29	399.50	
	STR-6050	35	30	0.2	0.4	0.2		30-50K +3	90	2.5	90	2.6	2	0.4	0.5	40	Meter	70	17 3/16 x 13 3/8 x 5 15/16	20	279.50	
	STR-6040	22	15	0.5	0.5	0.2		30-50K +3	90	2.5	90	2.6	2	0.4	0.5	40	Meter	70	15⅜ x 12¼ x 5⅜	16	199.50	
	STR-222	12	8	0.8	3	1.5		30-50K +3	65	3, 4	80	3	2	0.4	0.5	38	Meter	7	16 9/16 x 12 5/16 x 4 5/8	12.5	149.50	

A TV commercial composer talks about the new VM professionals.

"If you're a pro, you can't help but be impressed with the new VM PROFESSIONALS."

"I sure like the way my music sounds on them. Sensitive. Subtle. And yet this is the kind of equipment you can play ten hours a day and not have trouble with."

"I am particularly impressed with the receiver. The VM PROFESSIONAL 1521. It has a new type filter that really gives you great FM selectivity. And the stereo separation! It's almost as good as some 8-track playbacks I heard in recording studios."

"And I really like the VM PROFESSIONAL automatic turntable. The "Synchro-Matic" 1555. It tracks beautifully. I can't pick up any tonal variation from the beginning to the end of a record. That's probably because the tone arm is longer. 9½ inches. And the tripping mechanism is photo-electric, so there's no mechanical distortion."

"It's really great at reproducing those nuances and shading you work so hard to get out of a vocal or an arrangement."

"And the spindle! Really something to see. It gently lowers records all the way down to a motionless platter. That's what I call loving care."

"Of course the speakers make the whole outfit payoff. They're VM's new Spiral Reflex System speakers. Compact. And very efficient. Gives you really clean basses and horns. And none of the instruments ever sound strained or pushed, even in attack-passages."

"And another thing, about 95% of all the component parts in the VM PROFESSIONAL line are made in America. And I know it isn't fashionable, but to me that means better and tougher."

"The only problem I have with my VM PROFESSIONAL outfit is, I can't decide whether to leave it at my studio or take it home."

"I just may have to buy another one."

Bill Walker makes his living in sound. He writes and produces music for television and radio advertisers. Chevrolet. Kraft. Oldsmobile and Continental Airlines. He pioneered in the uses of the Moog Synthesizer. And has written songs for Peggy Lee, Dean Martin, Gordon MacCrea and others. Over the years, Bill produced more than 5,000 sound tracks for radio and television.

THE VM PROFESSIONAL 1555
Two synchronous motors —24-pole for turntable, one for changer mechanism • Belt driven, completely isolated, low mass, dynamically balanced turntable • Gentle lowering spindle • Automatic record size sensor system • Photo cell cycle-change sensor eliminates side pressure and trip noise • Piston-damped 2-way cue control • 9½" tone arm (from pivot to stylus); the longest on any automatic turntable • Piano-key control center isolated from turntable and pick-up arm • Quick-change, plug-in housing accepts any standard magnetic cartridge • Rumble: —52 db (CBS weighting) • Comes complete with Shure magnetic cartridge and attractive walnut base with dust cover.

For engineering specs on the complete VM Professional Series write:

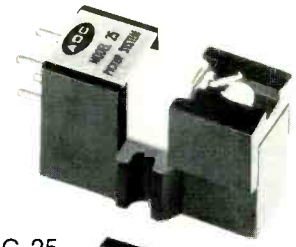
VM CORPORATION

Dept. 74, P.O. Box 1247, Benton Harbor, Michigan 49022 or call direct, Area Code 616-925-8841. (Ask for Dept. 74.)

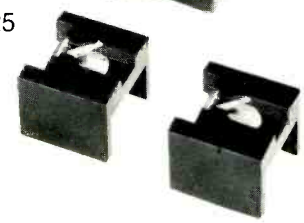
Check No. 61 on Reader Service Card

STEREO CARTRIDGES

MANUFACTURER (Circled number indicates adv. page)	MODEL	Frequency Response, Hz ±dB	Separation, 1000 Hz, dB	Separation, 10 kHz, dB	Output, mV/cm/sec.	Tracking-force Range, gms.	Load Resistance, ohms	Stylus Type (see letter code)	Stylus Radius (Radii), mils	Replacement	Weight, gms.	Price	Stylus type C – Conical E – Elliptical / SPECIAL FEATURES
ADC (16)	25	10-24K ±2	30	30	0.73	½-1½	47K	E E C	0.3 x 0.7 0.3 x 0.7 x 0.6	User		100.00	Only 3-stylus ctg. which allows custom matching to each record.
	26	10-24K ±2	30	30	0.73	½-1½	47K	E	0.3 x 0.7	User		75.00	As above, but with single stylus assembly.
	27	10-22K ±2	30	30	0.73	½-1½	47K	E	0.3 x 0.7	User		65.00	
	10E-MK II	10-20K ±2	30	30	0.73	½-1½	47K	E	0.3 x 0.7	User		59.50	
	550XE	10-20K ±2	20	20	0.92	½-2	47K	E	0.3 x 0.7	User		44.95	Top of new line of induced magnetic ctg. All styli in "X" series are interchangeable.
	990XE	10-20K ±2	20	20	0.92	½-2	47K	E	0.3 x 0.7	User		29.95	
B&O	SP-12	15-25K ±3	>25	>20	1.0	¾-1.5	47K	E	0.2 x 0.7	User	8.5		Response 50-10K ±1.5dB "Naked" diamond stylus.
ELAC (49)	444-E	10-24K	26	17	1.0	.075	47K	E	0.2 x 0.9	User	6.5	69.50	
	444-12	10-24K	26	17	1.0	.075	47K	C	0.5	User	6.5	59.50	
	344-17	20-22K	24		1.0	1	47K	C	0.7	User	6.5	39.50	
	244-17	20-22K	22		1.5	1.5	47K	C	0.7	User	6.5	24.95	
EMPIRE Cover IV	1000ZE/X	4-40K	35	25	1.5	¼-1¼	47K	E	0.2 x 0.7	User	7	99.95	
	999VE/X	6-36K	35	25	1.7	½-1½	47K	E	0.2 x 0.7	User	7	79.95	
	999TE/X	6-32K	35	25	1.7	½-1½	47K	E	0.2 x 0.7	User	7	64.95	
	999SE/X	8-32K	35	25	2.0	½-1½	47K	E	0.3 x 0.7	User	7	49.95	
	999PE/X	8-32K	35	25	2.0	½-2	47K	E	0.3 x 0.7	User	7	44.95	
GOLDRING	800-Super E	15-21K	30	20	0.8	¾-1½	47K	E	0.3 x 0.8	User	7	69.50	For "state-of-the-art" tone arms, response curve furnished
	800E-Mk II	20-20K	30	20	1.0	1-2	47K	E	0.3 x 0.8	User	7	39.95	For very good record players, tracing at 1 gm or slightly over.
GRADO	F-1	7-40K	35	30	0.8	0.7-2	Any	*	*	User	5.5	75.00	*Patented twin-tip-2 separate 0.3-mil conical tips ground on one diamond "Fluxbridger" generator.
	F-3	7-40K	35	30	0.8	0.7-2	Any	C	0.6	User	5.5	49.50	"Fluxbridger" generator.
NORELCO (99)	412	20-20K	30	20	1.0	¾-1½	47K	E	0.3 x 0.7	User	7	67.50	Individually calib. chart of freq. resp. supplied with each cartridge.
ORTOFON (47)	S-15M/T	20-20K	30	25	0.6	1-2	47K	E	0.3 x 0.7	Factory	31	85.00	
	S-15/T	20-20K	30	25	0.6	1-2	47K	E	0.3 x 0.7	Factory	18½	80.00	
(63) (97)	SL-15/T	20-20K	30	25	0.6	¾-1½	47K	E	0.3 x 0.7	Factory	7	75.00	
	SL-15	20-20K	30	25	0.6	¾-1½	47K	E	0.3 x 0.7	Factory	7	60.00	
PICKERING Cover III	XV-15/750E	10-25K	30	22	4.4	½-1	47K	E	0.2 x 0.9	User	5	65.00	All XV-15 models include "V-Guard" replaceable stylus and "Dustomatic" brush hinged to stylus assembly; exclusive snap-in cartridge mount.
	XV-15/400E	10-25K	30	22	5.5	¾-1½	47K	E	0.3 x 0.9	User	5	54.95	
	XV-15/350	10-25K	30	22	6.0	1-3	47K	C	0.7	User	5	39.95	
	XV-15/200E	10-25K	30	22	8.0	2-4	47K	E	0.4 x 0.9	User	5	49.95	
	V-15 Phase IV-AME	10-25K	30	22	5.5	1½-2½	47K	E	0.3 x 0.9	User	5	49.95	V-15 Phase IV series has high profile; Low mass stylus assembly includes "Dustomatic" brush.
	V-15 AM-3	10-23K	25	20	6.5	1-3	47K	C	0.7	User	5	34.95	V-15 3 series has "Dustomatic" brush, 15-degrees tkg. angle, snap-in cartridge mount.
	V-15/AME-3	10-25K	25	20	5.5	¾-1½	47K	E	0.3 x 0.9	User	5	49.95	
SHURE (11)	V-15 Type II Improved	20-25K	25+		0.7	½-1½	47K	E	0.2 x 0.7	User	6.8	67.50	Analog-computer-designed for finest-quality TT's.
	V-15 Type II-7 Improved	20-25K	25+		0.7	¾-1½	47K	C	0.7	User	6.8	62.50	As above, except with conical stylus.
	M91E	20-20K	25+		1.0	¾-1½	47K	E	0.2 x 0.7	User	5	49.95	New series of high-trackability cartridges for good turntables.
	M93E	20-20K	25+		1.2	1½-3	47K	E	0.4 x 0.7	User	5	39.95	As above.
	M75E	20-20K	25+		1.2	¾-1½	47K	E	0.4 x 0.7	User	6	34.95	Lowest cost high-trackability cartridge for upgrading older turntables.
	M-75-6	20-20K	25+		1.2	1½-3	47K	C	0.7	User	6	24.50	As above, conical stylus.
STANTON (21)	681A	10K-20K	35		1.1	1½-3	47K	C	0.7	User	5.5	66.00	All models with "Longhair" brushes. Primary calib. std. for rcdg. sys checkout.
	681EE	10-10K +½ dB	35		0.82	¾-1½	47K	E	0.2 x 0.9	User	5.5	72.00	For critical listening; high compliance, low mass, and low tkg. force assure min. wear
	681SE	20-10K +½ dB	35		1.1 ±2	2-4	47K	E	0.4 x 0.9	User	5.5	66.00	More rugged ctg; ellip. stylus des. for med. force, exc. freq. resp. and linearity.
	500A	20-10K +1dB	35		1.0	2-5	47K	C	0.7	User	5	30.00	For heavy-duty on-the-air use
	500AA	20-10K +1dB	35		1.0	1-2½	47K	C	0.5	User	5	35.00	For auditioning-room use
	500E	20-10K +1dB	35		1.0	2-5	47K	E	0.4 x 0.9	User	5	35.00	Larger stylus radius, tougher armature susp. for long life in broadcast applications.



ADC 25



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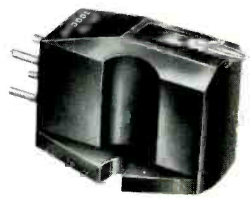
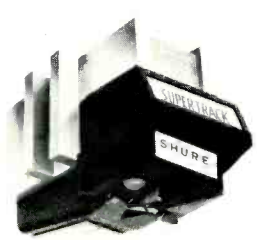


ORTOFON SL-15

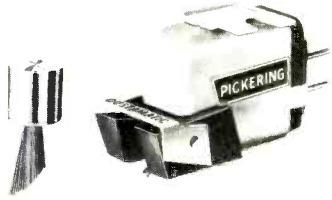


SHURE V15-Type II Improved

STEREO CARTRIDGES – Continued

ELAC STS-444

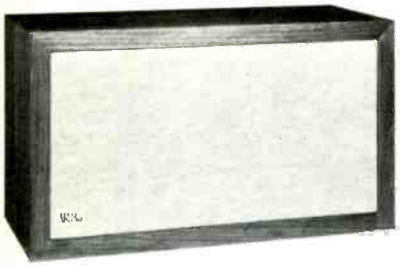
GRADO F-3



PICKERING XV-15/DCF

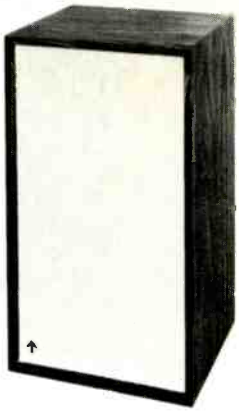
STANTON 68 1EE

SPEAKER SYSTEMS



AR 3a

ALTEC 890C



AUDIONICS Model 10

BOZAK
B-300/B-302A

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, in.	WOOFER Resonance (in System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, in.	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Type	Overall Freq. Response, Hz to kHz ±? dB	Ampl. Pwr. for AVE. Room, W	Pwr. Handling Capacity (RMS Cont.)	Crossover Frequency (ies), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, in.	Wood Finish	Grille Material Color	Weight, Lbs.	Price	SPECIAL FEATURES
ACOUSTIC RESEARCH (67)	AR-4X	8	65	Acous. SWS			2½	Cone	*	15	**	1200	8	19 x 9 x 10	wal. unf.	Cloth, Beige	18½	63.00	*Comp. freq. resp. and dist. data avail. from AR on request. **Depends on var. fact; avail. on req.
	AR-2aX	10	56	Acous. SWS	3½	Cone	¾	Dome	*	20	**	1400 5000	8	24 x 11½ x 13½	wal., ch., teak, mah., bir., unf.	Cloth, Beige	36½	128.00	Same as above.
	AR-5	10	56	Acous. SWS	1½	Hemisp. Dome	¾	Dome	*	20	**	625 5000	8	24 x 11½ x 13½	wal., ch., teak, mah., bir., unf.	Cloth, Beige	39	175.00	Same as above.
	AR-3a	12	42	Acous. SWS	1½	Hemisp. Dome	¾	Dome	*	25	**	575 5000	4	25 x 11⅜ x 14	wal., ch., teak, mah., bir., unf.	Cloth, Beige	53	250.00	Same as above.
ADC (16)	450A	12					½	Dome	30-20K ±3	15	60		8		Wal.	Black		150.00	Two way sys. with 12" rubber surround woofer.
	303AX	10		Acous.			1½	Dome	37-20K ±3	15	60		8	23¾ x 13 x 11¾	Wal.	Black	37	100.00	2 way spkr; 10" woofer; and wide dispersion super tweeter removable frame.
	210	8		Acous				Dome	40-20K ±3	15	50		8	20 x 11 x 10	Wal.	Black	30	75.00	2 way spkr; Hi comp 8" woofer and Hi accuracy wide disp. tweeter.
	404	6		Acous.			1½	Dome	45-20K ±3	15	50		8	11⅞ x 7⅞ x 8⅛	Wal.	White	11	55.00	2-way speaker; bookshelf sys., 6" woofer and Hi accuracy wide disp. tweeter.
ADVENT (14)		10	43	Acous.			1¾	Dome	30-20K ±4	15	100	1000	8	25½ x 11½ x 14¼	oil wal.	Cloth Light	44	116.00	Available in wal. finish vinyl-clad. cab.
AIR COUSTIC	PC-12	12*	40	PC*	5 x 7	Cone	1	Dome	30-15K ±4	20	35W.	400 5000	4	15½ x 13½ x 27	Wal.	dk. brn.	51	239.00	*12 inch woofer is pneumatically coupled to a 12X17 bass diaphragm.
ALTEC (42) (43)	2873A Barcelona Bramp Spkr.	15	40	Inf. Baffle				Compr. Driver	20-20K		90 Tot. 60 Bass 30 HF	500	8	29¾ x 38½ x 24	oil wal.	mid. scpt. pat. brn.	162	750.00	Elec. x-over Bi-amp. built in RMS 90 w.
	2875A Granada Bramp Spkr.	15	45	Inf. Baffle				Compr. Driver	25-20K		90 Tot. 60 Bass 30 HF	800	8	29¾ x 27½ x 24	oil wal.	mid. scpt. pat. brn.	142	650.00	Bi-amp. built in 90 watts RMS.
	846A Valencia	15	–	Bass Reflex				Compr. Driver	35-20K		50*	300	16	29¾ x 27½ x 19	Wal.	wood scpt. pat.	100	339.50	High efficiency "The Voice of the Theater" component.
	848A Flamenco	15	–	Bass Reflex				Compr. Driver	35-20K		50*	800	16	27¾ x 27½ x 19⅛	Wal.	Mid. Spanish pat.	105	339.00	High efficiency "The Voice of the Theater" component.
	893A Corona	10		Inf. Baffle			3	Cone	50-18K	15	45*	2500	8	12¼ x 22 x 9½	Wal.	Brown	22	85.50	Snap-on grille, 3-way high freq. control.
AUDIONIC (111)	Ten	10	48	Acous.			4	Cone	38-13K ±5	10	30	150	8	24 x 14 x 10½	Wal.	Cloth White	38	69.95 79.95*	Hi-temp, 4-layer, 2" v.c. in woofer. *East price.
	Ten Type A	10	48	Acous.	4	Cone		Dome	38-20K			150, 10K					40	89.95 99.95*	As above, plus dome tweeter. *East price.
AZTEC	Gauguin III	12	25	Contra-Duct	3 x 9	Horn	2 x 6	Horn	25-20K ±3	10	20	2000 10,000	8	20 x 27⅜ x 15⅞	Wal.	Decor wood grille	65	249.95	
	Petite 1000	8	50	Acous.			3½	Cone	50-15K ±3	15	30	2,000	8	20 x 10 x 9½	Wal.	White tweed	30	69.95	
BOGEN	LSX	4		Port					100-15K ±5	5	10		8	12 x 5¾ x 8⅞	Wal.	Black	6	60.00 pr.	Sold only as a pair.
	LS10A	6		Acous.			2	Cone	70-20K ±5	10	30	5,000	8	15 x 8¾ x 7	Wal.	Black	9	49.95	
	LS30	10		Acous.	5	Cone	3	Cone	40-20K ±5	10	50	600 5,000	8	22 x 11 x 14	Wal.	Cloth grn.-blue tweed	32	99.95	
BOSE (71)	901	Nine full-range 4½ in. Drivers							–	25	270	–	8	20⅛ x 12⅞ x 12¾	Wal.	White, dk. brn. wal. facings	33	476.00 pr. *	Direct reflecting® dk. brn. grille or wal. facings opt. Bl. or Wht. ped. opt. *Incls. Act. Eqzr
	501	Integrated woofer – 2-tweeter combination, balanced for direct and reflected sound.								20	50	–	4	14½ x 14½ x 24	Wal.	dk. brn.	35	124.80 each	Direct reflecting®
BOZAK	B-410 Concert Grand	(4)-12	40	Inf.	(2) 6	Cone	(8) 2	Cone	28-20K	15	150	400 2,500	8	36 x 19 x 52	Wal.	Silk	225	986.00	Line array.
	B-4000A	(2)-12	40	Inf.	6	Cone	(8) 2	Cone	35-20K	10	100	400 2,500	8	27 x 16 x 44	Wal.	Silk	165	654.00	Line array.
	B 300 302A Mediterranean	12	40	Inf.	6	Cone	(2) 2	Cone	40-20K	6	60	800 2,500	8	24 x 20 x 28	Wal.	Brn. Cloth	120	316.00	Dual cone.
	B-301	12	40	Inf.	4	Cone	2	Cone	40-20K	4	40	1,200 3,600	8	14½ x 11½ x 23⅛	Wal.	Brn. Cloth	40	157.50	Single

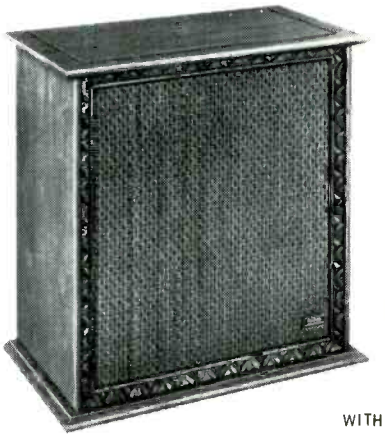
Wharfedale...ALL NEW FOR 1971

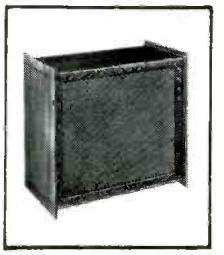
Achromatic and Variflex Speaker Systems . . . all with unitized construction...all built to take power

VARIFLEX® W80A

A NEW CONCEPT . . . ELIMINATES THE USUAL LIMITATIONS INVOLVING SPEAKER PLACEMENT

Two W80A Speaker Systems may be placed end to end as a console, or spaced at any distance from each other or from the wall, at almost any height between ceiling and floor, to project flawless stereophonic sound to all areas of the room. Decorator designed to add elegance to any setting.
• Speakers: All professional grade components. Woofer: Heavy duty 12½" with 9½ lb. magnet assembly; mid-range: 5" acoustically isolated; two different treble speakers: 3" domed for sub-treble; 1" domed for extra highs • Controls: Individual for each treble; variplanular disc on a swivel mount to adjust sound projection • Minimum power required: 20 watts (per channel) IHF • System impedance: 4 to 8 ohms • Dimensions: 28"x17¼"x17" deep (Two W80A's can be used for a single 56" console. Removable bumpers add 1" to height.) • Shipping weight: 81 lbs. • Finish: Oiled walnut. • Price: $317.60. B-69 roll-out base for individual speaker, $18.50. B-68 pedestal for use when two speakers are end to end in console arrangement, $25.75.





ACHROMATIC W70E

VERSATILE HIGH AND LOW BOY DE LUXE 3-WAY SPEAKER SYSTEM WITH ACOUSTIC SUSPENSION

One of the industry's most popular and versatile floor-standing systems, a W70E combines the finest components to provide the ultimate in home stereo reproduction. Superbly styled, the versatile W70E can be used vertically or horizontally. Either way, it creates a decorative end table to complement any room setting.
• Speakers: Woofer: Long throw, heavy duty 15"; mid-range: Acoustically isolated 5"; tweeters; Omnidirectional 3"; 1" mylar dome tweeter with phase compensating diffuser • Controls: Separate, continuously variable controls for mid and treble ranges • Minimum power required: 15 watts (per channel) IHF • System impedance: 8 ohms • Dimensions: 24"x22¾"x13⅝" deep • Shipping weight: 72 lbs. • Finish: Oiled walnut • Price: $223.00

ACHROMATIC W60E

3-WAY SPEAKER SYSTEM WITH ACOUSTIC SUSPENSION FOR BOOKSHELF OR FLOOR LOCATION

The remarkable W60E is the new version of Wharfedale's most popular speaker system. New 3-way configuration and upgraded components, make the sound more impressive than ever before.
• Speakers: Woofer: Heavy duty 12½"; 9½ lb. magnet assembly, distortion-free bass; mid-range: Acoustically isolated 5"; super tweeter: 3" omnidirectional mylar dome and phase compensating diffuser for clean high response • Controls: Individual and variable for mid-range and treble • Minimum power required: 10 watts (per channel) IHF • System impedance: 4 to 8 ohms • Dimensions: 24"x15"x12" deep • Shipping weight: 56 lbs. • Finish: Oiled walnut • Price: $153.00

ACHROMATIC W45

3-WAY SHELF SPEAKER SYSTEM WITH ACOUSTIC SUSPENSION

A new speaker system engineered specifically to meet today's challenging musical requirements. Truly an outstanding value. A multiple speaker assembly yielding a carefully tailored ultra-linear response.
• Speakers: Woofer: Heavy duty 8". Oversized voice coil and long-travel cone for extended bass; mid-range: Acoustically isolated 3¼"; tweeter: Ultra-curvilinear 2½" provides wide angle dispersion and smooth responses at high output levels • Controls: Continuously variable mid-range and treble • Minimum power required: 10 watts (per channel) IHF • System impedance: 8 ohms • Dimensions: 22"x12"x10" deep • Shipping weight: 37 lbs. • Finish: Oiled walnut • Price: $117.00

ACHROMATIC W35

3-WAY SHELF/CORNER SPEAKER SYSTEM WITH ACOUSTIC SUSPENSION

A new, highly versatile shape in speaker systems for today's special decorative needs. May be used free-standing on shelf or at shelf corners, or suspended in room corners with optional corner mounting bracket. Exceptionally robust and highly articulate performance results from the 3-way speaker configuration. Ideal for four-channel stereo application.
• Speakers: Woofer: Heavy duty 8". Low resonance, high compliance cone suspension for deep, faithful bass reproduction; mid-range: Acoustically isolated 3¼"; tweeter: 2½" ultra-curvilinear for undistorted wide-angle response • Controls: Individual and variable mid-range and tweeter • Minimum power required: 10 watts (per channel) IHF • System impedance: 8 ohms • Dimensions: 15"x15"x8" deep • Shipping weight: 24 lbs. • Finish: Oiled walnut • Price: $82.00. B-66 Mounting Bracket, $4.00

ACHROMATIC W25

2-WAY SPACE-SAVER SPEAKER SYSTEM WITH ACOUSTIC SUSPENSION

The remarkable performance of this small speaker system is even more amazing when you consider its compact size and modest cost. It is designed specifically to handle today's musical demands from percussive hard-rock to full symphonic material.
• Speakers: Woofer: High compliance 8" for base and mid-range; tweeter: Ultra-curvilinear 2½" • Control: Variable treble • Minimum power required: 10 watts (per channel) IHF • System impedance: 8 ohms • Dimensions: 15½"x10"x8" deep • Shipping weight: 14 lbs. • Finish: Oiled walnut • Price: $58.75

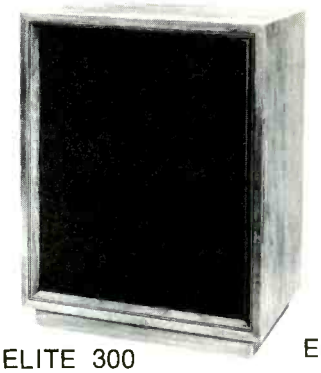
WHARFEDALE, DIV. BRITISH INDUSTRIES CO., WESTBURY, N.Y. 11590

Prices and specifications subject to change without notice.

Check No. 65 on Reader Service Card

CLARK MUSIC
CMS-124

EMI 300C



ELITE 300

EMPIRE Grenadier 7000M

SPEAKER SYSTEMS

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, in.	WOOFER Resonance (In System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, in.	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Type	Overall Freq. Response, Hz to kHz ±7 dB	Ampl. Pwr. for Ave. Room, W	Pwr. Handling Capacity (RMS Cont.)	Crossover Frequency (less), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, in.	Wood Finish	Grille Material/ Color	Weight, Lbs.	Price	SPECIAL FEATURES
CLARK (110)	CMS-124	12	58	Acous.	4½	Cone	(2) 3	Dome	30-20K ±5	15	100	300 4,000	8	14½ x 12 x 24	oil wal.	Cloth Brown	40	90.00	3-pos. brilliance contr; fin. 4 sides.
	CMS-83	8	70	Acous.	–	–	3	Dome	35-20K ±3	8	35	2,000	8	10½ x 9 x 19	wal.	Cloth Brown	20	40.00	Fin. 4 sides; changeable grille.
DYNACO (15)	A-25	10	58	Friction Loaded			1½	Soft Dome	47-20K ±5	15	35	1,500	8	20 x 10 x 11½	oil wal.	Linen, nat. beige	20	79.95	Also avail. in teak or rosewood at $89.95.
EICO	HFS-8	8	50				3½	Cone	40-18K ±3	3	20	4,000	8	22½ x 13 x 6½	mah.	Cloth, Tan	17	49.95	
ELECTRO-VOICE	Aries	12	42	Acous.	6	Cone	2½	Cone	25-20K	10	35	400 1,500	8	27½ x 16¼ x 22¼	see note	Var.	60	269.95	Deluxe furn. cab. avail. in cont pecan; trad cherry; Spanish oak.
	Four A	12	47	Acous.	6	Cone	2½	Cone	30-20K	10	35	400 1,500	8	25 x 13½ x 14	wal.	Cloth, dk. brn.	45	199.95	Ultralinear 12" foam.
	Nine	10	50	Acous.	5	Cone	3½	Cone	30-20K	10	35	400 1,000	8	22½ x 12 x 13½	wal.	Cloth, dk. brn.	30	139.95	5-in. mid-range fills out treble.
	Five C	10	50	Acous.	–	–	2½	Cone	30-20K	10	35	1,000	8	21¾ x 12¼ x 10⅜	wal.	Cloth, dk. brn.	22	99.95	4-layer woofer voice coil.
	Eleven	6	110	Reflex	–	–	–	–	80-15K	5	15	–	8	15¼ x 6½ x 8¼	wal.	Cloth, dk. brn.	9	34.95	Low-cost dual radiator system.
ELITE	300	15	25	Infinite	–	Two Horns	3	Two Cones	20-22K	10	60	5,000 850	8	28¾ x 22 x 16	Wal.	Cloth, brn.	80	229.95	Removeable grille 5 speaker system tweeter mid-range controls.
	280	12	34	Acous.	–	Horn	3	Cone	30-22K	15	35	5,000 1,000	8	24 x 14½ x 12	Wal.	Cloth, brn.	43	99.95	Finished on 5 sides tweeter and mid-range controls.
EMI (49)	300	15	53	Acous.	(2) 5	Cone	2	Compr. Type	10-30K	35	100	1,000 7,000	8	26 x 19 x 27½	Wal.	Brown	90	350.00	
	205	14 x 9	55	Acous.	(2) 5	Cone	–	Compr. Type	25-20K	20	90	1,500 5,000	8	14¼ x 13¾ x 24⅜	Wal.	Brown	52	225.00	
	105	14¼ x 8⅜	62	Acous.	5	Cone	3⅜	Cone	35-20K	15	80	1,000 4,000	8	13½ x 12¼ x 24½	Wal.	Brown	50	169.50	
	62	10 x 6⅝	91	Acous.	–	–	3⅜	Cone	60-20K	10	35	5,000	8	11⅜ x 10 20½	Wal.	Black	28	79.95	
EMPIRE	9000M	15	20	Inf. Baffle	5	Dome	1	Dome	20-20K	5	125	450 5,000	8	22 x 29	Wal.	Gold Fin. Metal	120	299.95	Grenadier models; woofer faces down; wide-angle lens pedestal style enclosure; no grille cloth.
	7000M	12	30	Reflex	5	Dome	1	Dome	25-20K	5	100	450 5,000	8	16 dia. x 26	Wal.	Gold Fin. Metal	90	209.95	
	6000M	10	40	Reflex	4	Flat Cone	2	Cone	30-20K	5	75	500 5,000	8	18 dia. x 24	Wal. or Dk. Oak	Gold Fin. Metal	60	109.95	
FAIRFAX (73)	FE-8	(2) 8		Acous.	(2) 8	Cone	(2)-3 (2)-3½	Cone Paper	20-22K ±3	15	100	750 2K,7K	8	20 x 12 x 28⅜	Oil Wal.	Black	80	249.50	1-in particle board cab.
	FL-34	(2) 8	–	Layb. Folder Horn	3	Cone	3½	Dome	22-22K ±3	10	60	2,000 7,000	8	14 x 12 x 24	Oil Wal.	Black	65	129.50	As above.
	FX 100	8	–	Bass Reflex	–	–	3	Cone	30-20K ±3 db	10	30	5,500	8	12 x 7⅞ x 21	Oil Wal.	Black	28	79.50	
FISHER (31)	XP-16	(2) 12	15	Acous.	8	Cone	1½ ⅜	Dome Horn	28-24K	20	60	250 2,500	8	27½ x 31½ x 19⅜	Wal. Pecan	Cloth, Brn.	105	299.95	Furniture styles in 3 finishes, incl. cherry.
	XP-9C	15	10	Acous.	(2) 5	Cone	(2) 1½	Dome	28-22K	20	30	500 1,200 5,000	8	16¼ x 27½ x 13	Wal.	Cloth, Brn.	55	199.95	4-way with dome super tweeter.
	WS-80	8	36	Dmn.	5⅛	Cone	3	Horn	35-20K	10	20	400 1,500	8	18 x 18⅜ x 11	Wal.	Cloth, Brn.	24	99.95	Model WS-70 with 6" woofer 3" tweeter $79.95.
	XP-55B	8	38	Acous.	–	–	3	Cone	37-20K	10	15	1,500	8	20 x 10 x 7½	Wal. Finish	Cloth, Brn.	18	49.95	Model KP-44B with 6" woofer. $44.95.
GOODMANS	Magnum-K	12	40	Acous.	4	Cone	4	Cone	30-20K ±5	6	25	1,500 6,000	8	15 x 11⅛ x 24	Wal.	Cloth, Char. & White	47	189.00	Vinyl cone suspension; tweeter & mid-range conts.
	Maxim	4	60	Acous.	–	–	3½	Cone	45-20K ±5	8	12	2,000	8	10½ x 5½ x 7⅞	Wal.	Cloth, Brn. & White	8	59.95	Vinyl Cone Suspension.
GROMMES	GS-310	10	–	Acous.	6	Cone	3½	Cone	25-20K	20	50	600 3,500	8	13⅜ x 23 x 10¹⁵⁄₁₆	Wal.	Brn.	30	119.85	

Four Japanese music critics rated the AR-3a best of fifty domestic and imported speakers.

①ブラインドテスト・採点表

	オーケストラ	室内楽	ピアノ	声楽	ムード	ヴォーカル	ジャズ	コストパフォーマンス	総合評価
岡	◎	○	◎	◎	○	◎	○	8	◎
菅野	○	◎	○	◎	◎	○	○	6	○
瀬川	◎	○	○	◎	◎	◎	◎	7	◎
山中	◎	○	○	◎	◎	◎	○	8	◎

Categories of music are across the top; reviewers at left. Two circles denote *excellent*, three circles *superior*. Overall ratings are at extreme right, following rating of value per unit cost, in which 5 is the break-even point.

In Japan, *Stereo Sound* magazine recently conducted a listening comparison test of fifty Japanese, American, British and German speaker systems. Four distinguished Japanese music critics brought their own records to test, and each spent four full days of 8 to 14 hours comparing speakers. The location of each speaker system was changed daily behind the acoustically transparent curtain which also concealed the size and identity of the tested units. The critics were asked to rate each speaker system as *superior, excellent, good* or *unacceptable* for each of seven kinds of music and were encouraged to use the volume and tone controls of the amplifier. A JBL SA600 amplifier and Shure and Ortofon cartridges were used.

The AR-3a received the highest score of all the systems tested. It was also the only speaker system rated *excellent* or *superior* in every music category by every critic. This is of particular interest since the critics were carefully prevented from communicating with each other during the test period.

Complete technical specifications of the AR-3a are available free on request.

AR

Acoustic Research, Inc.
24 Thorndike Street, Cambridge, Massachusetts 02141

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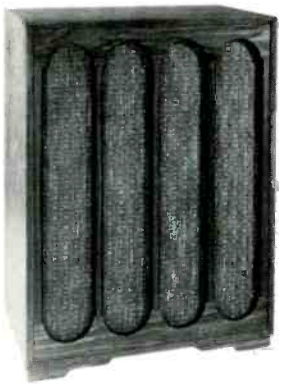
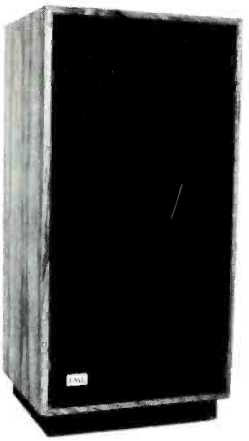
SPEAKER SYSTEMS — Continued

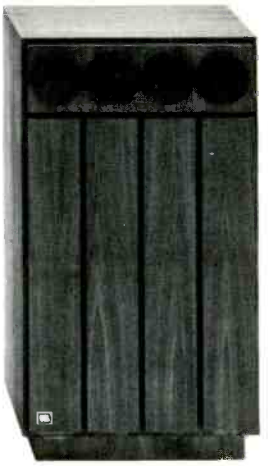
H-K Citation



HARTLEY Concertmaster



IMF TLS Monitor II



JBL Aquarius 2

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, in.	WOOFER Resonance (In System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, in.	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Type	Overall Freq. Response, Hz to kHz ±3 dB	Ampl. Pwr. for Avg. Room, W	Pwr. Handling Capacity (RMS Cont.)	Crossover Frequency (ies), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, In.	Wood Finish	Grille Material Color	Weight, Lbs.	Price	SPECIAL FEATURES
HARMAN-KARDON	Citation	(3)-6	30	Double Chamber Bass Ref.	3	Dome	(2)-2	Dome	30-22K ±2	20	60	2K	4		Wal.	Light Tan	75	295.00	Omnidirectional type without reflectors.
HARTLEY	Concertmaster V & VI	24	13	Semi-Infinite	10	All Polymer Cone	5 2	Poly Cone & Dome	16-25K ±3	25	50	200 3,000	12	29 x 18 x 40½	Wal.		150	775.00 795.00	All speakers of identical cone mat'l., magnetic susp. cast alum. baskets, dual cones and dual voice coils on 10" and 7" units. X-overs at 12 dB/OCR 14 lb magnets on woofers and 6.1 lbs magnets on 10" and 7" units.
	III & IV	18	17	Semi-Infinite	10	All Polymer Cone	5 2	Poly Cone & Dome	16-25K ±3	20	40	200 3,000	12	29 x 16 x 39	Wal.		135	695.00 725.00	
HEATH	AS-48	14	–	Ducted Port	–	–	2	Cone	40-20K	8	50	2,000	8	23½ x 12 x 14	Oak	Cloth Brn.-Blk.	42	169.95	HF balance switch RLC crossover.
	AS-38	12	–	Tube Ported	–	–	2	Cone	45-20K	–	40	2,500	8	23½ x 11¾ x14	Wal.	Cloth, Brn.	37	129.95K	High frequency level control.
	AS-10W	10	–	Acous.	–	–	(2)3½	Cone	30-15K ±5	10	40	2,250	16	24 x 11½ x 13½	Wal.	Cloth, Cane	42	64.95K	HF Level control.
	AS-16	8	–	Acous.	–	–	3½	Cone	45-20K ±5	–	25	1,500	8	19 x 8¼ x 10	Wal. Vinyl	Cane	15	49.95K	HF Level control.
IMF	TLS	9 x 12	15	trans. line	5	Cone (trans. line)	2¼ ¾	Comp dr. Dome	20-35K ±3	30	30	350 3500 12K	8	20 x 17 x 43	gray, rosewood	cloth blk.	140	660.00	For monitoring matched, phased pairs.
INFINITY	Servo-Statik II		*		–	–	**		10-30K ±3	40			40K ***	****	rosewood	rosewood			*Feedback contr. com. bass woofer, **two ESL screens for treble, ***into 110-w ampl., furnished. ****hi f. screens: 28 x 37 x 6½
	Infinity 2000								30-35K ±4	20		375 2200	4	18 x 12 x 26					
JBL	Aquarius 3	14		Radial Horn Driver	(2)-5	Radial Horn Driver		Comp. dr.			60	300 1500	8	18 x 20 x 50	wal. or white	molded polymer	117	657.00	Peripheral radial slot plus multi-lobed high frequency horn.
	Aquarius 2	12		Radial Horn Driver	(2)-5	Radial Horn Driver	1¾	Direct rad.			50	300 3000	8	18 x 16 x 32	wal. or white	cloth charcoal	95	387.00	Diffuse – source system projects sound from peripheral radial slot.
	Aquarius 4	8		Radial Horn Driver	–	–	1¾	Radial Horn Driver			25	3000	8		wal. or white	cloth charcoal	50	168.00	Unique pedestal shape houses twin radial diffraction slots.
JVC (9)	5340	12	45	Acous.	6½	Cone	3½ 2	Cone Horn	20-30K ±2	20	50	1500 7K,10K	8	16 x 15 x 28	wal.	cloth gray	47	259.95	Level contr's behind grille.
	5303	(4)-5	35	Acous.			(4)-2		20-20K ±3	20	40	5000	8	13½ dia. sphere		Metal black	26.4	199.95	Omni-dir. ball system 4 woofers, 4 horn tweeters.
	5304	12	45	Acous.	6½	Cone	3½ 2	Cone Horn	30-23K ±5	15	40	1500 7K,10K	8	15 x 13 x 24¾	wal.	Cloth 'Brn,	35	149.95	Multi-channel input terms. for use with multi-ampl. sys.
	5310	6½		Air susp.	2	Cone	2	Horn	40-20K ±5	8	20	7000 10,000	8	11 x 17 x 7¾	wal.	cloth blk.	12	69.95	Free-edge woofer.

Our amazing new low-cost speaker is made with a revolutionary substitute for money: Brains.

Two facts stand out about the new **Rectilinear XI** bookshelf speaker:

Its price is $69.50.

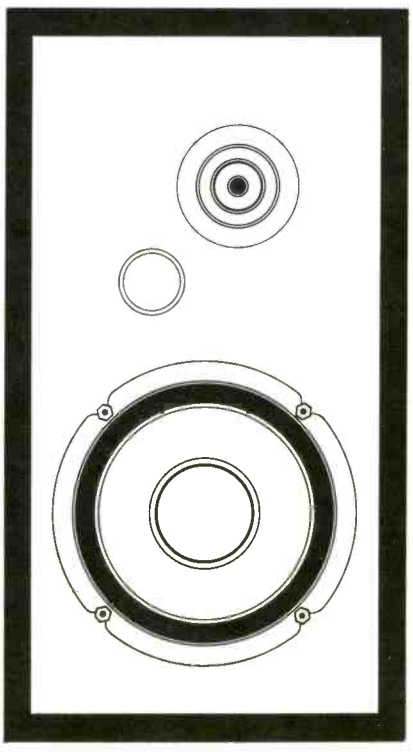
And its sound is beautiful.

In fact, it sounds quite respectable even in comparison with our top speakers, which cost three and four times as much and have been called the best in the world. To be on the conservative side, let's say the **Rectilinear XI** sounds like an exceptionally fine $135 speaker.

A year or two ago, a speaker like this would have been just about impossible. Every manufacturer knew that inexpensive speakers were supposed to sound mediocre, so that's how they made them, give or take a few sales features.

Luckily, our young engineers are somewhat naive about these things. All they know is physics, mathematics, electronics and acoustics. As far as they're concerned, a correct crossover frequency costs no more than an incorrect one. The right distance between the drivers no more than the wrong one. Proper phasing no more than improper. And so on, down the line. They act as if they believed that at least seventy-five percent of speaker design is knowledge, not money.

So they specified a 10-inch woofer, a 3-inch tweeter, a choke, a capacitor and a volume control. They put these into a 23" by 12" by 10½" cabinet and fussed and fussed. Without any preconceived notions as to how good or bad such an austere design should sound. They stopped only when they could no longer improve the performance.



The result is a $69.50 speaker that not only covers the range from 45 to 17,000 Hz without peaks or harmonics but also has extremely low *time delay distortion*, which is Rectilinear's chief criterion of speaker quality.

What's more, the **Rectilinear XI** is a high-efficiency speaker. It can be driven to window-rattling levels with a puny 10 watts.

A triumph of brain over brawn, you might say.

(For more information, including detailed literature, see your audio dealer or write to Rectilinear Research Corp., 107 Bruckner Blvd., Bronx, N.Y. 10454. Canada: H. Roy Gray Co. Ltd., 14 Laidlaw Blvd., Markham, Ont. Overseas: Royal Sound Co., 409 N. Main St., Freeport, N.Y. 11520.)

Rectilinear XI

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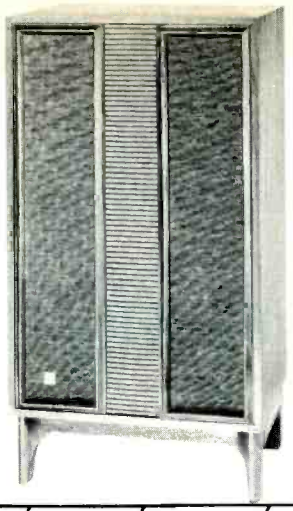
SPEAKER SYSTEMS — Continued



JENSEN 700-XLW

KLIPSCH La Scala

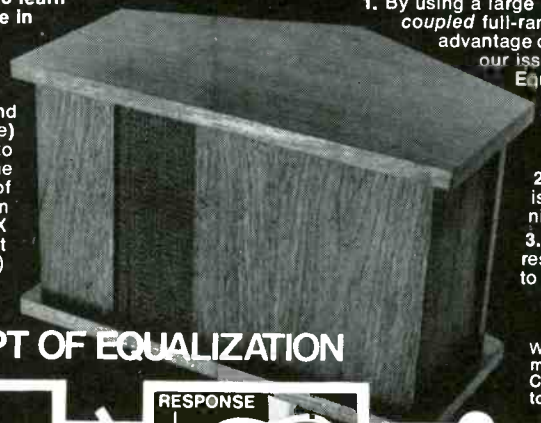
MARANTZ Imperial IVA

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, in.	WOOFER Resonance (In System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, in.	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Type	Overall Freq. Response, Hz to kHz ±1 dB	Ampl. Pwr. for Ave. Room, W	Pwr. Handling Capacity (RMS Cont.)	Crossover Frequency (ies), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, in.	Wood Finish	Grille Material Color	Weight, Lbs.	Price	SPECIAL FEATURES
JENSEN	700XL	12		Inf.	4 x 8	Horn	2 1	Horn Dome	20-25K	5	40	600 4K,10K	8	16¼ x 25½ x 12	wal.	cloth brn.	50	275.00	4-way, opt. consolette base.
	TF-25	10		Inf.	–	–	2 x 6	Horn	25-19K	10	25	2000	8	22½ x 14 x 8⅝	Durasin wal.	cloth brn, wood strips	22	89.50	2-way.
	X-45	8		Inf.	–	–	2 x 6	Horn	30-18K	10	25	2000	8	19⅛ x 10½ x 9	Durasin wal.	Cloth brn.	19	69.50	2-way.
KLH	12	12	35	Acous.	(2) 3	Cone	1¾	Cone		30		600 2500	8	22¼ x 15 x 29	Oil wal.	Boucle off white	114	275.00	4 3-pos level contrs; can be used remotely; changeable grille cloth.
	5	12	44	Acous.	(2) 3	Cone	1¾	Cone		25		600 2500	8	26 x 11½ x 13¼	Oil wal.	Cloth, lt. brn.	54	189.95	2 3-pos level contrs; fin on 4 sides; changeable grille cloth.
	6	12	55	Acous.	–	–	1¾	Cone		20		1500	8	23½ x 11⅞ x 12⅛	Several	Boucle off white	40	134.00	3-pos tweeter level contr; avail unf birch, cherry, wal, oil wal; fin 4 sides.
	33	10	56	CAC*	–	–	1¾	Dir. rad.		15		1500	8	23⅛ x 10⅝ x 12¾	Oil wal.	Cloth lt. brn.	33	99.95	*Contr. acous. compliance 3-pos h.f. level contr, fin 4 sides; changeable grille.
	1†	10	60	Acous.	–	–	1¼	Cone		12		1500	8	23½ x 9 x 11¾	Oil wal.	Cloth off white	27	74.95	3-pos tweeter level contr; fin 4 sides; changeable grille.
KARLSON (110)	X-15	15	40	Spec.	–	–	2½	Spec.	20-18K ±4	2	100	4000	16	28 x 20 x 18	wal.	Woven plastic	90	299.00	Sep. conn. for woofer for organ or instrument use; avail. utility and other finishes.
KENWOOD (39)	KL-5060	12	45	Ducted Reflex	6½	Cone	2	Horn	30-22K	10	40	600 5000	8	15 x 11⅝ x 25½	wal.	Metal dk. brn.	44	139.95	3-way, 4-spkr. system 2 level controls.
	S-606	8	55	Acous.	–	–	3	Cone	50-20K	6	20	2500	8	11 x 10 x 21	wal.	cloth, brn.-blck.	30*	109.95 pr.	*pair, 2-way.
	S-505	6½	55	Acous.	–	–	3	Cone	50-20K	6	15	2500	8	17¼ x 8 x 8¼	wal.	cloth, brn.-blck.	22*	59.95 pr.	*pair, 2-way.
KLIPSCH	Klipschorn	15		Horn	2	Horn	1	Horn	32.7 17.5K ±5	10	100	400 6000	8-16	31 x 28 x 49	wal., mahog., others	Several	179 218	571.00 1,080.00	All models acoustically identical.
	Heresy Model H	12		Inf.	2	Horn	1	Horn	45 to 17.5 ±5	20	50	700 6000	8-16	15 x 13 x 21	wal, mah, maple, others	Several	55	209.00 252.00	Fir plywood furn. finish.
LOUDSPEAKER DESIGN	Eziekel II	(2) 8		Horn	–	–	2	Horn	27-23K ±4	2	85	175 800 5000	4	27 x 18 x 22	wal.	cloth blk.	57	279.95	Horn loaded system passive electronic network.
	Eziekel I	10		Horn	–	–	2	Horn	45-17K ±4	2	50	175 1000	8	26 x 11 x 16	wal.	cloth blk.	29	159.95	As above.
LWE	I-A	15		elec. susp.	6	Cone	5	Horn	22-20K ±3		50	1500 4000	4	25 x 17 x 12	wal. or kit	cloth dk. brn.	61	270.00 225.00K	Neg. feedback, electronic suspension.
	III	12		elec. susp.	6	Cone	3½	Cone	25-19K ±5		38	1200 4000	8	22½ x 15 x 9½	wal. or kit	cloth dk. brn.	35	180.00 130.00K	As above.
	VI	8		elec. susp.	–	–	3½	Cone	30-16K ±5		25	1500	8	19 x 10 x 9	wal. or kit	cloth dk. brn.	23	82.50 66.00K	As above.
LAFAYETTE (106)	Criterion 5 x B	12		Acous.	6½	Cone	3 1½	Cone Cone	18-25K	5	75	800 4500 10,000	8	23⅞ x 14⅜ x 11⅝	Oil wal	cloth dk. brn.		129.95	
	Criterion VI	12		Ducted port	5	Cone	(2) 3 (2) 1½	Cone Cone	20-20K	7	50	800 5000 12,000	8	24 x 14½ x 12	Oil wal.	cloth dk. brn.			
	Omni II	10			–	–		Cone	50-20K	5	40	2600	8	13 x 13 x 19¼	Oil wal.	cloth dk. brn.			Omni-directional.
LEAK	Mark III Sandwich	13	19	Int.	–	–	3½	Poly. Sand. bet. Alum.skins	30-18K	4	70	900	8	26 x 15 x 12	Oil wal.	cloth brn.	50	215.00	Piston Action polyurethane cone between al. skins.
MARANTZ (58) (59)	I	12	–		3	Cone	2	Cone	20-20K	10	40	700 6000	8	26 x 22 x 15		cloth brn.	50	199.00	
	IV	12	–	Acous.	2	–	1		30-20K		100	1500 6000	8	23 x 13½ x 12	Oiled wal.	cloth brn.	40	199.00	
	IVA	8	–	Acous.	2	Cone			60-18K			2000	8			cloth brn.	13¼	69.00	

Why doesn't every speaker system have an EQUALIZER?

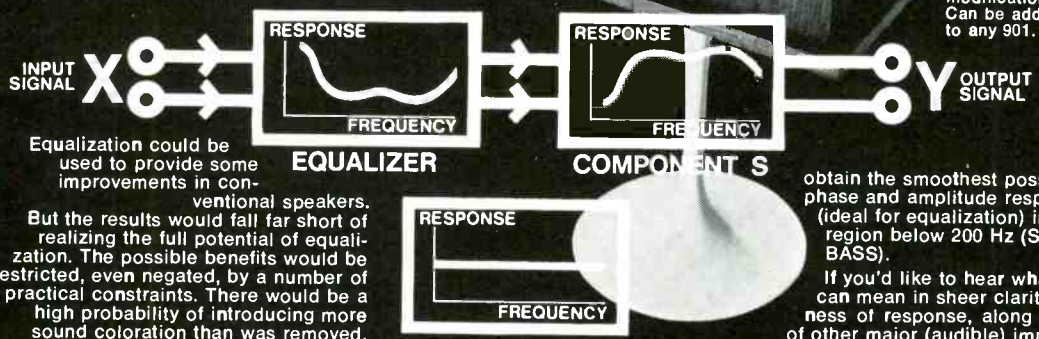
If you have heard the BOSE DIRECT/REFLECTING™ speaker system, or if you have read the unprecedented series of rave reviews in the high fidelity magazines, you already know that the 901 is the longest step forward in speaker design in perhaps two decades. The superiority of the 901 derives from an *interralated group of advances* (covered by patent rights issued and pending) that are the result of a 12-year intensive research program on sound reproduction. In each issue we discuss one aspect of this research, with the hope that you will be as interested to learn about these new concepts as we were in developing them. In this issue we examine EQUALIZATION.

The principle of equalization is depicted in the accompanying block diagram. An input signal X passes first through an equalizer and then component S (a speaker, for example) to reach the output Y. Component S is said to be equalized when the response of the equalizer is complementary to that of component S, to create the desired uniform response of the overall system from input X to output Y. When we consider that this concept is used throughout engineering from (all) phonographs and tape recorders to complicated television and communication systems, we naturally wonder why every speaker doesn't have an equalizer.



Walnut grille modification extra. Can be added to any 901.

CONCEPT OF EQUALIZATION



Equalization could be used to provide some improvements in conventional speakers. But the results would fall far short of realizing the full potential of equalization. The possible benefits would be restricted, even negated, by a number of practical constraints. There would be a high probability of introducing more sound coloration than was removed.

PROBLEMS IN EQUALIZATION OF CONVENTIONAL SPEAKERS

1. Any mechanically vibrating membrane manifests many irregularities (normal modes) which are individually too complex to equalize.*
2. No satisfactory solution has ever been obtained for the equalization of a speaker system over the crossover region where two speakers of grossly different amplitude, phase and spatial radiation characteristics are attempting to make an acoustical transition.

OVERALL RESPONSE FROM X TO Y OF EQUALIZED SYSTEM

3. The fundamental resonance of conventional speakers lies in a low frequency range (below 100 Hz) for which the ear is very critical of both amplitude and phase irregularities. Despite many attempts over the past decades, no really successful solutions have been found for the equalization of conventional speakers through the frequency range of their fundamental resonance.

We can now ask: HOW DOES THE 901 USE THE FULL POTENTIAL OF EQUALIZATION?

1. By using a large number of *acoustically coupled* full-range speakers, we take advantage of 'resonance-splitting' (See our issue on RESONANCES). Equalization is required for only the smooth average curve rather than for the complicated individual speaker characteristics.
2. The crossover problem is eliminated by the use of nine full-range speakers.
3. In the 901, the fundamental resonance is designed upward to near 200 Hz in order to obtain the smoothest possible phase and amplitude response (ideal for equalization) in the critical region below 200 Hz (See our issue on BASS).

If you'd like to hear what equalization can mean in sheer clarity and smoothness of response, along with a number of other major (audible) improvements, ask your franchised BOSE dealer for an A-B comparison of the 901 with the best conventional speakers — *regardless of their size or price.*

***See 'ON THE DESIGN, MEASUREMENT AND EVALUATION OF LOUDSPEAKERS', Dr. A. G. Bose, a paper presented at the 1968 convention of the Audio Engineering Society. Copies of the complete paper are available from the Bose Corp. for fifty cents.**

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BOSE 901 DIRECT/REFLECTING™ Speaker System — $476 the Stereo Pair. Including Active Equalizer. Slightly higher in the west and southwest. Pedestal base extra.

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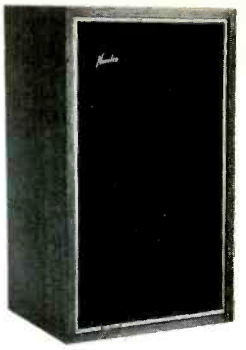
MAXIMUS 55



NORELCO 710

SPEAKER SYSTEMS — Continued

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, In.	WOOFER Resonance (In System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, In.	MID-RANGE Type	TWEETER Diameter, In.	TWEETER Type	Overall Freq. Response, Hz to kHz ±3 dB	Ampl. Pwr. for Avg. Room, W	Pwr. Handling Capacity (RMS Cont.), W	Crossover Frequency (ies), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, In.	Wood Finish	Grille Material Color	Weight, Lbs.	Price	SPECIAL FEATURES
MARTEL	VS1200	12	–	Acous.	5	Cone	3	Cone	35-20K	25	100	1400 5000	8	15 x 11¾ x 26¼	wal.		50	179.95	
	VS1000	10	Cone	Acous.	5	Cone	(2)	Horn	40-20K	25	100	800 3000	8	13 x 11½ x 23	wal.		27	99.95	
MAXIMUS (99)	70	(2)12	45	Acous.	(2) 6	Cone	(2) 3½ (2) 1	Cone Dome	20-35K ±5	15	*	1000 4K,8K	8	29 x 29½ x 18	Oil wal.	cloth brn.	94	299.95	*All models can accept any commercial ampl. made for home music listening.
	5X	12	45	Acous.	6	Cone	3½ 1	Cone Dome	25-25K ±5	15	*	1000 5K,8K	8	24 x 15 x 12	Oil wal.	cloth brn.	34	149.95	All models have controls on front after removing snap-out grilles.
	55	12	45	Acous.	6	Cone	3½	Cone	20-20K ±5	15	*	2000 5000	8	24 x 14 x 12	Oil wal.	cloth brn.	30	109.95	
NIKKO	SS-83	8		Acous.	–	–	2⅜	Cone	40-21K		15	4000	8	9 x 9 x 14⅛	Oil wal.	Cloth blk.	10.2	89.95 (pair)	Constant RLC network (12 dB/OCT). High Compl. woofer; lntchgbl. grille cloth.
NORELCO (89)	710	10	55	Acous.	3½	Cone	1¾	Cone	32-19,500	20	35	5000 7500	8	14 x 11 x 22	Wal.	cloth blk.	22.5	129.95	
	700	8	90	Acous.	–	–	3½	Cone	40-18,000	10	15	5000	8	11 x 9 x 18	Wal.	cloth blk.	13.5	69.95	
PIONEER (29) (45) (57)	CS-630X	15		Acous.	(2) 5	Cone	(2)2½	Cone Horn	20-20K	10	80	770 3.3,12K	8	18⅞ x 13 1/16 x 28⅜	Wal.	Wood Lattice	63	259.00	Level contrs. for midrange & tweeter.
	CS-A-700	12		Acous.	4⅜	Cone		Multi-Cell Horn	35-20K	10	60	500 4500	8	12¾ x 15 x 26	Wal.	Wood Lattice	37	179.00	Bi- or tri-amp inputs.
	CS-A-500	10		Acous.	4¾	Cone	3	Cone	40-20K	10	50	800 6000	8	13 x 12⅜ x 22½	Wal.	Wood Lattice	32	149.00	As above.
	CS-66	10		Acous.	6½	Cone	3	Cone	35-20K	10	40		8	12 1/16 x 11 1/16 x 22	Wal.	Wood Lattice	29	109.00	Level contr. for tweeter.
QUAD									45-18K	30	60			34½ x 31 x 10½	Wal.	Anod al, bronze		260.00	Full-range doublet; electro-static; dispersion 70 deg. hor, 15 deg. vert.
RECTILINEAR (69)	III	12	40	Ducted Port	5	Cone	(2)2½ (2) 2	Cone Cone	22-18.5K +4	20	100	500 8K, 11K	8	18 x 12 x 35	Wal.	Cloth brn.	70	279.00	Low-mass drivers.
	Xa	10	60	Acous.	5	Cone	2½	Cone	40-18.5K +4	30	180	100 8000	4	25 x 14 x 10⅜	Wal.	Cloth brn.	55	199.00	No time-delay distortion.
	XII	10	45	Ducted Port	5	Cone	3	Cone	35-17K +4	10	85	350 7500	8	25 x 14 x 10⅜	Wal.	Cloth brn.	40	139.00	High efficiency phase-linear X-over.
	Mini III	8	50	Acous.	5	Cone	2	Cone	50-18.5K +4	20	70	400 8000	4	19 x 12 x 9½	Wal.	Cloth brn.	25	89.50	Low-mass driver, e/c. bass resp.
	XI	10	55	Ducted Port	–	–	3	Cone	35-17K +4	10	70	1800	8	23 x 12 x 10½	Wal.	Cloth brn.	28	69.00	Flat resp; high efficiency.
ROBERTS	S918	12			5¼	–	2		40-20K		40W		8	25⅛ x 16 x 11⅜	Wal.	Wood brn.	35.2	149.95	3-way 3 speaker sys.; high and midrange level controls.
	S916	12					3½		50-18K		25W		8	22½ x 16½ x 12 1/8	Wal.	Cloth brn.	28.9	99.95	
SANSUI (6) (7) (41)	SP-2002	12		Duct. Port.	6½ 5	Cone Cone	(2)1	Dome	35-20K		50	600 5000	8	15 x 12⅜ x 25½	Wal.	Fret-work	46	179.95	Sep. terms for elect. X-over; mid & h.f. contrs; acetate damping material.
	SP-1001	10			6½	Cone	1	Dome	35-20K		40	600 5000	8	14 x 12 x 24½	Wal.	Fret-work	38½	139.95	As above.
	SP-50	8					2	Horn	50-20K		25	7000	8	12⅜ x 19¾ x 9⅜	Wal.	Fret-work	19¾	79.95	Acetate damping material.
	SP-30	6½					2	Sq. Horn	50-20K		20	7000	8	10⅜ x 7⅛ x 16¾	Wal.	Fret-work	10	19.95 pr.	As above.
SCHOBER (98)	LSS-100	Two 12	32	Reflex	8	Cone		(2) Horns	30-18K	1	100	150 1,3.5K	8	32 x 16 x 54	Wal.	Cane Beige	150	499.50	4-way system capable of 100 watts continuous program.
	LSS-10A	12	32	Reflex	8	Cone	1 treble horn, 1 tweeter horn,		30-18K (w tw.)	2	40	250 3500	8	24 x 16 x 34	Wal.	Cane Beige	60	180.00K	2-way without opt. tweeter. 3-way with opt. tweeter.
SCOTT	Q101	(2)10		Acous.	(4)4¼	–	(4)3	Cone	35-20,000	10-12	100		8	17⅝ x 17⅝ x 22	Cont. wal.	Cloth Tan.		229.95	
	Q100	(2)8		Acous.	–	–	(4)3	Cone	40-20,000	10	80		8	14½ x 14¼ x 22	Cont. Wal.	Cloth Tan		149.95	
	S-20	10		Acous.			3½	Cone	38-20,000	7	50		8	20 x 11¾ x 11	Ant. Pecan Medit.	Cloth Tan		109.95	
	S-17	8		Acous.	–	–	3	Cone	40-20,000	7	35		8	18 x 10½ x 8½	Cont. Wal.	Cloth Tan		59.95	
	S-14	6		Acous.	–	–	3	Cone	50-20,000	7	28		8	16 x 10 x 6½	Cont. Wal.	Cloth Tan		49.95	

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SPEAKER SYSTEMS — Continued

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	WOOFER Diameter, in.	WOOFER Resonance (in System), Hz	WOOFER Enclosure Type	MID-RANGE Diameter, in.	MID-RANGE Type	TWEETER Diameter, in.	TWEETER Type	Overall Freq. Response, Hz to kHz ±3 dB	Ampl. Pwr. for Avg. Room, W	Pwr. Handling Capacity (RMS Cont.)	Crossover Frequency (ies), Hz	Impedance, Ohms	Enclosure Dimensions, W x D x H, in.	Wood Finish	Grille Material Color	Weight, Lbs.	Price	SPECIAL FEATURES
SHERWOOD	Tanglewood	(2)10	18	Acous.	8 5	Cone Cone	3½	Cone	20-20K	15	60	150 800 3000	8	24 x 13 x 31.5	Wal. or Birch	Cane Brn.	73	239.95	Rear facing woofers. 5-way system.
	Ravinia II	15	24	Acous.	5	Cone	3½	Cone	24-20K	10	50	600, 5000	8	25 x 11½ x 17	Wal.	Cloth Brn.	53	169.95	Omni-polar convex cone tweeter; Snap-out grille.
SONY (37) (54) (55)	SS-3100	12	25	Reflex	6½	Cone	2	Horn	30-20K		30	400 5000	8	15⅜ x 11⅞ x 26¾	Wal.	Cloth Blk.	55	229.50	Sep. Sw. for multi-channel use.
	SS-2800	10	30	Reflex	6½	Cone	2	Horn	40-20K		20	600 6000	8	13⅜ x 9⅛ x 23¼	Wal.	Cloth Blk.	35	124.50	
TANNOY (108)	Windsor G.R.F	15	Cut Off 35	Rear Horn Loaded	–	–	2½	Exp. Horn	35-20K ±4	15	50	1000	8	23⅜ x 17 x 42	Oil Wal.	Dec. Crvd. Wood; Wht. Cloth	120	477.00	Dyn. & frq-bal contr. non-decorator model G.R.F., $420.00
	Orbitus I	12	40	Reflex	–	–	2½	Exp. Horn	35-20K	20	30	1000	8		Oil Wal.	Dec. Grille	50	245.00	360° omni-dir. sound source (complete integration over audio spectrum) dyn & freq-bal contrl.
	Mallorcan	12	68	Reflex	–	–	2½	Exp. Horn	45-20K ±5	20	30	1000	8	23½ x 14⅝ x 11½	Oil Wal.	Dec. Crvd. Wood; Wht. Cloth	45	219.00	Dyn & freq-bal contr.
UNIVERSITY	Presidio	12		Acous.	*	–	**	Dome	25-40K	5	40	1000 3000	8	24 x 15 x 23	Wal.	Cloth Lt. Brn.	70	199.95	*Diffusicone® **Sphericon. 12-in. passive radiator.
	Laredo	12		Acous.	8	2-way Cone	**	Dome	30-30K	5	40	600 1500 3000	8	15¾ x 12 9/16 x 24	Wal.	Cloth Brn.	47½	129.95	Brill. & presence contrs; Mustang. components, removable grille. **Sphericon.
	Project M	11		Acous.			2½	*Cone	30-20K	5	60	1000	8	12¾ x 11⅞ x 23½	Wal.	Cloth Beige	30	109.95	*Silver-plated al. v.c; high-compl, low res. woofer low distortion.
	Ultra D	10		Acous.	4	Cone	3½	Cone	30-30K	3	32	1000 5000	8	11⅞ x 9¾ x 23	Wal.	Cloth Beige	24	89.95	Brill. & presence contrs.
UTAH (8)	AS-6	12	25	Acous.	4 x 10	Horn	1⅜	Horn	35-20K	20	30	2200 5000	8	25 x 14 x 13½	Oil Wal.	Cloth Gold	49	120.00	Credenza; mid. & h.f. contrs.
	HS	12	45	Reflex	2 x 6	Horn	3½	Cone	30-18.5K	10	20	3500 5000	8	15 x 25⅜ x 14	Oil Wal.	Cloth Gold	46	94.50	Molded Wal. Trim.
	AS-1	10	25	Acous.	–	–	3½	Cone	32-18½K	10	20	3500	8	24 x 12 x 12	Oil Wal.	Cloth Gold	41	79.95	h.f. cont.
WHARFEDALE (65)	W80A	12½			5 3	Dome	1	Dome	20-inaud.	25	80		8	17⅞ x 28 x 17	Oil Wal.	Cloth Gold	81	317.60	Indiv. midrange & treble contrs; opt. pedestal (adds 4" to height) Variflex system.
	W70E	15		Acous.	5	Cone	1	Dome	25-20K	15	60		8	22⅜ x 24 x 13⅝	Oil Wal.	Cloth Brn.	72	223.00	Cont. var. treble contr. *incl.g. table tops vert or hor. mtg.
	W60E	12½		Acous.	5	Cone	1	Dome	30-20K	10	50		8	24 x 15 x 12	Oil Wal.	Cloth Brn.	56	153.00	Cont. var. treble contr.
	W45	10		Acous.	3¼	Cone	2½	Ultra-Curv-Cone	30-18.5K	10	40		8		Oil Wal.	Cloth Brn.	37	117.00	As above.
	W35	8		Acous.	3¼	Cone	2½	Ultra-Curv-Cone	35-18.5K	10	40		8		Oil Wal.	Cloth Brn.	24	82.00	As above.
	W25	8		Acous.			2½	Ultra-Curv-Cone	35-18.5K	10	35		8		Oil Wal.		14	58.75	As above.
WOLLENSAK	A-2000	8	58	Acous.	–	–	1	Dome	40-18K	20		1300	5	23 x 10⅛ x 13½	Wal.	Cloth Black	35	159.95	2 contrs. to voice woofer; tweeter contr; low IM distortion.
	A-1000	4	100	Acous.	–	–	–	–	80-12K	10	14		8	8 x 5 x 13	Wal.	Cloth Beige	4½	49.95 pr.	
YAMAHA	JA6002	32½ x 22½									25		8	25 x 34 1/16 x 5⅛			14.4		"Natural Sound" Spkr; shaped like piano
	JA5002	25 x 18									20		8	19¾ x 26½ x 4¾			9.5		
	JA4001	18 x 13¾									30		8	14¾ x 20½ x 5¼			7.9		As above, but designed for use with guitar ampl.

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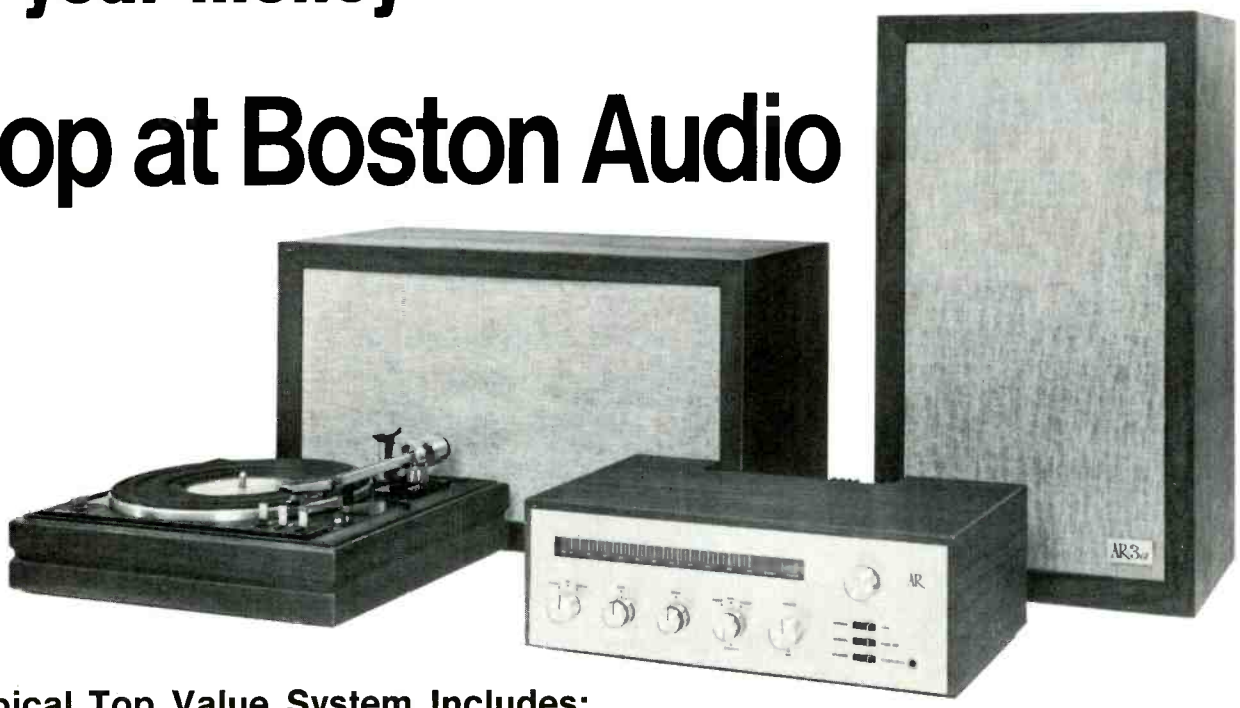

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15					x	x	x	
7½	x	x	x		x	x	x	
3¾	x	x	x		x		x	x
1⅞	x		x	x			x	x
15/16			x					

*** at the highest speed of the machine**

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	Speeds (See letter code)	Power Amp(s) Built in ?	Max. Reel Size, in.	No. of Heads	No. of Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Frequency Response Hz to kHz * ± 3 dB	Wow and Flutter, % *	Signal-to-noise Ratio, dB *	Fast Wind, 1200 Ft., Sec.	Mic Input Z, Ohms	Rec'ng Level Indicator Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
AMPEX	AX-300	A	No	7	6	4	3	Hys.	Idler	20-20K ±3	.09	55	55	High	2 Mtrs.	16½ x 14½ x 8	45	649.95	Speed logic cct; outside tape bias and VU mtr. calib. ports; 6 hds-2 rec; 2 play; 2 erase.
	2161	A	Yes	7	4	4	1	Hys.	Belt	20-22K ±3	.07	52		110K	2 Mtrs.	18⅝ x 13¾ x 7	42	529.95	Bi-directional recording; 2-sec. auto threading; auto-rev. system.
	AX-50	A	No	7	3	4	1	Hys.	Idler	20-20K ±3	0.12	55		High	2 Mtrs.	16½ x 15⅜ x 8½	23	279.95	Auto tape lifter; sgl. function contr; 3 heads-erase, deep-gap rec, deep-gap play.
	755A	A	No	7	3	4	1	Hys.	Belt	20-20K ±3	.08	48		150K		13 x 15¾ x 6½	27	249.95	
ASTROCOM/ MARLUX	407	B	No	7	4	4	3	Hys.	Belt	30-20K	.07	50	60	10K	Dual Meter	21 x 14½ x 10½	40	459.95	Auto-rev. pb; sws. s-o-s; sol. contrs.
CONCORD (78) (79)	MK IV	A	No	7	4	4	1	Hys.	Idler	20-23K ±4	.08	55		15K	2 Mtrs.	18½ x 13 x 6	25¾	299.79	Auto rev. p.b.; silent sensing; dual capstan.
	MK 8	A	Yes	7	2	⅛	2	Ind.	Belt	50-12K	.2	45		2K	2 Mtrs.	18 x 16¼ x 8 5/16	49	289.79	
	MK III	A	No	7	3	4	1	Hys.	Idler	20-27K ±3	.09	55	116	15K	2 Mtrs.	18½ x 13 x 6	25¾	249.79	Var. echo contr; tape 'source monitor; 4 pre amps.
	MK II	A	No	7	3	4	1	Hys.	Idler	20-23K ±4	.09	55	116	15K	2 Mtrs.	18½ x 13 x 6	25¾	199.79	As above.
CROWN (17)	SX724	B	Opt.	10½	3	4	3	Hys.	Belt	20-25K ±2	0.09	60	45	350K	2 Mtrs.	19 x 15¾ x 9	45	995.00	Dual mic and 'or line mxg; 5" mtrs; opt cntr, $39.00; wal cab, $70.00; mon amp, $229.00.
	SX824	B or F	Opt.	10½	3	4	3	Hys.	Belt	20-25K ±2	0.09	60	45	350K	2 Mtrs.	19 x 15¾ x 9	48	1,495.00	Computer-logic "Pro-800" deck; opt. rem. contr; other options as above.
	CX822	E	Opt.	10½	3	2	3	Hys.	Belt	30-30K ±2	0.06		45	250 (bal.)	2 Mtrs.	19 x 17½ x 9	53	2,120.00	Same deck as above, w 'plug-in electronics--tone contrs; tape echo; prof. mxg; opt noiseless rem contr, $185.00.
FERROGRAPH	704 A-S	A or E	No	8¼	3	2 or 4	3	Ind.	Idler	30-17K ±2	.08	60	60	10K	2 Mtrs.	14⅞ x 16 x 8 11/16	37½	649.00	724 A-W in wal case, $699.00 724 A-P in port case, $699.00 also avail. w 'amplS. and spkrs.
JVC (9) (97)	1224	A	Yes	7	4	4	1	4p	Idler	30-20K ±2	0.15	47	160	10K	2 Mtrs.	38 x 12¾ x 7	38.5	329.95	Auto rev 'rpt stop; 20-W output.
	1694	A	Yes	7	3	4	1	4p	Idler	30-20K ±3	0.15	52	150	10K	2 Mtrs.	15 x 12 x 8	20	169.95	Single contr for rewind, stop, play 'rec, pause, f.f.
	1545	H	Yes	5	1	2	1	4p	Idler	100-7K	0.4	35	180	1K	-	11 x 9 x 3¾	7.3	69.95	Portable--a.c. or batt. operation.
	1541	H	Yes	5	1	2	1	Hys.	Idler	100-7K	0.4	35	180	1K	-	11 x 9 x 3⅜	7.3	69.95	As above; incls mon. sw.
KLH	41	A	No	7	3	4	1	Ind.	Belt	50-15K ±3	0.15	60*	130	1K	2 Mtrs.	14¼ x 11⅜ x 5⅜	23	249.95	*Includes Dolby system; with Dolby in s 'n is 68 dB.
KENWOOD (39)	KW-8077	B	No	7	6	4	3	Hys.	Idler	20-20K ±3	.04	52	70	10K	2 Mtrs.	17 x 19¼ x 9	46	629.95	Auto rev. rec 'play, mic-line mixing, eqzr. contr. loading, 5-step equal.
	KW-5066	A	No	7	4	4	1	Hys.	Idler	25-20K ±3	.15	50	150	10K	2 Mtrs.	16 x 15½ x 7	22	279.95	Bias adjust; S-on-s; echo; full-track erase; noise filter.
	KW-4066	A	No	7	3	4	1	Hys.	Idler	25-20K ±3	.15	50	150	10K	2 Mtrs.	16 x 12 11/16 x 7	22	179.95	Auto stop, slide vol. conts, tape 'source mon. mode switch.

Super deck!

Sony Model 650. Super 3-motor, solenoid-operated tape deck offering dramatic improvements in performance, features, and dependability. Available in two versions: the 650-2 two-track deck for semi-professionals and the 650-4 quarter-track deck for audiophiles.

Plug-In Head Block Assembly and Mounting Frame. This allows quick changes from two-track to quarter-track operation with perfect mechanical alignment. Both assemblies are available as optional extras to allow dual two-track and quarter-track usage of the Model 650.

Three Heads for Tape Source Monitoring. Separate erase, record, and play heads are provided, allowing the user to check the quality of a new recording while the recording is in progress.

Illuminated Push-Button Controls: A built-in "logic circuit" permits switching from FAST-FORWARD to REWIND or from either of these modes to PLAY—without going into the STOP mode. This feature eliminates tape breakage and spillage. With the optional Model RM-16 remote control unit, you can have full remote operation.

Defeatable Tape Lifters. This greatly simplifies cueing and editing by enabling the protective tape lifters to be defeated in order to locate a particular passage quickly.

Mic/Line Mixing. Dual concentric level controls regulate the record levels of microphone and line inputs independently. Moreover, both microphone and line inputs may be mixed and recorded simultaneously.

Tape Equalization Selector Switch. This switch selects the proper record equalization curve for either standard or low-noise, high-output tapes.

More Sony Excellence. Ultra-high frequency bias. Electrical Speed Built-In Reel Locks. Automatic shut-off. Stereo headphone monitor jack with level control. Record interlock to prevent accidental tape erasures. Modular construction. And more!

Built-in Sound-on-Sound and Echo. Switching networks on the front panel facilitate professional echo and multiple sound-on-sound recording without requiring external patch cords and mixer.

Sony Model 650. The 650-4 quarter-track deck priced at $419.95 (remote-control optional). The 650-2 two-track priced slightly higher. For a free copy of our catalog, write to Mr. Phillips, Sony/Superscope, 8144 Vineland Avenue, Sun Valley, California 91352.

SONY SUPERSCOPE®

You never heard it so good.®

The Beginning of a New Deckade

And the dawn of a new era in home music entertainment. Take the Concord Mark Series decks offering the kind of performance that made Hirsch-Houck Testing Laboratories flip. All three feature hysteresis motor drives; a tape transport mechanism that assures a fast start-up; tape monitoring; three-speed; sound-on-sound; variable echo control for reverb; calibrated VU meters; stereo headphone jack; dynamic muting. The Mark II is a remarkable value for less than $200. The highly-rated Concord Mark III, featuring diamond-hard pressure-sintered ferrite heads with a 25 year guarantee, under $250. And, the top-of-the line Mark IV offers the performance quality and conveniences of the Mark II plus dual capstan electronic automatic reverse—an outstanding value under $300.

The F-106 cassette deck with bias selector for the new premium cassette tapes is the first deck to approach reel-to-reel quality. Less than $100 without microphone and accessories; under $120 with.

And, there is the new Mark 8, the world's most versatile tape recorder. Ideal as a deck for reel-to-reel tapes and 8-track cartridges. It's also a complete portable tape recording system with built-in amplifier and speakers. Great for making 8-track cartridges for auto players. A lot of entertainment for under $290.

The F-400 is a top quality stereo cassette portable that doubles as a quality stereo deck. Under $140.

And, three stereo compacts—the HES-35 with the famous built-in magnetic memory cassette recorder, and the HES-55 which adds a Garrard record changer to the cassette facilities. All these feature top-quality FM stereo/AM receivers and matched speaker systems. Concord HES-35, under $230; HES-55 under $370; HES-50 less speakers under $290. F-600 under $200.

And, Concord now has three new stereo receivers high enough in quality to bear the Mark Series name. A 300 watt model, the Mark 20 at under $300; a 150 watt model, the Mark 12 at under $240, and a 100 watt unit, the Mark 10 at under $200. All offer FM stereo, FM and AM with all audiophile controls and conveniences.

Celebrate the start of our second deckade by auditioning the Concord products at your audio dealer. Concord Electronics Corporation, 1935 Armacost Ave., Los Angeles, Calif. 90025/ a subsidiary of Ehrenreich Photo-Optical Industries, Inc. EPI

CONCORD® THE HI-FI TAPE RECORDER PEOPLE

Check No. 79 on Reader Service Card


CONCORD
CONCORD

OPEN-REEL TAPE RECORDERS — Continued

PIONEER T-600F

PANASONIC RS-736

SONY 352-D

REVOX A-77

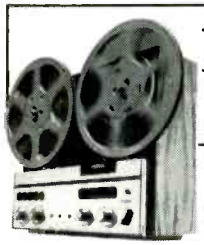
Indicate speed by letter code:

	A	B	C	D	E	F	G	H
15					x	x	x	
7½	x	x	x		x	x	x	
3¾	x	x	x		x		x	x
1⅞	x		x	x			x	x
15/16			x					

* at the highest speed of the machine

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	Speeds (See letter code)	Power Amp(s) Built In?	Max. Reel Size, In.	No. of Heads	No. of Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Frequency Response Hz to kHz ± 3 dB	Wow and Flutter, % *	Signal-to-noise Ratio, dB *	Fast Wind, 1200 Ft., Sec.	Mic Input Z, Ohms	Recrg Level Indicator Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
LAFAYETTE	RK 960	A	Yes	7	4	4	2	4p Ind.	Belt	30-22K ±3	.25	50	–	10K	2 Mtrs.	22 x 15½ x 8¼	44	229.95	Auto rev; dual capstan drive; bi-directional rcdg.
	RK 710A	A	Yes	7	2	2	1	4p Ind.	Idler	60-12K	.25	42	–	600	1 Meter	11⅝ x 12⅛ x 6⅔	16	69.95	Horiz. or vert. oper.
PANASONIC (106)	RS 736	E	No	7	3	4	1		Idler	20-20K	.09	>50	140		2 Mtrs.	16⅞ x 18⅝ x 7¾	35	349.95	Hot pressed ferrite heads; tape and speed eq'n.
	RS 796	A	No	7	4	4	1	Sync	Idler	30-20K	0.10	>50	180		2 Mtrs.	19¾ x 14⅛ x 8½	32	249.95	Auto reverse record and play.
	RS 768	A	No	7	3	4	1	Sync	Idler	20-20K	.09	>50	150		2 Mtrs.	18½ x 13¾ x 8	21	219.95	
PIONEER	T-600	B	No	7	4	4	1	Hys.	Belt	50-15K ±3	0.12	50	120	50K	2 Mtrs.	17¼ x 17⅛ x 8	33	299.95	Auto reverse rec and play.
REVOX	A-77	B	Opt.	10½	3	2 or 4	3	Servo	Direct	30-20K ±2	.08	58	60	Lo, Hi	2 Mtrs.	16 x 14 x 8	34	529.00	Electronic-governed capstan motor; all-metal low-wear heads; 15/7½-ips version.
ROBERTS (29) (45) (57) (81)	771X	A	Yes	7	3	4	1	Hys.	Belt	30-22K ±3	0.15	50		5K	2 Mtrs.	20 x 14 x 10	42		X-field hd; s-o-s; 4-dig. counter.
	333X	G	Yes	7	7	4-4	1	Ind.	Belt	30-23K ±3					2 Mtrs.				X-field hd; recs reel to ctg. and reel to cass; auto shutoff; counter; tape lifter.
	5050XD	A	No	10½	4	4	3	Hys.	Belt	25-22K ±3	0.2			25K	2 Mtrs.	14¾ x 17⅛ x 9⅜	48		X-field hd; 24-hr. progmng; auto cont. rev; mag brakes.
	420 XD	G	No	7	4	4	3	Hys.	Belt	30-22K ±3	0.12			10K	2 Mtrs.	17½ x 16 x 10	55		X-field hd; auto vol contr; auto shutoff; mag. brakes; auto head sentry.
SANSUI (7) (41)	SD 7000	B	No	7	4	4	3	Hys.	Belt	15-25K ±2	0.06	>60	100		2 Mtrs.	21 x 17 x 10	60	679.95	Auto rev w '20-Hz sig. rec. built in; auto rewind; opt. rem. contr; auto sleep sw.
SONY/ SUPER-SCOPE (5) (19) (77) (85)	366	A	No	7	3	4	1	Ind.	Idler	20-25K	0.09	55	90		2 Mtrs	16⅞ x 8⅝ x 14⅛	22½	229.95	Source tape mon; lo-noise tape sw.; vert. or horiz. mounting.
	352-D	A	No	7	3	4	1	Ind.	Belt	30-25K ±3	0.12	55	120	Low	2 Mtrs	15⅛ x 7½ x 1 37/64	18	179.95	
TEAC (1) (87)	A-7030U	F	No	10½	4	2 or 4	3	Hys. 2 spd.	Belt	40-20K ±2	0.06	58	66	10K	2 Mtrs.	17¼ x 8 x 20¼	62	749.50	Similar to above, but 4-track with auto. phase-sensing rev.
	A-7010U	B	No	10½	4	4	3	Hys. 2 spd.	Belt	45-15K ±2	0.88	55	66	10K	2 Mtrs.	17¼ x 8 x 20¼	62	849.50	Touch-buttons; NAB hub adapters; plug-in head assy; extra 4-track play head; cue contr; opt. full rem. contr.
	A-6010U	B	No	7	4	4	3	Hys. 2 spd.	Belt	45-15K ±2	0.88	55	90	10K	2 Mtrs.	15¼ x 7 x 18¼	52	664.50	Touch buttons; phase-sensing auto rev; plug-in head assy; opt. full rem. contr; sep. units.
	A-1200U	B	No	7	3	4	3	Hys. 2 spd.	Belt	50-15K ±3	0.12	50	100	10K	Dual Mtr.	17½ x 9¾ x 17	41	299.50	Built-in s-o-s and echo; outer rotor torque motors; opt. rem. pause contr.

STEREO REVIEW, JAN. 1969



EQUIPMENT TEST REPORTS

By Hirsch-Houck Laboratories

REVOX A77 TAPE RECORDER

● IT IS a pleasure to report that the widely acclaimed, but no longer available, Revox G-36 Mk III tape recorder has actually been surpassed in performance by Revox's new Model A77. The A77 has fully solid-state electronics, a bias-oscillator frequency of 120 kHz (as opposed to 70 kHz for the G-36), and a new electronic motor-speed control. The A77 model we tested is a three-motor, four-track, two-speed recorder; however, it is substantially lighter and smaller than its predecessor.

The Revox A77 has its operating controls grouped into separate recording and playback areas. On the playback side are two rotary switches with concentric knobs. One switch establishes the playback mode—stereo, either channel through both outputs, or both channels combined for mono. Playback level is controlled by the concentric knob. The other switch connects either the signal input or the output of the playback amplifiers to the output jacks in the rear. Two playback-equalization characteristics are provided; NAB or IEC (for European tape recordings). The recording equalization is to the NAB standards. The knob concentric with this switch is a playback channel-balance control.

On the right side of the recorder panel are two VU meters with real VU-meter characteristics. Adjacent to each is a red button of the push-on, push-off type. Depressing either channel's button alone records both inputs on that channel. If both buttons are depressed, a stereo recording is made. These supplement a record-interlock button, providing a double safety against accidental tape erasure. Recording levels may be set up before the tape is put into motion. When the recorder is in operation in the recording mode, the selected channel's VU meter (or meters) is illuminated.

Under each meter is a recording input-selector switch, with a concentric recording-level control. There are inputs for high- and low-impedance microphones (with front-panel jacks in parallel with rear phono connectors), radio (via a rear DIN connector), and auxiliary inputs with connectors in the rear. In addition, each switch has a position for recording the output of that channel combined with any additional source onto the other channel.

The transport mechanism is operated by a row of five pushbuttons, activating solenoids to control fast speeds, stop, play, and recording. A connector in the rear permits the use of an accessory remote-control unit for these functions. The tape speeds (7½ and 3¾ ips) are selected by a switch that also controls a.c. power to the recorder. Each speed setting has two switch positions that set the tape tension to optimum values for 10½-inch or smaller reels.

The servo-controlled drive system of the Revox A77 is unique and effective. The tape-drive capstan is powered by an eddy-current motor that delivers a high torque, free of the pulsations that are inevitable with any motor having a pole structure. The speed of this motor can be adjusted by varying a d.c. control voltage, with relatively little torque variation. The motor has a built-in tone generator that produces an a.c. signal whose frequency is proportional to motor speed. This signal is amplified, limited, and applied to a discriminator, whose d.c. output is proportional to speed. This is further amplified and used to correct the motor speed. The change between 7½ and 3¾ ips is accomplished electronically by shifting the resonant frequency of the discriminator circuit. The chief advantages of this technique are independence from power-line voltage and frequency variations, as well as reduced flutter. Flutter of the A77 motor is inherently so low that the capstan can be driven directly from the motor shaft instead of through a separate belt-driven flywheel. According to the manufacturer, line voltage fluctuations of ±20 per cent cause a speed change of only ±0.05 per cent, and a change in the a.c.-line frequency of 50 to 60 Hz causes a speed change of less than 0.05 per cent. Thus, the Revox A77 is a truly universal machine, capable of operating from 110 volts to 240 volts, 50 to 60 Hz, by adjustment of a switch in the rear of the recorder.

When the full-width head cover is swung down, two more pushbuttons are revealed. One cuts off the signal to external speakers, and the other switches off the power to the reel motors. This is for convenience in editing. When the reel motors are turned off, and the recorder placed in a fast-speed mode, the reels may be turned by hand with the tape in contact with the playback head. At the desired point, the tape may be lifted from the heads and placed in the tape splicing guide which is molded into the fixed portion of the head cover. The only problem with this arrangement is the possibility that one may spill tape by forgetting to turn on the reel motors before placing the machine back into normal operation.

We stated that the A77 surpassed the older G-36 in performance. This is best illustrated by its phenomenally flat record/playback frequency response, measured with Scotch 203 tape, for which the machine's bias was adjusted. At 7½ ips, the response was within +0.5, −2.0 dB from 20 to 20,000 Hz. This has never been equalled by any other recorder we have tested. Perhaps even more impressive is the response at 3¾ ips, which was +2.5, −5.5 dB from 20 to 20,000 Hz. The high end falls off smoothly and is perfectly usable all the way to 20,000 Hz. The NAB playback response, with the Ampex 31321-04 test tape, was +1.5, −0.5 dB from 50 to 15,000 Hz.

The signal-to-noise ratio was very good, 51 dB at 7½ ips and 48.5 dB at 3¾ ips, referred to a 0-VU recording level. Noting that the distortion at 0 VU was a mere 0.65 per cent, we increased the recording level until the distortion reached approximately 3 per cent, which occurred at +10 VU for the higher tape speed and +9 VU for the lower speed. At these levels, the signal-to-noise ratio was 59 dB at 7½ ips and 54.5 dB at 3¾ ips, figures that closely approach true professional performance.

The transport worked smoothly and with complete silence. Except for the turning of the reels, one could not tell the machine was operating from a distance greater than about 12 inches. Wow was 0.01 per cent (actually the residual inherent in our instruments) and flutter was 0.09 per cent at 3¾ ips and 0.07 per cent at 7½ ips. In fast speeds, 1,800 feet of tape was handled in about 90 seconds, and the machine could be brought to a stop in about 2 seconds.

The Revox A77 is housed in a teak cabinet with a fold-away carrying handle. It is one of the handsomest, as well as best-performing, tape recorders we have seen. We have never seen a recorder that could match the performance of the Revox A77 in all respects, and very few that even come close. It sounds as good as it tests, which speaks for itself. The Revox A77 is offered in a variety of configurations. It is available with either half- or quarter-track heads, in either the teak cabinet or a portable carrying case. The price of the deck in a wood base is $569; the deck with built-in power amplifiers is $599.

OPEN-REEL TAPE RECORDERS — Continued

TANDBERG
Series 3000

SONY 366-4 "Quadradial"

UHER 4400

TEAC TCA-41 "Simul-Trak'

Indicate speed by letter code:

	A	B	C	D	E	F	G	H
15					X	X	X	
7½	X	X	X		X	X	X	
3¾	X	X	X		X		X	X
1⅞	X		X	X			X	X
15/16			X					

• at the highest speed of the machine

MANUFACTURER (Circled numbers indicate adv. page)	MODEL	Speeds (See letter code)	Power Amp(s) Built In ?	Max. Reel Size, In.	No. of Heads	No. of Tracks	No. of Motors	Drive Motor Type	Drive to Capstan	Frequency Response Hz to kHz • ±?, dB	Wow and Flutter, % •	Signal-to-noise Ratio, dB •	Fast Wind, 1200 Ft., Sec.	Mic Input Z, Ohms	Rec'ng Level Indicator Type	Dimensions, W x D x H, In.	Weight, Lbs.	Price	SPECIAL FEATURES
TANDBERG	3000X	A	No	7	3 + Bias	2 or 4	1	Ind.	Idler	40-20K ±2	0.07	60	105	200	2 pk. rdg. mtrs.	15½ x 12⅜ x 16½	20	299.00	Cross-field rec. hd.
UHER (83)	10,000	C	Yes	7	4	4 or 2	1	Hys.	Idler	20-20K	.04	54			2 Mtrs.	17¾ x 13¾ x 7¾ inc. lid	30	550.00	Complete rcdg studio.
	4400	C	Yes	5	3	4	1	Sync		40-20K	0.10	50			2 Mtrs.	11 x 9 x 3½	8	459.50	Prof. portable hi-fi stereo.
	5500	3¾	Yes	5¾	3	2	1	Hys.		40-16K	0.15	48			Meter	13 x 10 x 6	16	379.50	Student-instr. tchg. mach; auto lecturing machine.
	263	A	Yes	7	3	4 or 2	1	Hys.	Idler	30-20K	.05	55			Dual Meter	17½ x 13¾ x 7 inc. lid	23	299.00	Simpl. prof. rcdr w intchg. 2- and 4-track hds.
WOLLENSAK (105)	6250	A	Yes	7	3	4	2	Hys.	Pulley	35-20K ±2	0.12	54	90	2.2	2 Mtrs.	20½ x 13½ x 7½	25	379.95	Self-contained mon. spkrs; rec. bias sel; tape/source mon.
	6150	A	No	7	3	4	2	Hys.	Pulley	35-20K ±2	0.12	54	90	2.2	2 Mtrs.	16½ x 13½ x 6½	18	279.95	Deck for prof. rcdg; rec. bias sel; tape/source monitoring.
	6120	A	Yes	7	2	4	2	Hys.	Pulley	40-18K ±3	0.15	50	90	2.2	2 Mtrs.	16 x 5 x 3	18½	199.95	Excl. fwd-rewind braking system.

FOUR-CHANNEL DECKS & RECORDERS

SONY/ SUPER-SCOPE (5) (77) (19) (85)	854-4	E	No	10½	4	4	3	Servo	Belt	20-30K	0.03	59	–	Low*	4 Mtrs.	17⅝ x 10 x 22⅛	61 7/16	1,395.00	*Bal. Cannon XLR mic inputs; dual capstan drive; 4-track, 4-chan rec and p.b.
	654-4	B	No	7	4	4	3	Hys.	Direct	30-22K ±2	0.04	57	60	Low	4 Mtrs.	16¾ x 9⅝ x 20	48 5/16	750.00	4-track, 4-chan rec. & p.b.
	652-4	B	No	7	4	4	3	Hys.	Direct	30-22K ±2	0.04	57	60	Low	2 Mtrs.	16¾ x 9⅝ x 18	46 3/16	549.95	4-chan p.b., 4-track stereo rec. and p.b.
	366-4	B	No	7	4	4	1	Ind.	Belt	20-25K	0.09	55	120	Low	4 Mtrs.	17 x 9⅝ x 18¾	20 11/16	479.95	4-track, 4-chan rec. and p.b.
TEAC (1) (87)	SIMUL-TRAK TCA-40	B	No	7	3	4	3	Hys. 2 spd.	Belt	50-15K ±3	0.12	50	100	10K		12 x 17½ x 7	37	365.00	Compatible 4- and 2-chan stereo p.b. deck; 4 p.b. amps; auto reverse for 2-chan. operation.
	SIMUL-TRAK TCA-41	B	No	7	3	4	3	Hys. 2 spd.	Belt	50-15K ±3	0.12	50	100	10K	2 Mtrs.	12 x 17½ x 7 deck	37	535.00	4-chan p.b. and 2-chan rec. and p.b. incls. connectors to adapt to 4-chan. recording. Amp. 4¾ x 17¼ x 7¼ in.
	SIMUL-TRAK TCA-42	B	No	7	4	4	3	Hys. 2 spd.	Belt	50-15K ±3	0.12	50	100	10K	4 Mtrs.	12 x 17½ x 7 deck	37	695.00	4-chan rec. and p.b. deck; compatible with 2-chan, ¼-track stereo rec. and p.b. Amp. as above.
WOLLENSAK (105)	6154	A	Yes	7	3	4	2	Hys.	Pulley	35-20K ±2	0.12	54	90	2.2	2 Mtrs.	16½ x 13½ x 6½	18	499.95	4-chan preamp deck; also avail as mod. 6364 with built-in amplis.

"Sets a new standard for others to aim at."

—Stereo Review, June 1970

WANT TO MAKE GREAT OFF-THE-AIR RECORDINGS AT ⅓ THE TAPE COST?
"When recording FM broadcasts, we were unable to hear the slightest difference between incoming and outgoing program signals—at 1⅞ ips!"*

WANT TO CUT YOUR 'LIVE' TAPING COSTS IN HALF?
"Between 20 and 20,000 Hz, the 3¾-ips record-playback response was essentially identical to that at 7½ ips—±2 dB from 50 to 20,000 Hz! The most critical recording can be done at 3¾ ips with no audible loss of quality."*

JUST WANT THE BEST TAPE RECORDER YOU CAN BUY?
"The record-playback frequency response was ±1.5 dB from 40 to 20,000 Hz... [and] the signal-to-noise ratio was as outstanding: 52 to 53 dB (unweighted) at all speeds.... Tandberg has achieved performance at 1⅞ ips that not long ago would have required a 15-ips tape speed, and on most good recorders today can barely be matched at 3¾ ips."*

The Tandberg 6000X is something special* And *Stereo Review* said it all in its Hirsch-Houck Laboratories' test report.

IN SUM:
"It is difficult to imagine how the Tandberg 6000X could be improved."*

***Stereo Review said it all.** For the complete Hirsch-Houck review, write: Tandberg of America, Inc., 8 Third Avenue, Pelham, New York 10803

TANDBERG 6000X

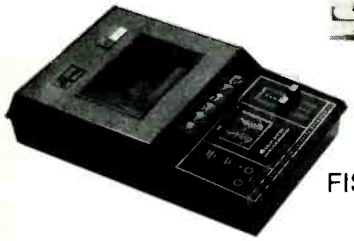
We have nothing to hide!

Check No. 83 on Reader Service Card

CASSETTE and CARTRIDGE MACHINES

CONCORD F-106

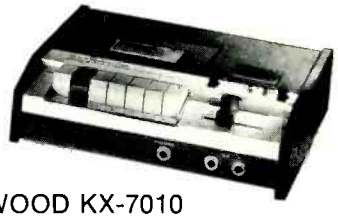
HARMAN-KARDON CAD-5



FISHER RC-80

JVC 1250

KENWOOD KX-7010



MANUFACTURER (Circled number indicates ad page)	MODEL	Cassette	Cartridge: No. of Tracks	Type: Portable, P; Home, H; Car Mount, C	Power Amp. Built-In	Rated Power Output, W	Mode: Stereo, S; Mono, M	Frequency Response, Hz, ± dB	Wow and Flutter, %	S/N, dB	Supply Voltage	Speakers – Built-In or External	Dimensions W x D x H, in.	Weight, Lbs.	Price	SPECIAL FEATURES
ADVENT (14)	200	X		H	No	–	S	40-13K ±3	0.15	50	117 AC	Deck	15 x 10½ x 4	14	250.00	Incl. Dolby system; Crolyn capability.
AMPEX	Micro 87	X		H	Yes		S	40-12K	0.25	45	117 AC	Ext.	16 x 10 x 6		219.95	
	Micro 70	X		P	Yes		S				117 AC 7.5 V Batt.	Ext.	3 x 5 x 12		189.95	End-of-tape alarm; deluxe carrying case.
	Micro 52	X		H	No	–	S	40-12K	0.25	45	117 AC	Ext.	16 x 10 x 6	15	169.95	
	Micro 42	X		C	Yes		S	40-12K			12DC*	Ext.	9 x 9 x 4	10	139.95	Cassette player/recorder. *Neg. Gnd.
BOGEN	CRP	X		H	No	–	S& M	30-12K	0.15	45	120 AC	Deck	10⅝ x 8½ x 3¾	7½	149.95	2 mic. input; pause; 2 meters, record light. push buttons.
	8-P		8	H	No	–	S	30-8000 ±3	0.25	45	120 AC	Deck	9¼ x 8½ x 4¾	8	79.95	Hys. Sync motor. "Micro-balance" tuning. aux. input.
CONCORD (78) (79)	F-106	X		H	Yes		S	40-12K	< 0.2	> 46		Built-In	10¼ x 10½ x 3½	4 3/16	119.79	Bias switch for SD tape; Auto shut-off.
	F-60	X		P	Yes	0.5	M	60-10K	< 0.3	35	4 "C" 120 AC	Built-In	5⅛ x 10 x 2¾	3½	59.79	Endmatic; Level meter, auto rec. level contr.
	F-400	X		P	Yes	8	S	50-10K	< 0.25	40	6 "D" 120 AC	Built-In	12 3/8 x 9¾ x 3¾	11	139.79	Portable, AC or DC power; lighted VU meters. Digital tape counter.
	F-101	X		P	Yes	0.5	M	50-10K	< 0.25	35	6V.	Built-In	6 7/8 x 4½ x 2	2¾	99.79	IC's; One-hand operation.
FISHER (31)	RC-70	X		H	No	–	S	30-12K	0.25	43	117 AC	None	5¼ x 11 3/16 x 2 15/16		149.95	2 mtrs; Dual controls; 2 mics; Blank C-60 cassette.
	RC-80	X		H	No	–	S	30-12K	0.2	50	117 AC	None	10 x 11 3/16 x 2 15/16		199.95	Dolby Noise System with 2 VU meters; 2 Mics; Blank C-60 Cassette.
HARMON-KARDON	CAD-4	X		H	No	–	S	30-12.5K ±2	0.15	50	117 AC		12½ x 9 x 3¼	10	159.95	O'load ind. lts; 2 mic inputs; auto motor shutoff; dual mtr; counter; 2 rec level contrs.
	CAD-5	X		H	No	–	S	30-15K ±2	0.15	55	117 AC		12½ x 9 x 3¼	10	229.95	As above, with Dolby system for rec. & p.b.
JVC (9)	1100		8	H	No	–	S	40-12K	< 0.3	40	117 V AC		6¾ x 9 5/8 x 3 5/8	6.6	59.95	Auto start/stop via cartridge.
	1600	X		P	Yes		M	150-7K	0.4	38	6 V Batt 117 AC	Built-In	5¼ x 9¼ x 2½	3.1	49.95	Record/playback can be remotely controlled.
	1250		8	H	No	–	S	30-15K	< 0.2	48	117 AC	Deck	15 3/16 x 9¾ x 4 1/8	14	169.95	Auto ctg. Eject System; 2 mtrs.
	1310		8	C	Yes	12W	S	50-12K	0.2	45	6 or 12V Batt.	Ext.	8½ x 6½ x 3	7	89.95	IC circuitry; Tracing Tuning Control.
KENWOOD (39)	KX-7010	X	6	H	No	–	S	40-10K	0.2	45	117 AC	No	10½ x 9 x 4	7	149.95	Hys. Sync. Motor, VU meter; Noise filter; Counter; Headphone output.

Sony's got a brand new angle.

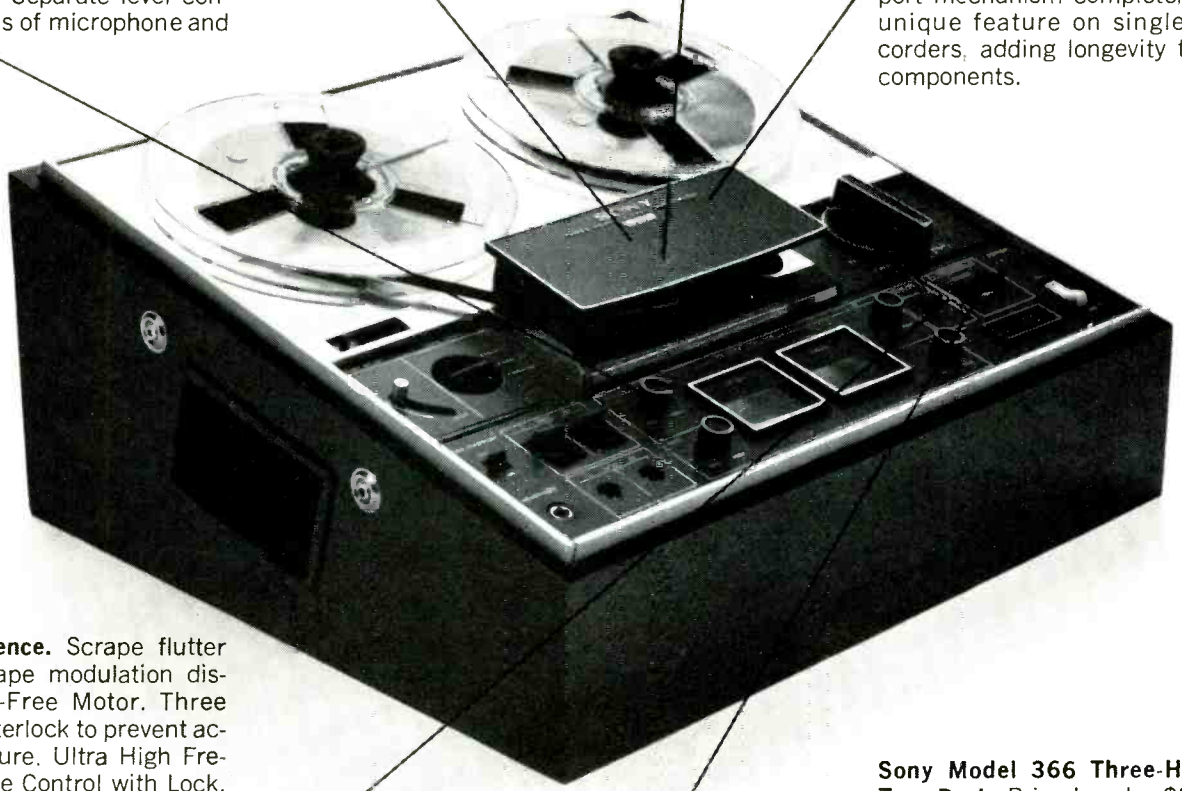
Sony offers a dramatic new design concept in tape decks with the introduction of the new Model 366. Not only is its classic walnut base slanted, but it permits convertible mounting in either a vertical or horizontal position. And either end up, the Sony 366 is packed with features that make sound sound like sound *should* sound.

No Pressure Pads. The incorporation of a servocontrolled back-tension regulator and hyperbolic recording head eliminates the need for pressure pads. The result—reduced modulation noise, headwear, wow, and flutter.

Three Heads. Allows monitoring of either input source or the actual recording being made on tape.

Automatic Total-Mechanism Shut-Off. When the tape runs out, the Automatic Total-Mechanism Shut-Off not only turns off the motor but disengages the transport mechanism completely. This is a unique feature on single motor recorders, adding longevity to transport components.

Mic/Line Mixing. Both microphone and line inputs may be mixed and recorded at the same time. Separate level controls regulate levels of microphone and line inputs.



More Sony Excellence. Scrape flutter filter eliminates tape modulation distortion. Vibration-Free Motor. Three Speeds. Record Interlock to prevent accidental tape erasure. Ultra High Frequency Bias. Pause Control with Lock. Four Digit Tape Counter. Retractomatic Pinch Roller for easy tape threading.

Tape Equalization Selector Switch. Two position tape equalization switch allows the use of both standard and low-noise tapes without requiring internal adjustments of the recorder.

Sound-on-Sound. A professional feature that permits special-effects recording without an external mixer. You can even harmonize with yourself!

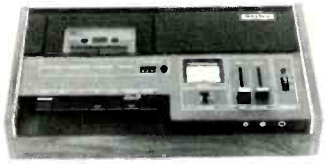
Sony Model 366 Three-Head Stereo Tape Deck. Priced under $249.50. For your free copy of our latest tape recorder catalog, please write to Mr. Phillips, Sony/Superscope, Inc., 8140 Vineland Avenue, Sun Valley, California 91352.

SONY SUPERSCOPE The Tapeway to Stereo

You never heard it so good.®

CASSETTE and CARTRIDGE MACHINES — Continued

ROBERTS 808D



SONY 127

TEAC A-24

WOLLENSAK 4800

MANUFACTURER (Circled number indicates ad page)	MODEL	Cassette	Cartridge; No. of Tracks	Type: Portable, P; Home, H	Power Amp. Built-In	Rated Power Output, W	Mode: Stereo, S; Mono, M	Frequency Response, Hz, ± dB	Wow and Flutter, %	S/N, dB	Supply Voltage	Speakers – Built-In or External	Dimensions W x D x H, in.	Weight, Lbs.	Price	SPECIAL FEATURES
LAFAYETTE (106)	RK-760	X		H			S, M	45-12K	0.3	35	117 AC		12⅜ x 8⅜ x 5	8	99.95	Records; 4-p hys motor; 2 mic inputs.
	RK-510	X		H	Yes	10	S, M	30-12.5K	0.2	44	117 AC	Ext. (opt.)	14⅜ x 8½ x 4½	12	149.95	6 p.b. function contrs; dual mtr.
	RK-800	–	8	H	No	–	S	40-12K	0.3	38	117 AC	–	9¼ x 9 x 4¼	11	54.95	Indiv. illum. track indicator lights.
	RK-850	–	8	H	Yes		S	30-10K	0.3	50	117 AC	Ext.	12 x 9⅛ x 3¾		79.95	"Remove tape" indicator light.
NIKKO	CR-301		8	H	Yes	24	S	40-12K ±3	0.3	45	120-240 AC	Ext.	18¾ x 13½ x 6	24	259.95	Comb. AM/FM stereo rec. and stereo ctg. player; ctg. ejector and chan. chg. knob in door panel; chan-lock function.
ROBERTS	100	X		H	Yes		S	50-11K	0.3	40	120 AC	Ext.	14 x 9¼ x 3½	10.6	179.95	Compl. sys; records; wal. fin; hys-sync motor; pause contr; phone jack; incls. 2 dyn. mics.
	808D		8	H	No		S	50-15K ±3	0.35	44	120 AC	–	13½ x 9½ x 5⅜	18¼	169.95	1-micron head gap; fast fwd; mic and radio-phono inputs; stereo line outputs; cont. play; 2 mtrs.; records.
	526	X		P	Yes	2	M		0.35	40	6 Batt-120 AC	Built-In	12⅛ x 8 3/16 2¾	7¼	99.95	As above, plus built-in AM/FM radio; teles. ant.; spkr. jack
	81	X		P	Yes	2	M		0.35	40	6 Batt-120 AC	Built-In	11¾ x 8 x 2¼	6¼	69.95	Built-in cond. mic; records; built-in a.c. batt. oper; vert. oper;
SONY/ SUPERSCOPE (5) (19) (77) (85)	CFM 8000W	X		P	Yes		M	50-10K	0.28	43	117 AC 6V batt.	Built-In	11 x 7 x 3¼	8	149.95	Built-in AM/FM radio; built-in condenser microphone.
	127C	X		H	No	–	S	30-12K	0.20	48	117 AC	–	15¾ x 8⅝ x 3⅞	10 9/16	139.95	
	CF-300	X		P	Yes		M	50-10K	0.28	42	117 AC 6V batt.	Built-In	11 5/16 x 8 9/16 x 2 7/16	7 1/16	119.95	Built-in AM/FM radio; built-in condenser microphone.
	CF-200	X		P	Yes		M	50-10K	0.40	40	117 AC 6V batt.	Built-In	10 x 2¾ x 6½	4 9/16	99.95	Built-in AM/FM radio.
	122C	X		H	No	–	S	30-12K	0.20	48	117 AC	–	11⅞ x 8 3/16 x 3⅛	3 3/16	94.95	
	CF-100	X		P	Yes		M	150-8K	0.40	40	117 AC 6V batt.	Built-In	10⅝ x 10¼ x 2 15/16	6⅛	79.95	Built-in AM/FM radio.
TEAC (1) (87)	A-24	X	–	H	No	–	S	40-12K ±4	0.2	45	117 AC		13⅝ x 9⅝ x 4¾	11	199.50	Auto. stop and pinch roller disengagement; hys. motor; dual contrs; digital counter; 3 inputs.
	A-25	X	–	H	Yes	20	S	40-12K ±4	0.2	45	117 AC	Ext.	13⅝ x 9⅝ x 4¾	12.3	279.50	As above, with 20-W. ampl and separate speakers, 8.8 lbs. ea.
WOLLENSAK (105)	4860	X		H	Yes	8/ chan.	S	60-12K ±3	0.25	46	117 AC	Opt. Ext.	13⅞ x 9¼ x 4½	18	239.95	Full-size capstan and motor; bi-peripheral drive; end-of-tape sensing.
	4750	X		H	No	–	S	60-12K ±3	0.25	46	117 AC	–	13⅞ x 9¼ x 4½	13	199.95	As above; pre-amp deck only.
	4510	X		P	Yes		M	80-10K				Built-In	11½ x 3 x 7	3¼	99.95	Auto rec. level; built-in AM/FM radio; Nicad batt pack.
	4400	X		P	Yes		M	80-10K				Built-In	10 x 3 x 8¼	4¾	49.95	Auto rec. level; built-in storage compartment for mic and power cord.

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CALMS TAPE TENSION.

Headache? Take aspirin.

Tape tension trouble? Take TEAC.

For instance, take the A-6010U stereo tape deck here – with its unique tape tension control system: an inertial flywheel and compliance arm for precision record/playback running speeds and smooth, fast winding. This system helps reduce external factors contributing to wow and flutter, such as warped reels and splices.

TEAC offers fast relief for other common complaints, too: unique ***phase sensing auto reverse*** operates electronically at any chosen point on the tape, or takes a sensing foil if you'd rather. Separate heads permit ***source- or off-the-tape monitoring while recording*** for easy A/B comparisons. And our exclusive ***symmetrical control system*** makes tape handling logical and easy – fast or slow, forward or back, at a flick of the finger.

This tape deck can't cure everything that ails you, but you're bound to feel better once you own one.

TEAC

TEAC Corporation of America • 2000 Colorado Avenue • Santa Monica, California 90404

MICROPHONES

MANUFACTURER (Circled number indicates ad page)	Model	Directional Pattern	Operating Principle	Case Material	External Finish	Impedance, Ohms	Frequency Response, Hz to kHz, ± 2 dB	EIA Sensitivity, dBm	Mic Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, In.	Weight, Oz.	Mounting Method	Price	SPECIAL FEATURES
AKG (89)	D-190E	Card.	Dyn.	Metal	Satin	200	40-15K ± 3	-149	XLR	15	Free	6¼ x 1½ d.	6	5/8 – 27	50.00	Internally suspended capsule.
	D-200E	Card.	Dyn.	Metal	Chrome	200	30-15K ± 3	-151	XLR	15	Free	7 5/16 x 1 5/8 d.	8	5/8 – 27	69.00	Two-way cardioid mic. Similar to two-way spkr; woofer & tweeter & cross-over.
	D-24E	Card.	Dyn.	Metal	Satin	200	30-18K ± 2.5	-148	XLR	15	Free	6½ x 1 9/16 d.	6	5/8 – 27	160.00	Wide range, studio microphone.
	C-451E	Vari.	Con-denser	Metal	Satin	200	30-20K ± 2.5	-135	XLR	–	–	¾ x 5 7/16 d.	4.5	5/8 – 27	179.00	Modular system features: a) interchangeable capsules b) Phantom, a.c. and d.c. powering.
ALTEC LANSING (42) (43)	650A	Card.	Dyn.		Satin Chrome	150-250; 20K	50-15K	-120	XLR	15	Phone Plug	7¼ x 1¾ d.				Bass roll-off sw, 400 Hz down, front-back disc. 20 dB. Model 651AH, 20K ohms only, no roll-off sw; sgl. cond. cable,
	650BH	Card.	Dyn.		Satin Chrome	150-250	50-15K	-120	XLR	25	Phone Plug	7½ x 1¾ d.				Incls on/off sw and bass roll-off sw. Model 650BL, same except cable fitted with w XLR plugs.
ELECTRO-VOICE (General Purpose)	664	Card. (Var. D)	Dyn.	Diecast Zinc	Chrome gray or gold	150 and Hi	60-15K	-149 -151	E-V QC4M	15	None	7¼ x 1 7/8 Max. Dia.	26	5/8 – 27	56.70	Variable-D card.; resp. independent of dist; on-off sw.
	674	Card. (Var. D)	Dyn.	Diecast Zinc	Chrome	150 and Hi	60-15K	-151 -152	E-V QC4M	15	None	7 7/8 x 1¼ Dia.	18	5/8 – 27	57.00	As above, w/3-pos. bass-tilt sw. for control of room rumble.
	676	Card. (Var. D)	Dyn.	Diecast Zinc	Chrome	150 and Hi	60-15K	-151 -152	E-V QC4M	15	None	7 3/8 x 1¼ Dia.	12	300 Std Adapt.	57.00	As above, w/o on/off sw.
	631	Omni	Dyn.	Diecast Zinc	Chrome	150 or Hi	80-13K	-149 -151	Amph	15	None	6 x 1 7/8 Max Dia.	6	310 Std Adapt.	36.00	For hand-held ent. use; 4-std. pop filter; removeable mag. reed on-off sw.
	627A	Card. (Sgl. D)	Dyn.	Diecast Zinc	Black & Chrome	150 or Hi	60-13K	-151 -153	Amph	15	None	6 1/8 x 1 5/8 Max. Dia.	8	310 Std Adapt.	36.00	For above use; bass resp. var. w/dist. 14 dB incr. at 100 Hz, 24" to ¼".
	626	Card. (Sgl. D)	Dyn.	Diecast Zinc	Fawn Beige Micomatte	150 and Hi	70-12K	-151 -153	None	15	None	6 11/16 x 1 5/8 Max. Dia.	8½	310 Std Adapt.	29.40	Integral-cable version of 627A.

AKG C-451E

E-V 674

E-V RE-20

AKG C-451E Microphone System

the common-sense approach to phantom powering.

Just one or two resistors! Simple, isn't it?

- No AC power supplies required
- No DC power supplies
- No "central" power supplies
- No special "cards"
- Operates off any DC voltage between 7.5 and 52v (including the standard 24v available in most equipment).
- Stabilizes its own operating voltage, to maintain constant output level.
- Optimum polarization voltage, for best signal-to-noise ratio.

MICROPHONES • HEADPHONES

DISTRIBUTED BY
NORTH AMERICAN PHILIPS CORPORATION
100 EAST 42nd STREET, NEW YORK, NEW YORK 10017

AKG CANADA • DIVISION OF DOUBLE DIAMOND ELECTRONICS • SCARBOROUGH, ONTARIO

SKG-138

THE SIMPLICITY OF SIMPLEXING

The AKG C-451E may be powered at the cost of one or two precision resistors: No separate AC or DC power supplies required nor special "cards" or "central" power supplies at additional cost.

The microphone preamplifier requires as little as 7.5v DC and may be operated directly off the *standard* 24v B+ supply available in your equipment (or any other voltage between 7.5 and 52v). The current consumption is only 2.8 mA.

Other features unique with the AKG system are:

A) Stabilized operating voltage: The DC supply voltage to the microphone is not required to be particularly well regulated nor is it rigidly tied to a specific voltage. In fact, it may vary by ± 15% since the C-451E preamplifier will stabilize the operating voltage. There is no limit to the number of microphones to be powered off your console.

B) Constant 60 volts polarization voltage: 60 volts is the optimum polarization voltage for highest performance standards, specifically sensitivity; resulting in more gain without increase in noise level and better signal-to-noise ratio. The C-451E supply voltage is not simultaneously the polarization voltage (too low). The microphone preamplifier provides a constant 60 volts polarization voltage and fluctuation in the supply voltage will not change the output level of the microphone.

There are no short cuts in the AKG C-451E circuitry!

HOW DOES IT SOUND?

Interestingly enough, its pick-up characteristics are being compared to the quality previously obtained only with large diaphragm condenser microphones.

The newly developed CK-1 capsule incorporates a metallic alloy diaphragm (similar to the diaphragm material used in measuring microphones) and is absolutely smooth between 30-18,000 Hz with unequaled transient response characteristics and wide dynamic range.

The polar pattern is a true cardioid at all frequencies with linear off-axis acceptance and a front-to-back discrimination of 20-30 dB over the entire range.

Last, but not least, a practical and economic modular design permits you to choose from a variety of interchangeable capsules with different response characteristics and polar pattern (cardioid, omni-directional, figure-eight and shot gun tube).

AKG OFFERS A CHOICE— NOT A STANDARD

Write for complete technical data.

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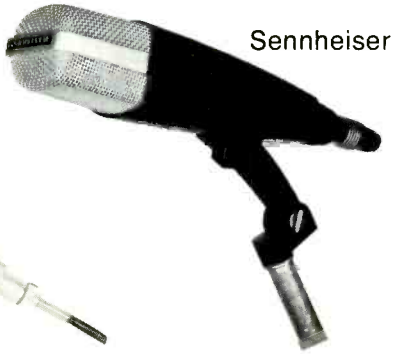
MICROPHONES — Continued

MANUFACTURER (Circled number indicates ad page)	Model	Directional Pattern	Operating Principle	Case Material	External Finish	Impedance, Ohms	Frequency Response, Hz to kHz, ± 7 dB	EIA Sensitivity, dBm	Mic Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, In.	Weight, Oz.	Mounting Method	Price	SPECIAL FEATURES
ELECTRO-VOICE (Professional)	RE-20	Var-D card.	Dyn.	Steel	Fawn Beige Matte	50, 100, 150	40-20K	−150	Swcrft A3M	18	Not furn.	8½ x 2 1/8 Max. Dia.	26	Adapt.	255.00	Very wide range; uniform polar curve.
	RE-16	Var-D card.	Dyn.	Steel	Fawn Beige Matte	150	80-15K	−150	Swcrft A3M	18	Not furn.	7 1/8 x 1 7/8 Max. Dia.	8	Adapt.	165.00	Super-effective pop filter similar to RE-15.
	RE-15	Var-D card.	Dyn.	Steel	Fawn Beige Matte	150	80-15K	−150	Swcrft A3M	18	Not furn.	6 7/16 x 1 3/8 Max. Dia.	6	Adapt.	159.00	Super-cardioid; max. rejection at 150 deg; uniform resp. at all angles.
	RE-55	Omni	Dyn.	Steel	Fawn Beige Matte	150	40-20K	−149	Swcrft A3M	18	Not furn.	10½ x 1¼ Max. Dia.	8½	Adapt.	132.00	Extremely smooth resp. suitable as secondary calib. std.
	635A	Omni	Dyn.	Steel	Fawn Beige Matte	150	80-13K	−149	Swcrft A3M	18	Not furn.	6 x 1 3/8 Max. Dia.	6	Adapt.	52.80	Integral 4-stage pop filter; for hand-held use.
LAFAYETTE (106)	99-45973	Omni	Dyn.		Chrome	50K	50-15K			54		6 1/8 x 4½	64		17.95	2 ind. ctgs; floor stand or hand held.
	99-46203	Omni	Dyn.		Satin Alum.	50K 250	100-10K			20		6¼ x 2 1/8	2		15.95	Ball screen; on/off sw; "pop" resistant; desk stand.
	99-45932	Omni	Dyn.		Satin Silver		50-250K			18		9 x 1 3/8	3		11.95	Tiltable head; on/off sw.
PML	TC 4 US-V	Card./ Omni Bi-Dir.	Cond.	Metal	Satin Chrome	50 or 200	30-20K Hi Z	−172	Tuchel att.	20	None	5 5/8 x 1 1/16	5	5/8 x 27	350.00	Studio FET Mic power a.c. pwr. sup.
	EC-71	Card.	Cond.	Metal	Satin Chrome	30-50 200 600 Hi	40-18K +3 H2	−164	PREH Plug	12	None	2 11/16 x 11/16	1¼	5/8 x 27	109.50	Micro Min. cond., a.c. or d.c. pwr. sup.
	EK-71	Omni	Cond.	Metal	Satin Chrome	30-50 200 600 Hi	40-18K ±3 H2	−164	PREH Plug	12	None	2 11/16 x 11/16	1¼	5/8 x 27	99.50	As above.
	D-44	Card.	Dyn.	Metal	Blk; Grid	200	60-16K H2	−165	att.	12	None	5"	4.7	5/8 x 27	34.95	Avail. on/off sw.; 30 ft. cable 200 ohms bal. or Hi Z at $39.95
RCA (13)	HK-111	Omni	Dyn.	Diecast	Black & Sat. Chr.	200,15K	50-20K		RCA Conn.	20	Not furn.	10.6 x 1.6 d.	9	5/8 & 5/16	54.00	Integ. wind screen; flat wide freq-resp. characteristics.
	HK-96	Card.	Dyn.	Diecast	Black & Sat. Chr.	200,15K	50-15K	–	RCA Conn.	20	Not furn.	9¾ x 1.6 d.	16	5/8	50.00	3-pos bass roll-off sw.
	HK-106	Super Carol	Dyn.	Diecast	Black & Sat. Chr.	200,15K	150-10K	–	RCA Conn.	20	Not furn.	5.3 x 1.2 d.	69	5/8	44.00	2 transfs; 2 ctgs; gentle rolloff at low freqs.
	MK 12	Omni	Cond.	Metal	Dull Gray	10	20-20K	−121.5	Att	15	Min.	0.5 x 1½	3.2	Tie Clip	210.00	Lavalier Type
SENNHEISER	MD 421U	Card.	Pres. Grad.	Synth. Fiber	Dull Gray	200	30-17K	−148.5	XLR	15	XLR	7 x 1 7/8 x 1¾	14	Stand or Boom	123.20	
	MD 420	Close-talk	Pres. Grad.	Metal	Lt. dull Gray	200	200-10K	−146.5	Tuchel T-3080	15	Tuchel T-3080	1½ x 5¼	4	Stand or goose neck	68.00	Noise-cancelling mic.

PML M TC-4

RCA HK-96



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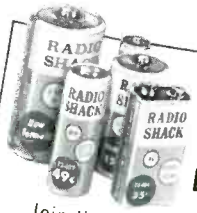

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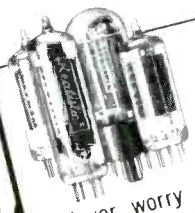

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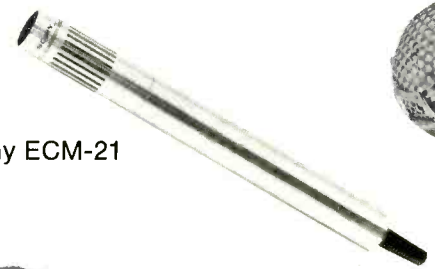
MICROPHONES — Continued

MANUFACTURER (Circled number indicates ad page)	Model	Directional Pattern	Operating Principle	Case Material	External Finish	Impedance, Ohms	Frequency Response, Hz to KHz, ± 7 dB	EIA Sensitivity, dBm	Mic Connection	Cable Length, Ft.	Cable Plug Type	Dimensions, In.	Weight, Oz.	Mounting Method	Price	SPECIAL FEATURES
SHURE (General Purpose) (11)	585SA	Card.	Dyn.	Diecast Zinc	Chrome	Hi	50-13K	-153.5	Amph. MCIF	15	Not Furn.	6¾ x 2 1/16	13½	Adapt.	45.00	Unisphere A; also avail in low-Z model 585SB.
	588SA	Card.	Dyn.	Diecast Zinc	Chrome	Hi	80-13K	-155	Can XLR	15	Not Furn.	6½ x 2⅛ Dia.	12	Adapt.	39.00	Unisphere B; also avail in low-Z model 588SB.
	515SA	Card.	Dyn.	Diecast Zinc	Blk. Chrome	Hi	80-13K	-154	–	15	Not Furn.	6½ x 1½ Dia.	15	Adapt.	27.00	Unidyne B; also avail in low-Z model, 515SB.
	579SB	Omni	Dyn.	Diecast Zinc	Chrome	Lo	50-15K	-151	Can XLR	20	Not Furn.	6⅜ x 1 9/16	5½	Adapt.	45.00	Vocal sphere.
	548	Card.	Dyn.	Diecast Zinc	Black & Chrome	Hi Lo	40-15K	-151	Can XLR	15	Not Furn.	6⅛ x 1 9/16 Dia.	9	Adapt.	69.00	Unidyne IV; also avail w/mag reed sw as model 548SD.
	565	Card.	Dyn.	Diecast Zinc	Black & Chrome	Hi Lo	50-15K	-150.5	Amph. MC4M	15	Not Furn.	6 x 2 Dia.	11	Adapt.	64.80	Unisphere I; also avail w/mag reed sw as model 565SD.
	545	Card.	Dyn.	Diecast Zinc	Black & Chrome	Hi Lo	50-15K	-151	Amph. MC4M	15	Not Furn.	5 13/16 x 1¼ Dia.	9	Adapt.	57.60	Unidyne III; also avail w/mag reed sw as model 545SD.
	55SW	Card.	Dyn.	Diecast Zinc	Chrome	Hi, Med, Lo	50-15K	-151.5	Amph MC3M	15	Not Furn.	7 11/16 x 3 1/16	26	⅝" – 27	58.80	Unidyne II with on/off sw.
SHURE (Professional) (11)	SM33	Super Card	Ribbon	Diecast Zinc	Gray Enamel	30/50 150/250	40-15K	-148	Can XLR	20	Not Furn.	8 x 1¼ x 1⅞	26	⅝" – 27	150.00	Wide-range response.
	SM53	Card.	Dyn.	Alum.	Matte Metallic	150	40-15K	-151	Can XLR	20	Not Furn.	7 1/16 x 1½ Dia.	8	Adapt.	153.00	Eff. rejection of unwanted sounds; mech. noise isolation; rolloff sw.
	SM58	Card.	Dyn.	Diecast Zinc	Gray Enamel	30 50 150/250	70-16K	-148	Can XLR	20	Not Furn.	6½ x 2 Dia.	15	Adapt.	96.00	Built-in wind and pop filters; shock-mounted cartridge.
	SM60	Omni	Dyn.	Alum. & Steel	Matte Metallic	150	45-15K	-153	Can XLR	20	Not Furn.	6 7/12 x 1 7/8 Dia.	6	Adapt.	49.20	Clean natural reproduction.
SONY/ SUPERSCOPE (5) (19) (77) (85)	ECM-22	Card.	Elect. Cond.	Alum.	Nickel Satin	50,250 600	50-12K		XLR	20	Not Furn.	7 11/16 x 5/16 d.	4.6	½" Pipe	99.50	Operates on int. batt; bal or unbal output on off sw; l.f. attenuator sw. (Elect = electret).
	ECM-21	Card	Elect. Cond.	Alum.	Nickel Satin	50,250 600	50-12K		Att.	19	Not Furn.	6⅜ x ¾ d.	5	½" Pipe	49.50	Operates on int. batt; bal or unbal output.
	ECM-15P	Omni	Elect. Cond.	Alum.	Nickel Satin	1000	50-10K		Att.	3	Mini	1 7/16 x ¾ d.	1 appr.	Tie Clasp	29.95	Operates on pocket batt. pack; lavalier type, using tie-clasp mount.
	ECM-19B	Card.	Elect. Cond.	Alum.	Nickel Satin	250	50-12K		Att.	9	Mini	6 x 1⅜ d.	4.4	Desk Stand	29.50	Operates on internal batt; desk stand supplied.
UNIVERSITY	5000	Super Card.	Dyn.	Diecast Alum.	Satin Chrome	200-30K bal.	25-20K	-120	Term	15	Not Furn.	7 7/16 x 2 3/16	12	SA-10	98.95	Also avail w/sw, mod. 5100 w/Amph. conn, mod 5020 integ. swivel & Amph, 5050; shock-mounted cartridge.
	6000	Card.	Dyn.	Diecast Alum.	non-glare Black	150 bal.	50-15K ±4	-151	Term	15	Not Furn.	3 11/16 x 1 1/16	5	SA-10	69.58	
	2000	Omni	Dyn.	Zamak 3	Acrylic Silver grey	50Ω 20K bal.	50-14K	-143	Term	15	Not Furn.	6 x 1 5/32 Dia.	16	SA-10	54.93	All mics supplied w SA-10 std; adapt. may be attached to stand or hand held; Also avail w/sw.

Shure 565



Sony ECM-21

University 5000

Shure SM60

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HEADPHONES

AKG K-60

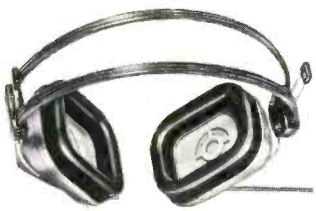
Clark 100

MANUFACTURER (Circled numbers indicate adv. page)	Model	Type	Frequency Response, Hz ± 1 dB	Impedance, Ohms	Sensitivity mW input for 100 dBm Out	Maximum input, mW	Distortion, %	Cord Length, Ft.	Weight, Oz.	Price	SPECIAL FEATURES
AKG (89)	K-60	Dyn.	20-20K	600 chan.	1.0	20	1.0		11	39.50	
	K-120	Dyn.	20-20K	600 chan.	1.0	20	1.0		11	22.50	
BOGEN	EP-10	Dyn.	20-15K -5	8	1.0	200	0.5	9	20	29.95	Adjustable, washable vinyl ear cushions.
CLARK (95)	Clark 100A	Dyn.	20-18K -6	17	0.95	1000	1.2	Coil 9	16	50.00	Also available in 300- and 600-OMM models (600-OMM $55.00).
	Clark 200	Dyn.	30-16K	8	1.0	500	1.5	Coil 9	16	29.00	
	Clark 250	Dyn.	30-16K	8	1.0	500	1.5	Coil 9	16	34.00	As above with vol. contls.
	Clark 300	Dyn.	40-14K	8	1.0	500	2.0	Coil 9	16	21.00	
FISHER (31)	HP-60	Dyn.	30-18K	8	1.0	500	0.1	8	15	24.95	With individual balance controls.
	HP-100	Dyn.	18-22K	50	2.0	700	0.1	8	10	39.95	With foam over cushions, slot-loaded reverse driven; mic elements.
JENSEN	HS-2	Dyn.	20-17K	4-4	20			8	16	24.95	Accurate stereo balance.
KOSS	ESP-6	Electro static	30-19,000K -5	4-16	100 W/O T-3 Box	4000	< 0.2	10	27	95.00	Self-energized and self-contained electrostatic; push pull mode reduces distortion, incls resp. curve.
	ESP-7	Electro static	30-15,000K -5	4-16	1000	4000	0.25	6	17	90.00	Light weight, w. sep. energizer and self-energizer feature, incls curve.
	ESP-9	Electro static	15-15,000K -2	4-16	1000	4000	< 0.2	6	19	150.00	As above. Line energized option for precision.
	PRO-4AA	Dyn.	10-20,000K	4-16	150	1000	0.5	10	19	60.00	Newly designed efficient dyn. element.
LAFAYETTE (106)	F990	Dyn.	20-20K	8				6½	2½	29.95	Two 3½" wide range transducers, air tight cushions.
	F880	Dyn.	25-15K	8				5	2	17.95	Soft rubber air-cushioned pads, two 2½" hi fi spkrs.
	SP-55	Dyn.	30-15K	8				5	2½	11.95	Air cushioned headband, two 2½" wide-range spkrs.
	8X	Dyn.	35-15K	8				5	1½	7.95	Adjustable headband, lightweight.
PML	D42 Deluxe	Dyn.	30-20K	200 Capsule	0.3		2.0	6	9	29.95	Can be used for stereo or mono, series Z, 400 ohms, parallel 100.
SANSUI (7) (41)	SS-2	Dyn.	20-18K	8		1000	<1.0	6	12½	19.95	
SENNHEISER	HD 414	Dyn.	20-20,000K	2,000	1 mW chan.		<1.0	10	5	29.95	Light weight "open aire" unit.
SHARPE (2)	770	Dyn.	28-20K -3	8-16 (500 opt.)	1.12V	2 w. ea.	<1.0	Coil. 10	24	95.00	Calibrated, matched drivers, each fused. Liquid-filled ear cushions, incls. resp. curves.
	660 PRO	Dyn.	20-20K -3	8-16 (500 opt.)	1.12V	2 w. ea.	<1.0	Coil. 10	24	65.00	Drivers fuse protected. liquid-filled ear cushions, wal. grained decor.
	10 MK II	Dyn.	30-15K -3	8-16	0.5 V	2 w. ea.	<1.0	Coil. 10	22	45.00	Modern design, dynamic drivers; Forest green decor.
	10A	Dyn.	50-15K -3	8-16	0.5 V	2 w. ea.	<1.0	Coil. 10	18	35.95	Liquid filled ear cushions. flat frequency response within -3 dB except at 8K -6 dB. Color, gray.
	9	Dyn.	20-20K -5	8-16	.013	2 w. ea.	<1.0	Coil. 10	18	25.95	Smooth frequency response. High impact "cycolac". Gray decor.
SONY SUPER-SCOPE (5) (19) (77) (85)	DR-6A	Dyn.		8	0.9			6	13.5	27.50	
	DR-6C	Dyn.	20-20K	10K	0.9	110		6	14	29.50	
STANTON (21)	Isophase Model 570 Headset	Electro static	20-18K -2	4-8 ohm amp. Output terminals	Produces a S.P.L. of 95 dB for 2 volts input	12 v rms w. inst. peaks of up to 30 volts	1.0	11	15	159.95*	Patented diaphragm suspension, Universal cup adj., Detent-knob headband adjust. *Price includes both headset (Mod. 570) and Polarizer (Mod. 572) as one package.
	Isophase 572 Polarizer						1.0	11	5½		Automatic, resetable, overload protection circuit in each channel.
SUPEREX (102)	ST-PRO-B-5	Dyn.	16-25K	4-16		2000	.05	10 Coil.	23	59.95	Dyn. woofer, cer. tweeter, repl. cushions, avail. with Z of 600, 2000, or 15K ohms.
	ST-PRO-B	Dyn.	18-22K -5	4-16		2000	0.7	7	20	50.00	As above; also avail. w. 10 ft. coiled cord.
	ST-M	Dyn.	20-20K -5	4-16		2000	0.85	7	18	29.95	As above: adj. tweeter level.
	ST-2	Dyn.	30-16K	4-16		2000	0.7	10 Coil.	15	24.95	Avail. w. Z of 600, 2000 or 15K ohms; repl. cushions.
	ST-C	Dyn.	4-15K +5	4-16		2000	0.85	7	15	19.95	Avail. w. Z of 10K ohms repl. cushions.

HEADPHONES — Continued

Fisher HP-100

Koss ESP-6



Lafayette 8X

Sennheiser HD-414

Sharpe 660/PRO

Sony DR-6A

Stanton 570

Video Records

(Continued from page 8)

The actual information density is given as 500,000 bits per mm²—in other words 100 times greater storage capacity than present-day disks. Record material is thin PVC, so thin it can be more accurately described as a film (see photograph). It floats above the turntable on a cushion of air which stabilizes the motion and prevents wobble. Speed is a fantastic 1500 rpm (for 625-line European systems) and a "positive drive" cord and pulley arrangement advances the stylus one groove (.008 mm) per revolution (see Fig. 2). Provision is made for switching this drive off so the pickup stays in one groove resulting in a short sequence display—a very useful feature.

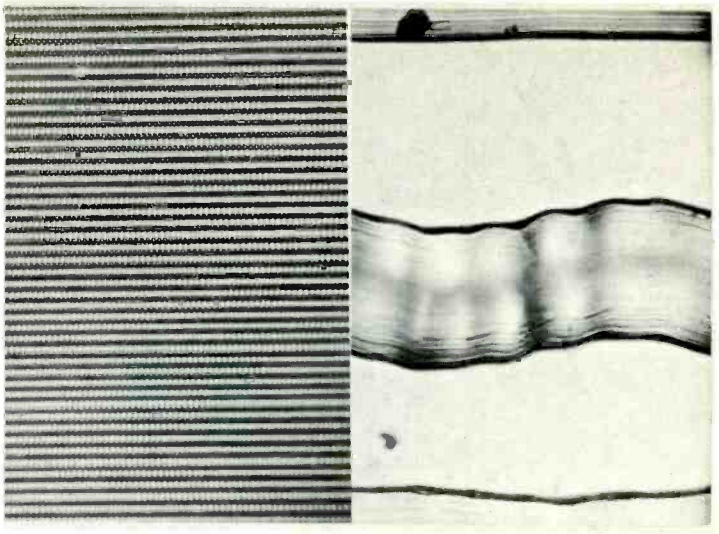


Fig. 1—Showing the groove pattern of a conventional record (right) compared with the dense grooves recorded by the FM system

The pickup

The pickup is a relatively inexpensive ceramic type and it operates as a pressure transducer. Figure 3 shows the stylus configuration and it will be seen that it glides over the grooves like a sleigh runner. The compressed modulation peaks are instantly relieved of pressure when they glide from under the edge of the stylus and the instantaneous load relief is transmitted by the stylus to the piezo-ceramic element. Playing time is 12 minutes for a 12-inch record and 5 minutes for a 9-inch. Picture resolution is quoted as 3 megahertz which is equivalent to 250 lines. How about the sound channel? This was fitted in by using a series of pulses inserted into the blanking intervals—a similar method has been used in Japan for experimental TV stereo sound. The development team are now working on color video disks which have shown very promising results. Can any of these techniques be applied to audio recording? Remember that the present video disks are made of very cheap material and can be stamped out by ordinary record presses at a rate of 12,000 an hour and that there are no problems of wear, warping, and so on. Let Dr. W. Berger, one of the AEG-Telefunken executives, speak: "The dense storage technology embodied in the video disk can also be applied to the recording of audio signals. The playing times thus obtained are longer and the next step from normal stereophony through the medium of four channels will involve no difficulty. At the same time, expressions such as rumble, anti-skating bias compensation will be things of the past." Very optimistic but some experts will certainly take the view that audio disks made with the new techniques will exchange one set of problems for others (that 1500- to 1800-rpm motor and air cushion for example) but I certainly like the idea of hill-and-dale recording. Maybe a compromise could be worked out with a carrier system giving a total bandwidth of 50 to 100 kHz and a playing speed of 100 rpm—or even back to good old 78! Latest news puts the availability of the video disks and playing equipment some eighteen months or two years ahead. Demonstrations are scheduled for New York in October and we will publish more details when available. Æ

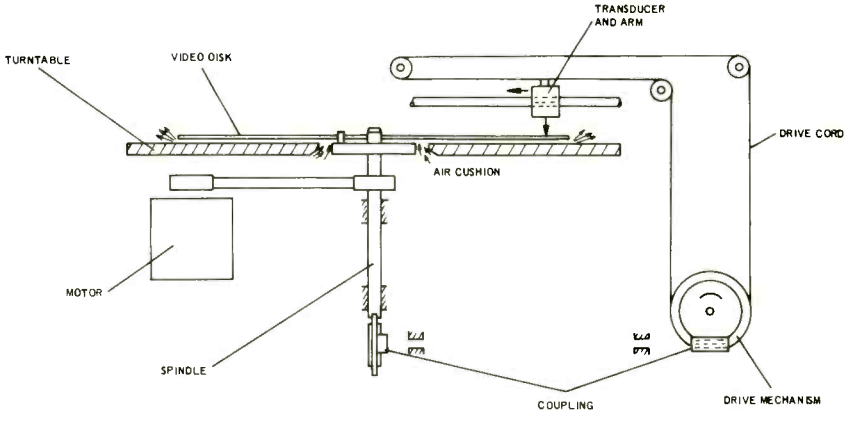


Fig. 2—The turntable drive system

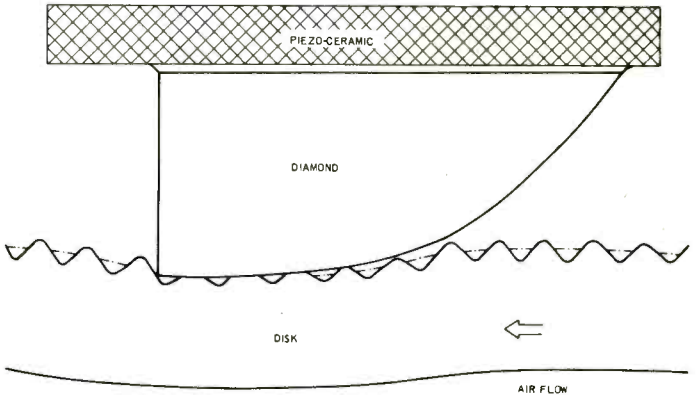


Fig. 3—Showing the shape of the stylus and the way it can glide over the grooves

Classical Record Reviews

EDWARD TATNALL CANBY

THE BEETHOVEN YEAR

Wilhelm Backhaus Beethoven Sonatas Nos. 13, 24, 3. (Op. 27, No. 1; Op. 78; Op. 2, No. 3) **London CS 6638 stereo** ($5.98).

Wilhelm Backhaus is surely the grandest old man of the recorded Beethoven piano sonata. His recordings for London would seem to beat all records (in both senses)—for longevity, quantity and quality—though I haven't totted up the others to be absolutely sure. My oldest Backhaus LPs date from the early fifties, among the very first London long-play recordings. He still goes right on, and the current Schwann catalogue is full of his Beethoven sonatas, though not in the sweeping "complete" format of such as Angel's young Barenboim, old Artur Schnabel (who did the first such set before the war) and that other Wilhelm, W. Kempff, whose complete set is available on imported Deutsche Grammophon. (He used to appear on U.S. Decca Gold Label LPs.)

Kempff, who mustn't be confused with Rudolph Kempe, is a precision performer on his records, impeccable in phrasing and sharp detail, powerful, passionate but, even so, a bit chilly. One admires, but at a distance. Backhaus is a very different sort. Elderly now, he is sometimes clumsy, blurring up the details in old-man fashion; but to my memory he has always been this way, a pianist interested in the grand lines and impact, inclined to be uneven in detail, using both a bouncy, staccato technique and a good deal of blurring pedal. But this man has such an unerring (and continuing) feel for the sense of Beethoven that these matters are of no account at all. His wholly natural, persuasive way with the composer is utterly musical.

Best of all, perhaps, is the lack of pose, the naturalness. So many pianists approach Beethoven with furrowed brow and determined mein, advertising loudly

that now they are performing THE MASTER. (Orchestras likewise!) Yet for all their determinedness, many of them do not really understand nor feel the music. With Backhaus, Beethoven is so comprehensible, so familiar, that there is no thought of anything but straightforwardness. For which, the thanks of us all.

Only the OP. 27, No. 1, "Quasi una Fantasia", runs into noticeable technical trouble here. The fugal segment with the running fast notes is just too much for the elderly fingers, though the sense is all there. The rest, and notably the early Op. 2, No. 3, is just fine. Backhaus is particularly good in the early works, so often treated as semi-youthful immaturities. He gives them their full due, without a trace of exaggeration. Try Backhaus first—then measure all the others.

Perfomance: A— *Sound:* B+

Beethoven: Symphony No. 6 "Pastoral." Phila. Orch., Ormandy. **Columbia MS 7444 stereo** ($5.98).

Beethoven: Symphony No. 6 "Pastoral"; Overture to Egmont. New Philharmonia Orch., Giulini. **Angel S-36684 stereo** ($5.98).

The Sixth Symphony with its pastoral picturesqueness, its peasants, birds, thunderstorms, all part of a straightforward love of nature and the countryside by Beethoven, was of all the symphonies the easiest to "put over" back in the 19th century when these things were taken for granted in the arts. Now, the Sixth is surely the toughest of all to play, and it seldom comes off. The hair line between dullness and overdoneness, between the routine playing of all the notes and the unctuous playing-up of the nature pictures, is always with us.

The Ormandy-Philadelphia Sixth—another of the flood of Columbia recordings of the orchestra issued since RCA took over—is exactly what we could expect. All the notes are there and one cannot fault a single one. Everything is done according to instructions. It should be perfect. It is ineffably dull. Polished, suave, velvety playing, to be sure. But where is the soul, the will to make the music re-live itself?

Carlo Maria Giulini's recording with the equally accomplished New Philharmonia is of another sort altogether. In spite of his Italian background, Giulini starts off somewhat heavily and slowly and, it might seem, the piece sets out to be heavyfooted throughout. But listen on! The Philharmonia probably didn't have more than a very few run-throughs with the conductor, hence a considerable amount of hesitant, out-of-time playing at moments of change. But this orchestra can read and play skillfully, and more important, it can take fire. The first and second movements go by with no more than an equably pleasant approach, OK but nothing wildly exciting.

Then, beginning with the peasant dance, the players take hold and the music begins to glow. The storm is wonderfully vivid, yet not a bit corny or overdone. It lives again! The calm after the storm has all of that delightful peacefulness that we know should be in the music, and the variations on the theme take on more and more warmth—I ended up enthusiastic. A splendid half-performance: the second half.

Could have been Giulini but, I suspect, it was as much the members of the New Philharmonia, simply working themselves into a very professional enthusiasm, almost of their own accord. It can happen among good musicians. A good conductor, on such an occasion, is wise enough to go right along and do all he can to help, giving only the necessary minimal leadership.

Performances: B−, B+ *Sound:* B, B

Artur Schnabel Beethoven: Concerto No. 4. Chicago Symphony, Stock (1942). **RCA Victrola VIC 1505 mono** ($2.98).

A memorable reissue, this one, though Schnabel is better known on records for his European recordings of the concerti, done previous to this American recording. The sound is unhelpful though in no way unpleasant—just dull, typically lacking in reverberation and the high end, the orchestra somewhat subdued in the background and the climaxes apparently limited in volume; they seem curiously to fall short of the proper impact and the fault is surely not the orchestra's nor the conductor's.

But the piano comes through silky smooth, in the best of the excellent RCA Victor manner, and Schnabel's dedicated playing of this, the gentlest of the five concerti, is plenty to carry us with him, technical faults or no. It is a splendid version, gentler than Serkin's Beethoven yet rugged all the same, less flamboyant than Gilels yet equally big in bravura concept. Schnabel was not a great piano finger technician but sheer musical faith, expressed so profoundly, made his music the finest Beethoven of his day. Brains and musical understanding, operating through a workable virtuoso technique —that did it.

Performance: A *Sound:* C+

Historic Organs of France. E. Power Biggs. **Columbia MS 7438 stereo** ($5.98)

The Historic Organ: Bach Organ at Schlosskirche, Lahm. (Music by the Bach family). Wilhelm Krumbach. **Telefunken SAWT 9551 stereo** ($5.95)

As more and more of the great classic organs are restored to playing condition, the recording crews keep us up-to-date on them—to the delight of many a home body whose previous experience of the organ may have been the sound of Sunday hymns in church. A great hi-fi sound and splendid for stereo reproduction. And the music is as sturdy as the organs themselves, remarkable products of an enlightened age.

Mr. Biggs' playing, characteristically, seems always to improve when he finds himself an inspiring historical instrument. At home, he is often uneven, the phrasing bad, the fingering nervous. Here, once again, he is mainly very good, at two celebrated French-style Alsacian organs, both built by Andreas Silbermann, French-oriented brother of the great organ builder Gottfried Silbermann. Andreas lived for years in Paris and his organs have that brilliantly nasal sound characteristic of the classic French instrument. The instruments at Marmoutier and Ebersmunster alternate in this recording; Ebersmunster is gentler and more distant (in the recording), Marmoutier is big, round, and full. The Biggs program, appropriately, is all French of the period, from Couperin le grand and an earlier Louis Couperin through a brace of lesser men—an oddity is a very familiar theme of Bizet, in a piece by Clerambault a hundred and fifty-odd years earlier. You'll spot it in an instant. Did Bizet "borrow"? More likely it's a well known pop tune out of history.

In contrast, Telefunken's Bach Organ is a splendid German instrument built 1728-32 for a minor nobleman to ornament his local church; his organist was Johann Lorenz Bach, a nephew of J. S. Bach. The single Prelude and Fugue by J. Lorenz in this recording is a brilliant piece of writing as played on his own organ. The entire recording is devoted to music by members of the far-flung (in Germany) Bach family—Johann Michael, J. Christopher, J. Bernard, J. Ernst, in addition to J. S. Bach himself. All these various Johanns were cousins or brothers or uncles and the program is a good practical illustration of the industrious talent for music that was spread through this family.

The Herbst organ, the only one of this German builder still surviving, is unusual in that it has been preserved absolutely unchanged since the day its first sounded

out in 1732. It has merely been restored to perfect working condition in the recent 1960s. An all-mechanical organ, including the hand-pumped wind supply, very much in the Bach tradition, with an altogether lovely sound, big and full yet never strident. Suits its church perfectly; we quickly sense the classic open Baroque interior of the building in the sound, so different from the reverberation of the long, high Gothic cathedral. Wilhelm Krumbach is an excellent performer, accurate, lively, and colorful.

Performances: B, B+ *Sound:* B, B+

MANDOLIN

It's all very well to speak of the "now" generation but what, after all, is time itself but a series of *nows* which become *thens* before you can think? Take, for perspective, that very unstylish instrument, the mandolin, currently at a lowish ebb if used here and there in a bit of rock or for a sentimental journey into the past. A batch of recorded mandolin music has given me a new look at this pear-shaped, pick-plucked relative of the lute from the vast viewpoint of several centuries. Remarkable—I wouldn't have believed it! Nothing earthshaking, of course. The mandolin isn't quite up to the violin or the piano or the string quartet. But I found its older music surprisingly interesting in terms of new musical horizons. Beethoven. Hummel. Mozart. More recent worthies such as Hans Gal and one Norbert Sprongl. (Anybody with a name like *that* deserves a hearing.) I had no idea the mandolin had gone so far.

My first contact with the instrument was in the nature of a family reverence—quite soundless. I had three old uncles, all of them obstreperous souls, brilliant minds, each in his own way fettered by small-town pettiness. The oldest, a bluff, hearty soul with the voice of a bull, terrified me as a youngster by insisting on three helpings of roast beef when I could swallow but one. The next, an irascibly humorous devil, has made life raffish for half a century on his local smalltown back street—you may still hear him today halfway down the block on an otherwise quiet summer evening. The youngest and most loveable was so long outshouted by these elders that for fifty years he has fought to make his vocal cords work at all. A brilliant talker, once he gets started.

Ah, but the fourth brother! I never met him. I only knew his mandolin. Uncle C. is the family saint. He was the eldest but he remains eternally youthful, a smooth faced college man with hair parted neatly

(Continued on page 101)

Canby's Capsules...

TITLE	CONTENT	SOUND
Ezio Pinza Bruno Walter Mozart Operatic Arias (1946). Metropolitan Opera Orch. *Odyssey 32 16 0335 mono.* ($2.98)	The great Pinza, matinee idol in "South Pacific," couldn't read a note of music but was the finest Mozart baritone of his generation. Here he sings robust Mozart with the verve that made him a later show-biz hit; "Seraglio," "Magic Flute," "Figaro."	Good highs and plenty of sibilants—are these from Columbia's 16" lacquer masters of that time? Mike style is dated: voice very close and loud, orch. minus reverb. Edgy tone in loud vocal passages but entirely listenable, with quiet background.
The Importance of Being Hoffnung with Charles Richardson. BBC Radio. *Westminster WBBC 8002 mono.* ($5.98)	Those who know the hilarious "Hoffnung Music Festivals" on disk will go along with these zany non-music radio interview spoofs, all ad lib and totally *non seq*. Hoffnung is the super-absent minded prof. Amusing in small doses.	The broadcasts date from a vague pre-TV mono era, early tape perhaps. These are copies of destroyed original 1957 BBC releases. Goodish quality, unspectacular and acoustically studio-dead. Very AM-radio.
Slovenian Holiday. Lojze Slak Ensemble. Monitor MFS 710 stereo. ($4.98) *Croatian Songs and Dances.* Ivan Goran Konacic Ens. Monitor MFS 711 stereo. ($4.98)	The East-European state-operated folk ensemble thrives in every country—it's amazing how lively and varied these "commercialized" pro groups manage to be. The Slovenians here echo the Tyrol, Austria, Switzerland, to the North, with accordion-based music and waltzy songs. The Croatians are more primitive, nearer Russian folk, with a plucked balalaika-type sound and wonderfully raucous voices.	Both these come from a state agency, Jugoslav, called Jugoton. Excellent recording in both, well balanced, the voices beautifully managed. But the (claimed) stereo is totally minimal. Maybe they just used a stereo cutter. No great matter—the mono is good.
The Naked Carmen. Cast of thousands, stars from Hair, Met, Julliard, Newport Folk Festival, Detroit Symphony, etc., etc. Mercury SRM 1-604 stereo. ($5.98)	I dunno. This tries hard and it's full of enthusiasm and young talent, pop/classic. But it is gimmicky, overdone, full of gadgetry of a sort we've heard too many times, the whole 8-tracked, or maybe 16-tracked into layer upon layer of overblown effect. They toss in everything from the Detroit Symphony to a kazoo, from Hitler orating to kids tap dancing, with Moog noises (natch) added as usual. If you accept the (noisy) premise of another pop Carmen (remember Carmen Jones?) you'll probably like some of the numbers—there's variety. But pop can be better, and much more economical. Mercury is trying too hard for the neo-Hollywood idea. It's super-chromed *now* stuff with tail fins.	
Jannequin Songs of Birds, Battles, and Love and the flowering of the French chanson. Deller Consort. *Vanguard Everyman SRV 298 SD.* ($2.98)	The Deller Consort sells on and on, in originals and reissues—its discography rivals the N.Y. Pro Musica. But the group is stylistically out of date with its operatic stage voices, loud and unblended, its exaggerated diction, arbitrary tempi. Yet basic good musicianship keeps the Dellers in the running, if you can hear past the outward un-blend and shrillness and don't mind everything sounding alike. Fast French chansons are best here, plus a few Medieval solos with instruments. Adequate recording—it's the voices that are shrill.	
Irish Night—The Gallowglass Ceili Band. Tradition 2090 stereo. ($5.98)	A manful and vigorous Irish band here, pounding out popular reels, jigs, and what-not via accordions, string bass, and the like—not exactly the old Gaelic folk music! It's all about the same except for varying tempi. Some slightly whiskey-jolly vocal solos on Side 2; the rest is instrumental.	

in the middle, a tall stiff collar around his aristocratic face. He died of appendicitis before his father could make up his mind whether to operate or not. Uncle C. was at the top of his class in college, where he had at last broken the family tethers—or had he? He was, they said, clearly designed for greatness. He played the mandolin.

In those distant days it was *the* instrument for an up-and-coming college man, setting off the heavy turtleneck sweater, the beer steins, the rakish derby hat. Alas, the family never told me what music he played but I can guess. Bereaved, his mandolin was passed silently on down the family line, a black bow figuratively tied about its neck. One looked at it, so to speak, in hushed tones. Symbol of youth cut off in flower.

My brother was named after Uncle C. and inherited this special instrument as a matter of sacred family duty. But it would not speak for him. It sat around for years, with its mother-of-pearl fretwork and its dark, brooding, ship-like curved body; not even I, the musical member of the family, could get more than a dismal jangle from its broken strings. So much for the mandolin. Or so I thought.

Well, there was a big mandolin, the mandola, used by jongleurs and the like in the 12th and 13th centuries. Around the end of the 18th century the mandolin became a musical craze, modestly, following hard upon the transverse flute, its more cultured neighbor. A very respectable instrument. Beethoven wrote for the mandolin, and that neglected first-rank musician, Johann Nepomuch Hummel. Also Mozart. The mandolin had even then a clearly marked character of its own—it was definitely a serenade-type instrument, graceful and pleasant, rather than impassioned like the guitar. You will have heard Mozart's mandolin (or imitation of same) in *Don Giovanni*. The Don's serenade—what else? A peculiar sound, dry and sweet, midway between the liquid guitar, the elegant lute, and the plunking banjo, and Mozart knew exactly how to use it.

Jump a century and there it is again, but now in the 1890s used for the first "popular music," that gentle sentimentality that was heard in college rooms and a few front parlors where "classical" music would forever remain unknown. That was my Uncle C.'s time—put a rakish, flat-topped visor cap on him above the tall turtleneck, and add the mandolin. Early Gibson-boy. Around the same time, the mandolin's most striking feature became mechanized and rolled on metropolitan streets, that walking mechanical piano, misknown as hurdy-gurdy (actually a much earlier hand-held mechanical player), which rattled out "The Sidewalks of New York" and "East Side, West Side, All Around the Town" while the monkey held out his cap for coins. Remember? The mandolin has pairs of strings tuned together in unison. You play it with a pear-shaped pick and for the longer notes you vibrate that pick back and forth across the two strings for that characteristic slow *brrrrrrrr* that makes a mandolin sound like a mandolin—and a street piano sound like a street piano. Curiously, though all later mandolin composers use that effect, it is missing from Mozart. Could his mandolin have had single strings? It was, of course, a Bohemian mandolin in Prague. That's where *Don Giovanni* was composed and produced, and where practically every citizen was soon humming its tunes. Or playing them on the mandolin?

Imagine, then, my gratification when I recently discovered not one, but two different new recordings of what is now perforce called the "classical" mandolin, encompassing between them almost 200 years of mandolinic time spread. Both mandolinists are excellent, revealing a surprisingly lively and fluent technique. My Uncle C. would be astonished, if taken aback by their uncollegiate names—Scivittaro and Bauer-Sleis. Even more unsettling to him (and his *now*) would be the old fact that both are women. A lady mandolinist?? As unthinkable then as a lady Yale man or a male Vassar co-ed. Nevertheless, both these ladies, Maria Scivittaro and Edith Bauer-Sleis, are superb players. Maria is backed by no less than the harpsichordist-pianist Robert Veyron-Lacroix on Nonesuch. Edith is aided by members of the Vienna Chamber ensemble and a tenor to sing a Mozart serenade or two on Everest.

Nonesuch's Robert and Maria perform the Beethoven and Hummel, from just a century before my Uncle C.'s day. Four pieces by Beethoven, all out of that sudden 200th anniversary wealth of unknown music with the curious designation "WoO"—music without opus number—dating from the composer's first maturity. Oddly, Beethoven wrote for mandolin and harpsichord, not piano, perhaps because both are plucked by plectra. Curiously, too, the WoO 44 music, a sonatina and an andante with variations, is superficial though pleasant, whereas the earlier WoO 43 pair, another sonatina and an adagio, are full of interesting harmonies and daring modulations of key. Matter of circumstance. WoO 44 was written in Prague (1796) for a mandolin-playing

countess. Beethoven could always write convincing potboilers when so moved. WoO 43, on the other hand, was done for a professional mandolinist who obviously aroused Beethoven's musical interest.

Edith Bauer-Sleis adds directly to this musical picture via two Mozart serenades with mandolin (zither in the parlance of the time), K. 349 and K. 351, which by their sound could be no less than studies for *Don Giovanni*, if Mozart had needed to do any studying. From Mozart this disk skips lightly over and beyond Beethoven *et al* to a much later period that is another ear-opener, our immediate past—which in mandolin terms (as in guitar music) means mostly a reminiscence of the last days of Romanticism. Hans Gal, a name I had heard of in a vague way. Raffaele Calace. Norbert Sprongl. Among other accomplishments these gentry composed music for mandolin in a variably grand manner and it comes off well. The least of them, I thought is Calace, who with his brother was for the instrument what Czerny and Hanon were for the piano. Teaching methods. Exercises. And music on the side. Sprongl and Gal, born in the early 1890s, both from lower Austria, were wider-ranging musicians and their music sounds it. The Hans Gal Divertimento for mandolin and piano is a really lovely, sunny piece, full of a gentle, rather Nordic nostalgia for the old days in Vienna. Norbert Sprongl, who moved to Scotland, writes a peculiar and more incisive style that seems, such is internationalism these days, to come from a later period, France of the nose-thumbing generation, poking vulgar and noisy fun at all that was Viennese elegance at the time of WWI. But Sprongl is still a Viennese and, so to speak, takes refuge in the nearest French equivalent, the manner of Cesar Franck though without the mysticism. A curious style! Both these composers write incredibly well for mandolin, Sprongl's music blending it expertly with a guitar. All in all, I'd say, the mandolin will never be the same again once you have tried these disks.

Mandolin Music. Beethoven, Hummel. Maria Scivittaro; R. Veyron-Lacroix, hps. and pf. **Nonesuch H-71227 stereo** ($2.98).

The Virtuoso Classical Mandolin. Edith Bauer-Sleis; Vienna Chamber Ens., Kurt Equiluz, tenor. **Everest 3244 stereo** ($4.98).

* * * *

Heinrich Schutz: Psalmen David, 1619. Soloists, instrumentalists, Westphalian Choral Ensemble, Ehmann. **Nonesuch H-71235 stereo** ($2.98).

Schutz Schein Scheidt. Voices and Brass. Purcell Chorus of Voices, Philip Jones Brass Ensemble, Leppard. **Argo ZRG 576 stereo** ($5.95).

Most of the Schutz we hear was composed parsimoniously for small ensembles during the Thirty Years War. But young Schutz, before the wars began, had studied with G. Gabrieli in Venice and had enthusiastically imported the multiple-choir magnificence of the Venetian style into Germany, where the Elector of Saxony gave him full resources for the same kind of gloriously big music in German terms. Out of that early period came the settings of the Psalms of David, as sampled on the above Nonesuch record. The Venetian magnificence held over into later adversity, where it was achieved necessarily with simpler means —contrasting groups of solo voices, as in Argo's "Ich beschwore."

The earlier Schutz is hardly distinguishable from Gabrieli, if even more sonically magnificent. Later, the characteristic Schutz melody takes over, for a more personal and intense effect. The

others of the "3 SCH" composers, Schein and Scheidt, borrow some of the same Southern magnificence, though more indirectly.

Nonesuch's German recording is made in a huge and resonant space, with a typically precise choir sound—no wobbles—a passel of soloists and a considerable band of "authentic" instruments (mostly). As recorded, the acoustics interfere somewhat; rather close miking was necessary to defeat the echo overlap. But the magnificence comes through—solos, chorus, organ, band, in multiple choirs. An interesting idea was to do two versions of the hymn-based "Nun lob, mein Seel, den Herren" (using two verses of the text) according to two optional instrumentations suggested by Schutz himself. One is circumspect, with only a simple accompaniment; the other tosses in the instrumental works. The two are note-for-note the same music and we are thus given an excellent idea of the range of option allowed in productions of that time.

"Voices and Brass," from England, is a stirring recording even if technically somewhat of a throwback. Here we have a similar magnificence, in the music of Schutz, Schein, and Scheidt, and an absolutely gorgeous spread of recorded stereo sound. But the instruments are strictly modern—including those powerhouse modern brasses that so many people love in Gabrieli, however unauthentic the sound—and the solo voices are modern concert type (as though this were to be taken for granted, as it still often is). The chorus is even more so, a collection of professionally trained vocalists quite suitable for Wagner and Verdi and Puccini! Nevertheless—as so often happens—sheer musicianship wins out, not to mention splendid acoustics and superb recording. I found the record excellent, and easier to listen to than Nonesuch's more documented recording. (We must merely keep in mind that it *is* possible to have the best of both worlds: documented, authentic production *and* musical awareness.)

Performances: B+, B+ Sound: B+, A–

Copland Conducts Copland. (Our Town, Outdoor Overture, Quiet City, Two Pieces) London Symphony Orch. **Columbia MS 7375 stereo** ($5.98).

Bernstein conducts Copland. (Inscape, Connotations) N.Y. Philharmonic. **Columbia MS 7431 stereo** ($5.98).

An interesting pair of Columbia disks (added to an already impressive Copland discology in the Columbia catalogue), summing up neatly two eras of Aaron Copland's musical life, and ours. One of them surveys the Copland output of the thirties and forties, the span of his great success as a popular classics man. The other offers two recent works, altogether different and changed, yet still unmistakably Copland for those who know his music. It will be a while, if ever, before these newer works become widely popular—if ever. Does it matter? A question.

Copland's own disk, with the London Symphony, is of a remarkable consistency. These are some of those short works, derived from folk-like American legend and melody or from American life scenes, that made him a leading exponent before WW II of the theory that American music could be popular and classical too. The square, jazzy tunes, the simple, rugged major chords, often tossed against each other in what once seemed like intriguing dissonance (don't even notice it now), the wide open spaces in the music, so to speak, took much of the "highbrow" labeling off of

Canby looks at "Les Illuminations"

opera today
opera today
opera today
opera today

WHERE ARE WE GOING, in this new age of quadraphonics? Since my first mention of it a long year ago I've said nary a word—but, as the phrase goes, I've had one ear to the ground. The other has been flapping wildly in sheer excitement. It *is* a new age, even if we are far from defining its shape and parameters. Quad sound does add a fundamentally new aspect to reproduced sound, never heard before. And it is strictly a logical development out of what has already happened in the past. It will surely prevail, in spite of the present confusion.

That confusion, alas, is the price for advancement. The greater the potential of a new system, the more dismal the chaos at its introduction! Never fails. We have immense problems, this time, what with so many possible quad media, competing and not necessarily compatible, with pure quad sound—four separate "tracks"—versus various sorts of quad information coded into more economical transmissions. And there are those two big jokers, quad broadcast and quad on disks, both requiring some form of compromise, (technically speaking, not aesthetically) and/or a radical change of the rules. No wonder there's confusion. Nor do today's strident demo-promo blasts do much to help. Remember "ping-pong stereo"? We're in the same rudimentary stage with quad sound. It's awful.

Yet there is good quad sound. And there's even better quad logic. First, take my word on the sound. It has a new, unique impact when it is done right. There has been nothing like it before.

I had long noticed that ordinary good stereo sound can make its impact even around a corner and through a doorway—without any apparent spread at all. Stereo, you see, is much more than merely two speakers to right and left. It gives the ear fundamentally new things to work on, as compared to any mono transmission, and that impact is surprisingly persistent, even around corners and into other rooms. Now I am discovering that quad sound, similarly, goes *much* further than the much-advertised "surround," which supposedly plops you down right in the middle of a concert hall. (The old "best seat" all over again.) Quad brings—or can bring—a quality of definition that to my knowledge has existed only in live music. And so it should, logically.

I've heard quad sound in extreme conditions. I have heard superb quad in a closet, the tiny work room of engineer Dave Jones in New York, so filled with equipment and boxes there wasn't room to sit down. Yet, via his recording, there we were listening to a splendid big brass ensemble in a large space, without the slightest impediment! The tiny listening room simply *was not there*. We were sonically taken straight out of it.

Then there was a recent multi-media extravaganza, at the opposite pole, "Spatial Variations on Benjamen Britten's 'Les Illuminations'," a presentation of Opera Today, New York, which is given inside an airy hemisphere of linked metal circles filled in with stretch cloth, and includes not only music recorded in quad but live music too, plus a troupe of live dancers, six film and eight slide projections (of the same dancers), all this going on at once.* In New York the show occurred improbably on the floor of a huge enclosed armory, the quad "surround" dwarfed by the vast surrounding arena; and the music was for chamber string orchestra and solo tenor! For once, here was small music in a vast space, instead of the more normal opposite.

Yet even as I climbed the stairs of that enormous building, late, I heard it unmistakeably. The sound of quad stereo, the sound of *live* strings, though I was completely outside the stereo surround of the four channels. It hit me in seconds. No earlier type of recording could have done it.

This beautifully produced show did more than that for my ears. It combined recorded music with live—the solo tenor sang in the flesh, against the quad sound of strings. But he also took part in the dance pantomime, and at those moments his voice was unobtrusively taken over into the quad sound. He stopped singing, *but the voice went right on*. Excellent! I was not aware of any changeover. The moral of this is that with quad we have more closely approached live sound and thus we can mix live and recorded music with a wholly new effectiveness. That mixture, as we know, is a big thing in the arts now, all the way from the corniest pop to the classiest classic. More quad versatility.

Even at the noisy Consumer Electronics Show last spring, with a thousand demos going on in two huge New York hotels, I heard the unmistakeable quad sound. Telex, for instance, bravely set up a quad demo right on the ballroom floor, out in the open in the midst of a raucous babble of other demonstrations. No more than a few partial reflectors, plastic room dividers, with walk space between, the four minimal speakers mounted overhead—yet as I walked through, there was that sound again! Against incredible odds. Just because most of the other quad demos at the show chalked up a zero for my ears doesn't lessen my respect. They'll learn.

What is the logic of quad sound? There is only one logic, and it applies to all of the variations and the systems we have been hearing, without exception. Quad sound aims to take us further in the direction where we have always been going, towards *greater information density for the listening ears*. Not more sound, but more kinds of sound, for the ears to work on.

Do not be misled by the "surround" hoopla. We have had "surround" sound with us ever since the earliest days of electrical mono recording, via the walls and ceilings of our listening rooms. We are *always* surrounded by sound, whether it's mono, stereo, or what have you. Even in our automobiles. (Only pop music at the beach is a real exception!) Our recordings have reasonably assumed that room reflection would help to create that sense of a larger, other space which is the aim of virtually all modern recordings of any sort. (One in a thousand actually brings an instrument *into* your living room.)

In mono, we could create a surprisingly real space outside our living rooms, even a Carnegie Hall, by recording the hall liveness with the music and spraying the

mixture into our listening space for all-around reflection. And this even though that space was non-dimensional—you could not point and say, *there are the violins;* for they were everywhere, equally. No differentiation. No matter—it worked. The room itself did it and, as we know, the room and the speaker placement were crucial for good listening. At best, we did not hear the mono speaker as such; we heard the music and its space, spread out before us. Quite a trick, all things considered.

Stereo sound took over the important end of the listening room, up front where the ears are most sensitive, to project newly differentiated sounds towards the ears, left and right. A deeper, more immediate space, a certain degree of actual spatial direction—the violins were, at last, on the left. (In concert your eyes do most of the direction finding, remember.) Stereo at best is an immense improvement in conveyed useful information—but note well that *the room is still there.* Three sides of it still operate as before, bouncing now a double echo but still surrounding you with sound, as always. Our stereo recordings take this into account, and count on it. In good stereo, we are still inside our rooms (or our autos) but we have moved *almost* into that other created space brought to us by the recording—we have a foot over the threshold, and the other space extends around us to each side, whenever the recording people want it to. (Stereo signals definitely create images out *beyond* each speaker, at the sides.) That is the increased versatility of the stereo recording process.

Yet look—the back of the room and the sides are still no more than passive reflectors, just as before. They work hard for you, but they merely follow along after the up-front power-signals. Like railroad cars following an engine. They contribute no new information; they merely help to process and distribute the old, for best effect.

It was inevitable, given the technology, that we should move on to a still further display of new information for the ears. Let's power up those rear spaces, take them over much as we have taken over the front end. Then we will no longer have an active front and a passive surround—we can control and manipulate sound projection not only in front but from all around. The basic result? Less listening room, more re-created space, to taste. We have, in theory at least, very nearly eliminated the listening room itself (though it still reflects, and must be taken into account). We are, indeed, "in" the recorded space, in whatever fashion the recording engineer desires and the music requires. There is a potentially much greater control over the effect of the recorded sound. And, because it gives more clues to the ear that are of the sort we hear in live sound, quad sound (again—when done right!), is closer than ever to a parallel with the live situation.

Not, mind you, a literal reproduction of the concert hall, though to a new degree that is possible in quad sound. Unimportant! What matters is a new versatility and a new control, over all kinds and degrees of recording and reproduction. This is the aim, in the last analysis, of every one of the new systems that has been offered for our consideration—even to those which merely process a two-channel stereo recording into a synthetic four-channel sound. There are, after all, four *different* sounds coming from four different directions, even if synthesized. With good taste, with experience, the synthetic quad sound can be a useful improvement over straight two-channel reproduction. So, too, with all the variants, from purely synthetic quad all the way to purely four-channel with total separation. Every one of them aims,

(Continued on page 107)

BW—Thanks for the compliment. After you've been doing this as long as I have, you sort of get the hang of it.

BW—*What kind of mikes do you use?*

BH—Mostly high-quality dynamic cardioids. With the tight pattern and the back cancellation, I can keep down the crowd noise.

BW—*After you make your tapes do you do any work on them at home, try to improve them with editing, or adding reverb . . . things like that?*

BH—No, as a matter of fact I don't believe in tampering with my tapes. I want the original, with no gimmicks. I'll tell you, I don't believe in all this splicing and editing they do on commercial recordings. I have wanted to release an album of my own, free of editing. If there is a mistake, it proves we are human. I think we get a better, more spontaneous performance this way.

BW—*But Bobby, on a recording if there are mistakes, one hears them over and over, and if you play the record a great deal, you get to anticipate the errors and this could drive you batty.*

BH—Well maybe so, but one of these days I am going to make a record like that.

BW—*Feeling like you do about tape gimmickry, you must be appalled when you walk into one of the modern recording studios where they may have up to 24-track recorders and each musician can be, and often is, miked separately and assigned to a specific channel.*

BH—I don't know how they do it . . .it's almost frightening. I should think some of the results would be very stilted and artificial.

BW—*Bobby, you have been playing recently at the Roosevelt Hotel in New York at the 5 o'clock cocktail hour.*

BH—Yes, the quintet plays up to 8 and then the "World's Greatest Jazz Band" takes over.

BW—*I understand the cocktail hour bit was considered an innovation. That is funny. You remember years ago, you would be in an office and at day's end you would ask a chick to have a drink with you and you could go to a number of spots and there would be a group like you. Innovation indeed!*

BH—Yeah, it is kind of a laugh.

BW—*I've heard that the appearances of the "World's Greatest Jazz Band" and your quintet at the Roosevelt were partly subsidized by this fantastic young man, Dick Gibson.*

BH—That's right.

BW—*Isn't he the party who invented the "Water Pic," the teeth-cleaning device, and then eventually sold the rights to it for millions of dollars?*

BH—Yes. Dick Gibson is one of the best friends jazz has ever had. He puts his money where his mouth is.

BW—*I think he is doing a great thing. I feel if more of the young people could hear good jazz, both small groups and big band stuff, they would get over their rock neurosis. Maybe Mr. Gibson might sponsor some jazz concerts for the kids one of these days.*

BH—Here is some news for you along those lines. Dick has interested the impressario Sol Hurok in the "World's Greatest Jazz Band," and Hurok is supposed to have booked more than a dozen concerts across the country.

BW—*You mean concerts in a nice big auditorium, classical style?*

BH—Absolutely. This could really get things moving in the jazz field.

BW—*Bobby, speaking of the young people, do you ever play any rock? What is your opinion of their music?*

BH—Very rarely. 99 percent of the rock stuff is junk, but the kids are gullible and they pay attention to what some people tell them to listen to.

BW—*Don't you like any of the Beatles' stuff? Their music is supposed to be a few cuts above the usual rock.*

BH—I'll take Cole Porter. Let me tell you something, Bert. I've had big bands I've led recently at colleges across the country. You know, the typical good music that people used to like to dance to. Well, at several colleges we were in one big hall and at the same time some rock groups were in an adjacent hall. I was told that there was very sparse attendance at the rock hall, while our hall was jammed. I think it is just a question of somehow exposing the young to good jazz and big-band music and we'll wean them away from the rock junk.

BW—*What are your plans now, Bobby?*

BH—I've got a very nice engagement at a fancy resort in New Hampshire for ten weeks this summer. I'll have a really swinging bunch in my quintet, too. I've rented a nice house up there and it has a big living room where I can play my stereo.

BW—*You're taking a stereo system with you?*

BH—I just acquired a big Kenwood receiver and I am going to use that with a pair of Bose speakers and my ReVox. I don't like to be without a playback system if I can help it.

BW—*Bobby, I could spend hours more talking with you, but I know it's time for practice. Thank you for a most pleasant visit.* Æ

▪ ▪ ▪ Les Illuminations

Continued from page 105

at least, to add new kinds of information to the sound we already have. And that is good.

Do I hear the soft sound of money? Of course. Nobody denies that a big reason for the appearance of quad is the need of the market place for new gimmickry. I merely point out to you that even though most of the promoters don't even know it, there *is* fire behind all that smoke, and behind the billowing clouds of present quadra-hot-air. Give us time! All in due course.

**Spatial Variations on Britten's "Les Illuminations," French text by Rimbaud, for tenor and string orchestra. St. Paul Chamber Orch., Herbert Kaplan; Michael Best, tenor. Quad sound by Sound 80, Minneapolis. Norman Walker Dance group, New York. Elaine Summers, color photography. Hemisphere by Omniversal, Roxbury, Mass. Artistic Director: Pat Collins. Gen. Manager: Al Berr. Presented in New York, June 1970 and at the Lake George Festival, N.Y., week of August 10.*

▪ ▪ ▪ Copland conducts Copland

Continued from page 103

this symphonic output. Almost anybody could listen to Copland—and recognize America. Even the British (who aren't good at this sort of playing) manage very well here, with Copland's own infallible direction to keep things in an American style.

"Inscape" (a species of landscape, figuratively speaking) and "Connotations" (1967, 1962) were among the works in which Copland finally took up the Schoenbergian serial system, now that it had emancipated itself from its earlier Germanic connotations. Like his works of the 1920s, these two are not in the least "popular" nor in any way derived from folkish or nationalistic themes. The extreme opposite, indeed! They are musician's music, for musicians, and perhaps stem naturally from the fact that over the last quarter century Copland has become a sort of dean of American composers and the leader wherever music schools, symposia, summer institutes, convocations and the like have brought professional musicians and teachers together. He lives in that world, and writes for it.

One work, by the way, celebrated the opening of New York's Lincoln Center, the other the 125th anniversary of the New York Philharmonic. So you see where it's at.

Performances: B, B *Sound: B, B*

NOW MUSIC

SHERWOOD L. WEINGARTEN

Dennis Lambert and Brian Potter have produced an album for a quintet, The Original Caste, entitled ONE TIN SOLDIER (TA-Bell, TA5003). The pair also wrote seven of the ten songs included (the others were penned by Bruce Innes, a member of the singing group).

Among their compositions is the title tune, an allegory with a "peace on earth" theme that is particularly poignant. And they also deal in apathy and fearfulness toward change, as in "Mister Monday"

Not incidentally, the quintet—Innes and three other males, Bliss Mackie, Joe Cavender, and Graham Bruce, and one gal, Dixie Lee Innes—have a pleasant and exciting sound, not unlike the Fifth Dimension at times. All the arrangements, by Artie Butler, have that contemporary pop feel that will allow you to concentrate on the music rather than the lyrics if you want to hide.

° ° °

A folksinger who is one of the few writers to add humor to his propaganda is represented by a new disk, TOM PAXTON 6 (Elektra, EKS-74066), that is a total joy. Contained is a variety of moods (from the spoofing but significant "Forest Lawn" to the patriotic but anti-war "Jimmy Newman") that have one thing in common—listenability.

The initial composition, "Whose Garden Was This?" is a simple song picturing man's destruction of natural beauty, and "Molly Bloom," in contrast, is an affectionate pat on the lip to James Joyce's famed badmouth. "Dogs at Midnight" is a supercharged portrait of a coal town and the gloom surrounding it, while "Crazy John" is a paean to Beatle John Lennon, a plea for change and acceptance of it.

The best number, however, is the lighthearted yet serious "Forest Lawn," a barbed look at the high cost of dying and the hypocrisy that surrounds some rites.

° ° °

Can many of today's problems be summed up in one song? Sure, if the composer is Sixto Rodriguez, a product of Detroit's ghetto life. The Mexican-American, who combines in his voice the

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gruffness of Bob Dylan and the sweet soulfulness of Jose Feliciano, escaped from that ghetto but carries it with him —a fact that's obvious from one hearing of COLD FACT (Sussex-Buddah, SXBS 7000).

Of the dozen tunes on this, his first, album, he is best on "This Is Not a Song, It's an Outburst; Or, The Establishment Blues," which is in reality urban-contemporary-dissatisfaction blues wrapped up in a unique Rodriguez package—a minor masterpiece.

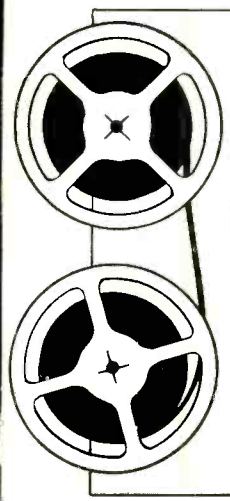
CAPSULE CRITIQUES

. . . SELF PORTRAIT (Columbia, C2X 30050) is a two-disk package that shows how deeply Bob Dylan is *into* country music. The 24 tunes range from a rockin' instrumental ("Woogie Boogie") to a repetitive choral outing that is completely sans Dylan ("All the Tired Horses") to Dylan trying to be a crooner ("Blue Moon"). The composer who set the style for folk-rock *tries* to sing and *almost* makes it, both with his own songs and those of others (including Gordon Lightfoot and Paul Simon).

. . . ENVIRONMENTS (Atlantic SD 66001) is most certainly an audio buff's delight. Side One, "The Psychologically Ultimate Seashore," is 30 minutes worth of waves' sounds—at 33⅓ rpm, that is. It also is playable at 45 rpm (22½ minutes) and 16⅔ rpm (an hour). The second side, "Optimum Aviary," which requires a reduction of the treble, can be spun successfully at either 33⅓ or 16⅔. According to the liner notes, one of the values of the disk is that, "if used while reading, comprehension and reading speed improve noticeably. If used at mealtime, appetites improve. Insomniacs fall asleep without the aid of drugs. Hypertension vanishes . . ." Still, it's mainly for sound buffs.

. . . ONE TIME IN A MILLION (RCA Victor, LSP-4356) features a 14-year-old, Browning Bryant, whose voice recalls that of a young Wayne Newton. Among the 11 tunes he renders, all in straight pop fashion, are "Yesterday," "Sweet Caroline," "Raindrops Keep Fallin' on My Head," "For Once in My Life," "What the World Needs Now," and "Jean."

. . . IRON MOUNTAIN DEPOT (RCA Victor, LSP-4337) showcases the banjo-pickin' talent of John Hartford, and his composing virtuosity as well. His voice, unfortunately, doesn't compare with the other attributes. It's all country-pop in format, and, for the most part, pleasant. Æ



Recorded Tape Reviews

BERT WHYTE

Beethoven—The Nine Symphonies
Herbert von Karajan conducting the Berlin Philharmonic Orch. Ampex/Deutsche Grammophon DGU-101, 7½ ips open reel

I don't know the price of this monumental set, but on the basis of five very full reels, it would have to be somewhere around $50.00. Obviously this release is Ampex' bow to this special Beethoven year, and one must admit it is quite a gesture!

It is rare to find any critics who agree on Beethoven performances, especially of the symphonies. On an individual basis, von Karajan's readings of the symphonies have been praised and damned with equal fervor. As a complete set, it has fared better, probably as much from the superior sound as from the performances. Personally, I am much taken with the performances of the 3rd, 6th, and 9th symphonies, and find the others more than acceptable. In fact, on balance it is probably the best of the complete sets. I admit that my opinion is strongly re-inforced by the superb playing of the Berlin Philharmonic and the generally clean, well-balanced, and spacious but well-detailed sound. Needless to say, for those to whom von Karajan can do no wrong, this set of tapes would be the gift par excellence!

The Concert Sound of Henry Mancini: Henry Mancini & his Orch. RCA PK-1226, **cassette,** ($5.95)

We are on familiar ground here, this program having appeared previously in disc, open reel and cartridge formats. Mr. Mancini is responsible for all of the arrangements, which generally means they are tasteful, well-balanced and musicianly. The cassette is loaded with good pop material . . . "The Music of David Rose", "Academy Award Selections", "A Tribute to Victor Young" and "Peter Gunn Meets Mr. Lucky". The orchestra plays well for friend Henry and the sound is typical of today's good multi-mix techniques . . . big, bright, close-up with plenty of power and with judicious use of reverb to lend spaciousness, without obscuring detail. Hiss level good for a cassette, but still too obtrusive. No print-through, however, nor did I detect more than a random sprinkling of drop-outs. As background music, you can't go wrong with this one.

Bizet—Carmen (highlights)
Leontyne Price, Franco Corelli, Robert Merrill; Herbert von Karajan conducting the Vienna Philharmonic Orch. RCA **cassette RK1036,** ($6.95)

von Karajan again, this time his excellent rendering of "Carmen." Blessed with a superior cast and the great Vienna Philharmonic, this is a "Carmen" that is always lyrical, yet is tautly paced to maintain the flow and action of the opera. All the big numbers are contained in these highlights . . . the "Habanera," "Gypsy Song," "Toreador Song," "Flower Song," "Card Scene," etc. The sound on this cassette is good . . . the voices are clear and articulate, the orchestral parts quite clean, and a good balance is maintained between voices and orchestra. What is missing is the dynamic range we are accustomed to, a fact which is attested by the all too pervasive and obtrusive tape hiss. Opera on cassette is a convincing argument for some sort of automatic reversing system, so that continuity can be maintained.

JOY—Original Cast Recording
RCA **cassette OK1045,** ($6.95)

This production takes a bit of getting used to . . . the idiom in this "way out" musical, falls strangely on this reviewer's ears. It is a rather small-scaled affair, with the main roles performed by Oscar Brown, Jr., Jean Pace, and someone simply called "Sivuca." The songs are racially and "peace movement" oriented, but they are fascinating for the strange rhythmic patterns formed by the voices and instruments. The more you listen, the more you discern and in many places I was reminded of the vocal/instrumental accents and interplay of Orff's "Carmina Burana." Good clean sound throughout, with lower-than-usual tape hiss. An offbeat item you might find interesting.

Andre Kostelanetz—Greatest Hits of the Sixties. Columbia HC1247, **open reel;** 3¾ ips, $5.95

Columbia has not released many 3¾-ips open-reel tapes, and certainly has not made any fanfare about what few they have issued. In any case, the reduction in speed has not meant any diminution of quality on the basis of what I heard on this tape. Frequency response is still quite wide, transient response excellent, no audible distortion. The program is as typical as the title of the tape . . . consisting of such blockbusters as "Hello Dolly," "Mrs. Robinson," "Born Free," "The Look of Love," and others in the same vein. They are all dressed up in the usual lush Kostelanetz arrangements and though there is nothing earthshaking here, this can serve admirably as easy listening for the summertime. Æ

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Ampex model 600 tape recorder. Mono, good working order. Barclay, Park View Apt. 406B, Collingswood, N.J. 08108.

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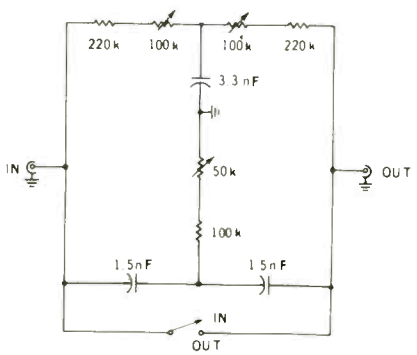
ERRATUM

How to align your stereo tuner

This is how Fig. 3, (page 20, July issue) should have appeared. Note that three of the resistors are actually variable pots—which of course makes it much easier to adjust!



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