

# Audio

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JULY 1976

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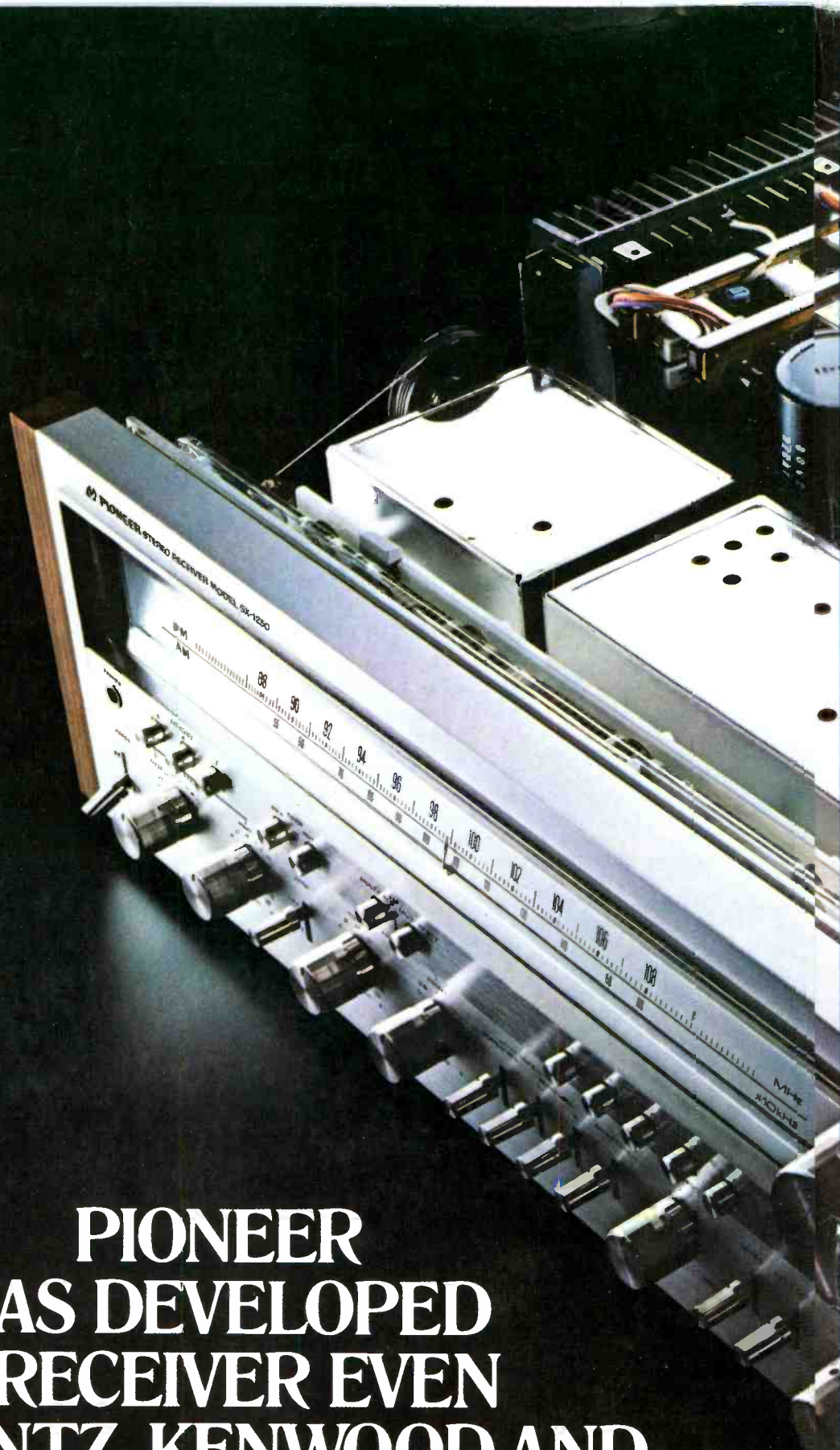
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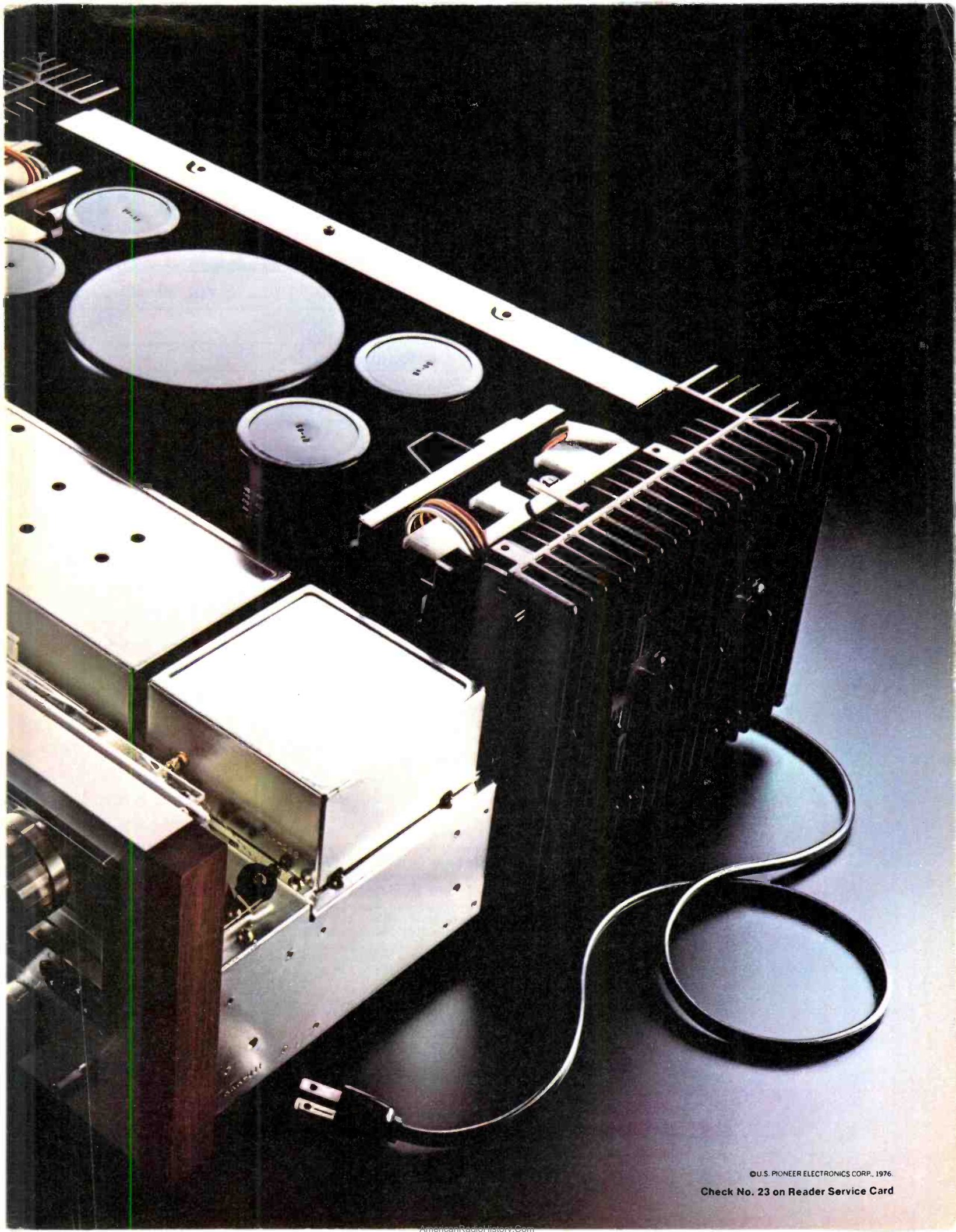
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July 1976

"Successor to **RADIO** Est. 1917"

Vol. 60, No. 7

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**AUDIO** (title registered U.S. Pat. Off.) is published monthly by North American Publishing Co., Irvin J. Borowsky, President; Frank Nemeyer, and Jay L. Butler, Vice Presidents; R. Kenneth Baxter, Vice President/Production; Vic Brody, Promotion Director; Mary Claffey, Circulation Director.

**RATES**—United States only: 1 year for \$7.00, 2 years for \$12.00, 3 years for \$17.00; outside the U.S.: 1 year for \$9.00, 2 years for \$16.00, and 3 years for \$23.00. Printed in U.S.A. at Columbus, Ohio. All rights reserved. Entire contents copyrighted 1976 by North American Publishing Co. Second class postage paid at Philadelphia, Pa. and additional mailing office. Back issues, \$2.00 each. **World Library Congress** number: ISSN 0004-752X. **Dewey Decimal** number: 621.381 or 778.5.

**REGIONAL SALES OFFICES:** Jay L. Butler, Publisher and Sanford L. Cahn, Marketing Director, 41 East 42nd St., New York, N.Y. 10017, telephone (212) 687-8924.  
Jay Martin, 2525 West 8th St., Los Angeles, California, 90057, telephone (213) 385-2917.

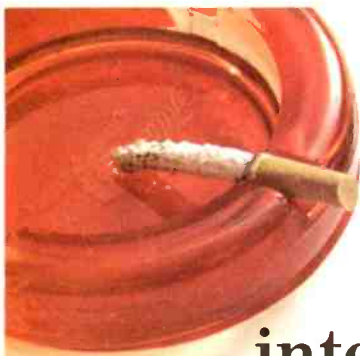
**REPRESENTATIVES: Continental Europe:** V. B. Sanders, International Publishers Advertising Service, Raadhuisstraat 24, Graft-De-Rip, Holland, telephone 02997-1303.

For Benelux and Germany, W.J.M. Saunders, Mgr., Herengracht 365, Amsterdam, Holland, telephone 24.09.08.  
**Japan:** Japan Printing News Co., Ltd., No. 13-2 Chome Ginza Higasi, Chuo-ku, Tokyo, telephone 541-5795.

**AUDIO** Editorial and Publishing Offices, 401 No. Broad St., Philadelphia, Pa. 19108

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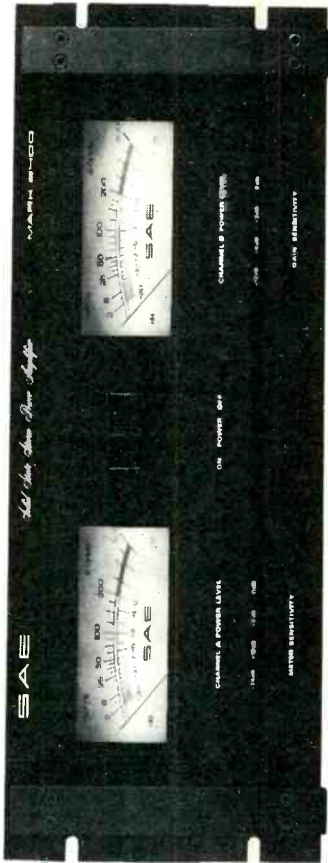
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# Audioclinic

Joseph Giovanelli

## Storage of Phonograph Records

**Q.** Please tell me what is the best way to store stereo LPs. I understand that storing them vertically is the best way to avoid warpage.—Peter Bellavigna, Massapequa, N.Y.

**A.** The best way to store phonograph is vertically. This is to avoid having a lot of weight on the bottom of a pile of horizontally stored records.

Vertical storage can also have its drawbacks if discs are permitted to lean over at too great an angle. This would cause them to warp.

## Intermittal Hum In a Record Player

**Q.** From time to time, while playing a record, a 60 Hz hum is heard from both speakers. It begins at a low volume and quickly increases in volume until it is louder than the music. By turning off the receiver for a moment, the hum is eliminated. I would like to determine the cause of this in order to eliminate this hum permanently.—Rocky Strickland, Dallas, Texas

**A.** There are many possible causes for the intermittent hum in your equipment. Assuming the receiver is indeed at fault, the most logical possibilities are poorly soldered ground connections or cracked circuit board

foils associated with the grounds for the phono input connectors or stages. If you had said that the hum was 120 Hz, rather than 60 Hz, in frequency, I would then have had to consider the possibility that there were poorly soldered filter capacitor grounds or perhaps defective filter capacitors.

Other possibilities include poor contact between the shields of the phono input connectors and the plugs. Squeeze these connectors to be certain that they mate up tightly with the input jacks.

You might have a loose cartridge lug in the tonearm. Squeeze each one lightly with pliers so that they slide over the terminals of the cartridge with a bit of pressure.

If your tonearm is equipped with replaceable cartridge holders, check the contacts between the holders and the innards of the arm. Clean the contacts with suitable contact cleaner. Depending on the design of the holder and contact strip, perhaps some mechanical bending is possible and desirable to insure good pressure when the holder is in its place.

Check solder connections on the cartridge slide lugs, as well as those which interconnect with fine tonearm leads with the heavier cable which plugs into the phono inputs.

The bearings, which pivot both horizontally and vertically as the arm traverses the disc, are often used to ground the arm. If these bearings are oxidized, intermittent hum can result. I have found that WD-40 works well for cleaning these bearings.

Even though none of these factors deals with the receiver, turning the receiver off for a second and then turning it back on, can cause the hum to stop. This may have to do with the fact that the connections are shaken as you move near the equipment.

If you have a problem or question on audio, write to Mr. Joseph Giovanelli, at AUDIO, 401 North Broad Street, Philadelphia, Pa. 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.

**About the cover:** This month we are celebrating the bicentennial of our country's founding, and it seemed nice to us to have the cover of this car stereo issue photographed in front of Independence Hall in downtown Philadelphia. Equipment is through the courtesies of Nakamichi and ADS. Model: Nelson Strubinger.

# Some reasonably unbiased suggestions on how to select your next record player.

Since you read this magazine, chances are you already own a record player. If you're considering replacing it, it probably no longer meets your requirements. One way or another.

For example, if your turntable operates only manually, you may now prefer the convenience and safety of automatic operation. If it already provides automatic start and stop, but only in single play, you may now want the ability to play a series of records in sequence and without interruption.

You may also be taking an expensive risk with your records every time you play them. Remember: your record collection probably costs more than the rest of your equipment combined. This alone should prompt you to give thought to a new turntable.

For years, Dual's approach has been to build every turntable with more precision than your records are likely to need. Since we traditionally lead the state of the art, every Dual tonearm produces optimum performance from today's finest cartridges and maximum longevity from every record.

This is as true of the least expensive Dual, the 1225, as it is of the CS701. All Dual tonearms, for example, follow the same basic design principles: straight line between pivot and cartridge for maximum rigidity and lowest mass; dynamic balance maintained throughout play; stylus pressure applied around the vertical pivot; anti-skating that automatically compensates for the inherent changes in skating during play.

As for rumble, wow, flutter and deviation from speed accuracy, all are far below audibility in every Dual. (With the direct-drive CS701, they are virtually unmeasurable.)

We don't suggest that Dual is the only quality brand turntable available. But where Dual does indeed stand alone is in the many years of proven reliability and durability. For example, many Duals that come in for servicing (usually only for lubrication and cleaning) are more than ten years old. And many Dual owners tell us (via letters and warranty cards) that they now own their second Dual... usually for their second system.

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Dual 1249.



Dual CS701.

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# Tape Guide

Herman Burstein

## Improving Response

**Q.** I have a tape recorder which is rather old but still has a lot of use in it, a Wollensak 1980. I am concerned

about the playback response of this machine in comparison with two Sonys I have. When I record a tape on the Wollensak and play it back on one of the Sonys, it sounds very much like the record; but if I play it back on the Wollensak, it is definitely lacking some bass and treble. I don't think it is a case of worn heads; the Wollensak has never had the bass and treble response that the Sony machines have. These machines are played back through a pair of AR-3 speakers; if there is any bass to be found, this system will find it. I would like to know if there is any way that I could get the Wollensak modified so that it will equal the Sony machines in playback.—Robbin Hodge, Watertown, N.Y.

**A.** I think that a new head, with a narrower gap than the original one, would improve the treble response. (Nortronics makes a wide line of replacement heads.) As for better bass, I believe this would require an appropriate change in the playback equalization of your Wollensak. A competent technician, with the circuit of the Wollensak before him, should be able to quickly figure out how to increase the bass response, probably requiring only the replacement of a resistor or capacitor.

## Recording "Stutter"

**Q.** I have a Philips open-reel, portable tape recorder. It is a fine machine and until recently has given very good service. However, of late the recording function seems to have developed

a problem. There is a certain shakiness in recording. It is not flutter, because playback remains perfect. It sounds like poor tape-to-head contact, but after replacing the pressure pad and thoroughly cleaning the heads there remains a slight "stutter" in recording.—Phil Hjemboe, Green Bay, Wis.

**A.** You can probably determine if your problem is poor tape-to-head contact by using a pencil or similar object to achieve good contact between the tape and record head; you can usually find a place where to apply the pencil in order to increase tension and thereby contact. If the cause is poor contact, it may be that your new pressure pad is of improper material or improperly positioned. Check the pressure pads for the other heads. If poor contact is not the cause, some faulty component in the record electronics, including the bias oscillator, may be responsible. Also check the cable connections between your program source and the tape deck.

## Treble Loss

**Q.** When I listen to either my tuner or my turntable, I get a pure sound. The same holds true when taping and monitoring the source. When monitoring the tape, the sound is pure from the tuner but muted from the turntable. It seems as if the highs drop out. I'm sure my recording procedures are correct. I've had the tape machine checked, and they said that with their instruments they couldn't detect any significant difference between tape and source performance. Is there some sort of mismatch involved?—Fred Hobson, San Francisco, Calif.

**A.** My guess is that you are overloading the tape with the sound from your turntable. The signal sent out by FM stations is usually compressed to a substantial extent. That is, the peak

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 401 North Broad Street, Philadelphia, Pa. 19108. All letters are answered. Please enclose a stamped, self-addressed envelope.



the audio amateur?

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The SC-3000 and SC-3003, top-of-the-line models with 0.09% (WRMS) wow and flutter are stacked with attractive features: front-access tape compartment positioned right-side up, fully automatic stop-shut/off, a reliable and easy-to-read 3-digit tape index counter with a very useful Memory Rewind Section, highly accurate VU meters, peak level indicator, extremely hard Permalloy record/playback head for long life and outstanding performance.

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Sansui has stacked its decks. Stop in at your nearest franchised Sansui dealer today and buy one of these outstanding new Sansui series to stack yours.

<sup>\*</sup> Dolby is a trademark of Dolby Laboratories Inc.  
<sup>\*\*</sup> The value shown is for informational purposes only. The actual resale price will be set by the individual Sansui dealer at his option.  
<sup>1</sup> Simulated walnut grain



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signals are reduced to prevent excessive modulation. Accordingly, in recording a tape you don't run into much danger that treble signal peaks will overload the tape. However, there may be substantially less compression in the case of a high quality phono disc. Hence, there are treble peaks which may overload your tape. Try recording at lower level from your phono discs.

### Playback Volume Lower

**Q.** I have a Dokorder tape recorder and an Akai tape deck fed to my Kenwood receiver through a Pioneer verb amplifier. I would like to know why my volume level is lower when playing back identical tapes through my tape recorder? It would seem just the opposite since my recorder has its own amplifier.—Ronald Slakie, Tacoma, Wash.

**A.** Many recorder amplifiers have gain of unity or even less. Thus the term "amplifier" is somewhat misleading. What happens is that gain is consumed by equalization. To illustrate, the way we get bass boost is by first amplifying all the frequencies and then selectively reducing the treble tones, thus leaving the bass tones at a higher level than the rest, but not necessarily at a higher level than originally. This would explain the loss of gain when playing through your tape machine.

### Tape Performance

**Q.** How do you feel about 1 1/2 mil vs. 1 mil tapes? I use the former for less print-through and greater strength. Some people say it is too stiff for proper contact with the heads. I am not concerned about recording time, for I am using 10 1/2-in. reels, and cost is not important. I am seeking maximum performance.—Richard Minke, Woodville, Ohio

**A.** Where home recording is concerned, 1 mil tape seems to be entirely satisfactory so far as print-through is concerned, provided you stay within recording levels that do not cause excessive distortion (recording companies, at least in the past, have often gone above such levels in their desire to improve S/N and therefore have run into appreciable problems of print-through). As you have been informed, 1 mil tape has the advantage of being more limp and therefore conforming better to the head contour so as to preserve high frequency response. In the present state of the art, my vote is for 1 mil tape in home use.

# The end of the war between art and engineering.



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Features and specifications as published by respective manufacturers in currently available literature

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# THE TAPE THAT FOR MOST

Maxell tapes are not cheap.

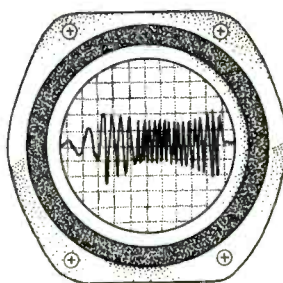
In fact, a single reel of our most expensive tape costs more than many inexpensive tape recorders.

Our tape is expensive because it's designed specifically to get the most out of good high fidelity components. And unfortunately, there's not much to get out of most inexpensive tape recorders.

Second, we're very careful.

**Nothing gets into our tape until it's been tested out.**

For example, every batch of magnetic oxide we use gets run through an electron microscope before we use it. This reveals the exact size and proportions of individual particles of oxide. Because if they're not perfect, the tape won't



We know how good our tape will sound because we've listened to it. We know how good our tape will sound because we've listened to it. We know how good our tape will sound because we've listened to it. We know how good our tape will sound because we've listened to it. We know how good our tape will sound because we've listened to it.

our cassettes and reel-to-reel tapes. Which is something no other tape company bothers to do.

**Our cassettes are put together as carefully as our tape.**

Many people don't realize it, but a cassette is actually a part of a tape recorder's drive mechanism.

So we make our cassettes better than we have to.



So it makes no sense to invest in Maxell unless you have equipment that can put it to good use.

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It's not difficult to make tape.

What is difficult is making great tape. Tape that's absolutely quiet, has no dropouts, is free of distortion and covers the entire audio spectrum flawlessly.

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And since even a little speck of dust can put a dropout in tape, no one gets into our manufacturing area until he's been washed, dressed in a special dust-free uniform and vacuumed. (Yes, vacuumed. From the top of his head to the soles of his shoes.)

Unlike most tape-makers, we don't test our tape every now and then. We test every inch of



Every employee, vacuumed.

No other tape starts off by cleaning off your tape recorder.

blank, unrecorded tape. (And if we hear anything, you never get to hear the tape.)

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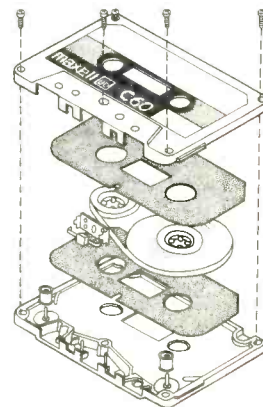
**We clean off the crud other tapes leave behind.**

After all the work we put into our tape, we're not about to let it go to waste on a dirty tape recorder head. So we put non-abrasive head cleaning leader on all

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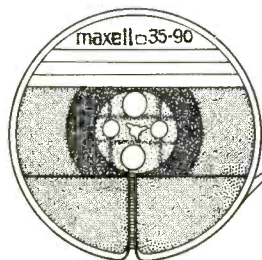
A lot of companies weld their cassettes together. We use screws. Screws are more expensive. But they also make for a stronger cassette. They act like steel reinforcing rods. (They also give you a way to get inside in the event that you ever need to.)

And before any cassette gets a Maxell label, it gets hit with a heat and humidity test that you couldn't tolerate. This is to make sure you'll never get stuck with a Maxell cassette that sticks.

**Our \$7.50 tape comes with a better take-up reel than most \$400 tape recorders.**

There are those who buy their first reel of Maxell tape just to get their recorder a better take-up reel.

That's because we've put more time, effort and polystyrene into our reels than other companies. Which has made our reel stronger, more rigid and less likely to warp than



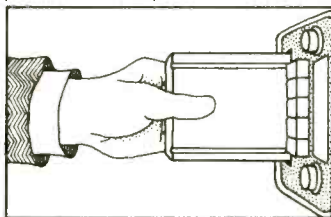
There's no way dust is going to get in here.

others.

Also, unlike other take-up reels, ours has no holes in it. This not only keeps dust from getting on our tape, it keeps the tape more accurately centered on the reel.

**Our 8-track tape can get more performance out of any 8-track player.**

We've found that many of our 8-track tapes end up in underpowered 8-track automobile players. So our top-of-the-line 8-track cartridges come with high-output tape. It has a bigger signal, and a better high end than any other 8-track tape. Which means any 8-track player you put it in will put out a



A quick way to upgrade your 8-track player.

higher sound level, at a lower volume setting.

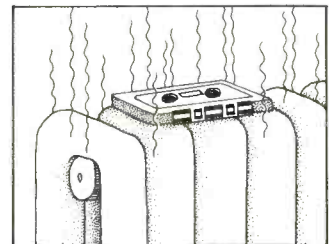
**Our tape comes with a better guarantee than your tape recorder.**

Nothing is guaranteed to last forever. Nothing we know of, except our tape.

We figure, if you've invested in the kind of equipment that can properly use our tape, you're not apt to misuse it.

So anytime you ever have a problem with any Maxell cassette, 8-track or reel-to-reel tape, you can send it back and get a new one.

**Give our tape a fair hearing.**



Our guarantee even covers acts of negligence.

You can hear just how good Maxell tape sounds at your nearby audio dealer. (Chances are, it's what he uses to demonstrate his best tape decks.)

You may be surprised to hear how much more music good equipment can produce when it's equipped with good tape.



Maxell Corporation of America, 130 West Commercial Ave., Moonachie, N.J. 07074

Check No. 18 on Reader Service Card

# What's New in Audio

## Avid Speaker



Model 101 is a two-way, 4-driver column design, using a large, vented enclosure for extended bass with medium efficiency. Frequency response is 30 Hz to 18 kHz  $\pm 3$  dB, with 180 degree high-frequency dispersion. Model 101 has a five-year warranty. Price, \$135.00.

Check No. 90 on Reader Service Card

## Micro-Acoustics Cartridge



The Model 2002-e is a low-mass stereo cartridge weighing four grams with an electret transducer coupled directly to the beryllium stylus cantilever. Claimed response is from 5- to 20,000 Hz  $\pm 1.5$  dB at tracking pressures of one gram or less. Price: \$115.00.

Check No. 91 on Reader Service Card

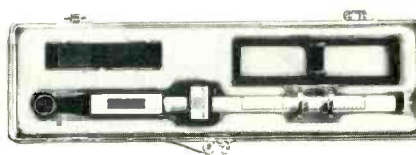
## AudioMobile System



The SA500 is a 50 W rms component stereo system for car radio systems consisting of a d.c. coupled amplifier, a preamp/equalizer, and a two-way, four-speaker, tweeter and woofer kit with grilles. The unit is compatible with any car radio or 8-track/cassette signal source. Price: \$388.00.

Check No. 92 on Reader Service Card

## Stylus Balance



The Metrosound M66 stylus Balance kit enables accurate setting of stylus tracking forces to within 0.1 gram using a balance beam type system. The unit consists of a base pivot, beam with bubble level to show when the tonearm has been balanced at a particular setting, and a flat spatula to move the sliding weight along the beam.

Check No. 93 on Reader Service Card

## Thornton Oscilloscope



The 4D-10 dual-trace 10 mHz scope has an independent sensitivity on both channels and can be set from 10 mV to 50 V per cm in 12 calibrated ranges, with sweep speeds from 1  $\mu$ S per cm to 100 mS per dm. The solid-state design incorporates a trace finder, and a single control for trigger level and polarity on complex waveforms. The portable size is for both field and lab applications. Price: \$445.00.

Check No. 94 on Reader Service Card

## Blooper Correction



In the May issue we inadvertently ran a photo of the Advent 101 Loudspeaker in place of the Epicure Five in our *What's New In Audio* column. We extend our sincere apologies to both firms for this mistake, and here-with show the proper photo of the Epicure Five Loudspeaker.



# Bring home a legend.

When you go out to buy a stereo system, you'll be matching sophisticated, expensive components from a vast array of choices.

More important (because good music means a lot to you), you'll be selecting an important part of your personal environment.

So you don't want to be let down, not even a little bit. That's why the speakers you bring home should be Bose 901s.<sup>®</sup>

You'll be impressed with your new 901s as soon as you unpack them. They're much more compact than their performance, reputation, or price would lead you to believe, and they're beautifully crafted from fine materials.

By the time you have the system set up, you'll somehow be expecting something new and better in the music, something you've never been able to hear before.

You won't be disappointed.

You will hear an extraordinarily open, spacious sound that very effectively reproduces the feeling of a live, concert-hall performance, a sound that has been acclaimed by reviewers all over the world.

That unique sound is the result

of several interrelated technical developments.

First, the 901s are Direct/Reflecting<sup>®</sup> speakers. Sound reflects off the walls of the room, surrounding you with the correct proportions of reflected and direct sound, all frequencies in balance, almost everywhere in the room. In contrast, conventional direct-radiating speakers tend to beam high frequencies, limiting optimum listening area, and producing a sometimes harsh sound.

Second, the 901 has no conventional woofers or tweeters, just nine identical, 4½-inch, full-range drivers, acoustically coupled inside that very compact 901 cabinet. Coupling tends to cancel out, across all nine drivers, the small imperfections found in any speaker (ours included). The result is a smooth, life-like sound that's virtually free of distortion.

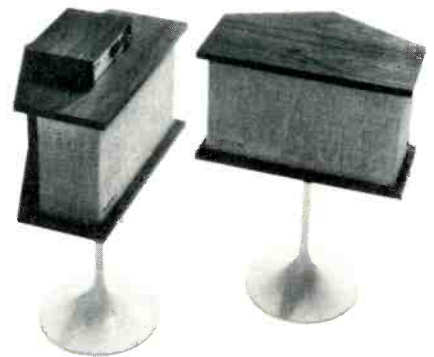
Third is the Active Equalizer, a compact electronic unit that automatically boosts power at frequencies that need a boost. This produces consistent sound output up and down the frequency range, with full, clear highs and solid, powerful lows.

The first time you listen to

your new 901s, you'll know you've brought home the right speakers. Years later you'll have the continued satisfaction of owning and using a product of uncompromising quality.

We invite you to go to a Bose dealer, listen, and compare the 901 to any other speaker, regardless of size or price. Then you'll begin to know why the Bose 901 has become something more than a loudspeaker system for thousands of music lovers all over the world.

For a full-color brochure on the 901 loudspeaker system, write: Bose, Dept. AU7, The Mountain, Framingham, Mass. 01701. Patents issued and pending.



**BOSE<sup>®</sup>**

The Mountain  
Framingham, Mass. 01701

# Audio ETC

Edward Tatnall Canby

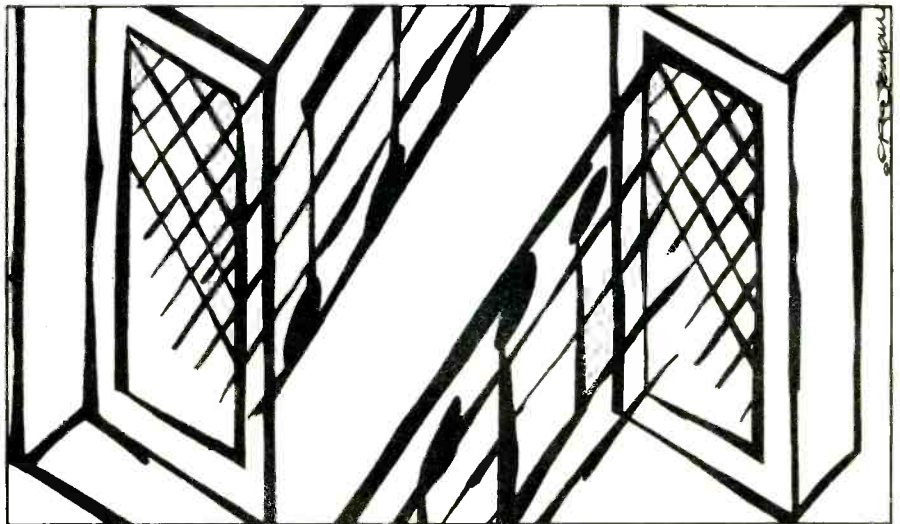
**I** DON'T intend to reopen the great Acoustic Suspension War—it was a long time ago. But it has plenty of historical interest, now that things have calmed down. This was a white-hot legal and engineering battle over speaker design and patents that raged between some big speaker companies and the then new and successful Acoustic Research, the vehicle for Edgar Villchur's radical AR speaker system. AR was fighting for protection. The others were busily challenging that protection while they developed excellent standby variants on the idea, just in case the patents didn't hold up. All very natural and to be expected in such a situation.

It was dog eat dog, and Villchur lost. Tragedy? Far from it! Later on, the man retired in triumph with one of the cosiest of all our big hi-fi fortunes, maybe not the size of Avery Fisher's—who knows? But Villchur was doin' OK, all right. If this proved anything, it proved emphatically that today you do not need to win exclusivity via patent protection in order to clean up in the hi-fi market. That was an earth shaker, I assure you, for a lot of our manufacturers. I doubt if there has ever been such a unique hi-fi success as the AR speaker, patent protection or no protection. Edison would even be amazed.

AR was not able to keep that revolutionary speaker principle for itself, if I am right, because of that complex of early basic audio patents which to this day still makes it extremely difficult to protect a "new" idea in speakers, or in any other audio area. A patent can be so basic that it is omnipotent. And audio, after all, is still young. The basics were developed only yesterday in real time.

## "Gray Flannel" Speakers

Even so, hi fi marches on and the AR lesson was a salutary one. AR, of course, is far from out of the running even now, in spite of recent trends away from its long-familiar format. But in its early success days, the words



Acoustic Suspension were fighting terms among the many AR challengers who understandably took a dim view of the enormous AR success. People are human, even in hi fi. I once had to write an article about "gray flannel suit" speakers—that being the conventional business costume of the time—a piece that had more double talk in it than I care to think about. The gray flannel was AR's sound, of course, and the more colorful suitings were, uh, the other speakers, the ones with that lovely coloration, so prized by many a listener. Not by me. Luckily, most readers couldn't figure out what I was talking about, which was just as well. It was a fighting time for all of us.

I've already sketched in the nearly forgotten earlier place of the R-J speaker enclosure (last month) because it was in fact the first of its sort, the modern small speaker with big bass. But AR, soon to overshadow R-J, went much further into the fundamentals. Where R-J remained strictly conventional in certain respects, AR broke loose with sensational new impact in the same areas.

First, R-J offered in the standard manner of the day an empty speaker enclosure minus speaker. You bought that separately, to choice. True, the R-J box did new and good things for

almost any speaker's sound, if it was the right size to fit inside. But there was not yet the concept of a permanent matching between speaker and cabinet, for a speaker system. There could have been, surely, and much to R-J's advantage. But it was too soon—by a hair.

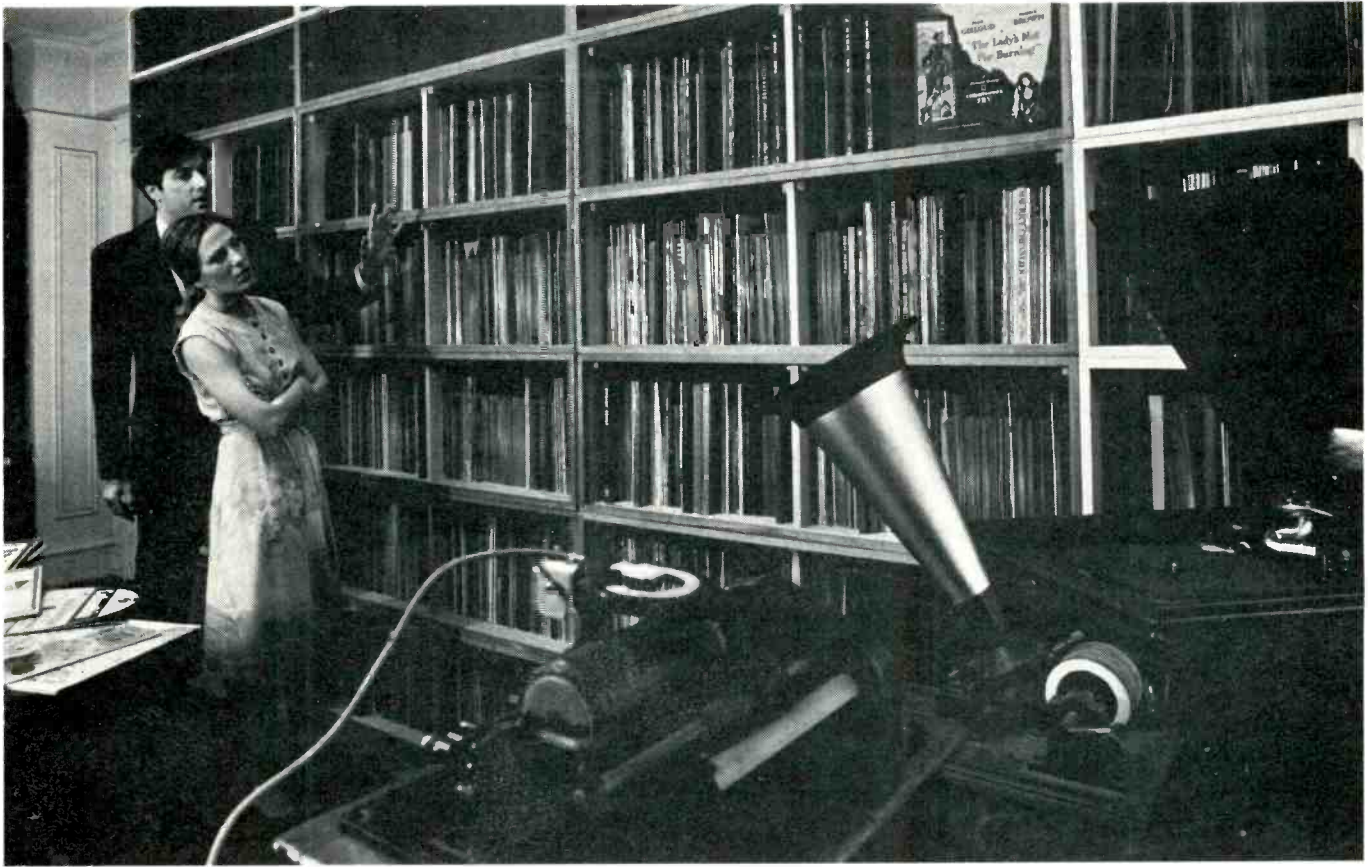
Secondly, R-J went along with the standard concept of a loudspeaker as a separate unit, able, so to speak, to stand on its own feet, that is, constructed with a normal cone and spider suspension, solid and springy enough to propagate sound, pumping in and out like a piston, yet remaining exactly centered in the circular voice-coil slot without outside aid or support. The speaker spoke, on its own, and you diddled, via cabinet or baffle, with its output signal. The enclosure—any enclosure—was built following this assumption; the thing simply made use of the radiated acoustic signal, hopefully with a minimum of cancellation and enforced distortion. R-J did exactly this, and did it quite well in a newly small space.

## Bass Only Boxes

Not so AR. The initial model, AR-1, as all subsequent models to this day, was built uncompromisingly with the sound generator unit, the speaker, sealed inside as a part of the system.



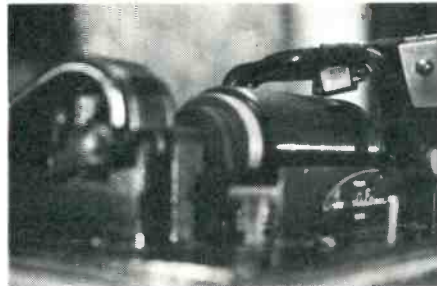
# No matter how young or old the recording, the Institute of the American Musical, Inc. relies on Stanton for playback.



Miles Kreuger, shows a portion of the extensive collection to a scholar.



Mr. Kreuger and Mr. Albert Husted, Vice President, show visitors how a Stanton 681 is installed on an original Edison Standard phonograph.



Close-up of the Stanton 681 with special stylus in position on the original Edison Standard phonograph.



Music scholar following the score of *Show Boat* while listening to original cast performances.

Speaking of problems, how would you like to be faced with the need to accurately reproduce the sound from Edison Diamond Discs, Pathés and Aeolian-Vocalions? That's just what the Institute is faced with — and that's precisely why they turned to Stanton cartridges.

The Institute collection consists of approximately 35,000 recordings, from just about every American theatre or film musical since the Berliners of the 1890's through to the latest stereo and quadraphonic recordings. The collection (not counting hundreds of cylinders) is roughly evenly divided between 78's and 33 rpm's. They have original, historic machines to play these accurately, but the arms are heavy and the old styli insensitive and somewhat worn. Furthermore, the acoustic playback does not permit them to filter the surface noise or tape these rare records.

Miles Kreuger, President of the Institute, discussed his problem with other famed and experienced archivists. They all agreed that the Stanton calibrated 681 Series was the answer. Naturally, it is the 681 Triple-E for critical listening and taping with more recent discs; the special 681 stylus for LP's; and, for the old ones, a 681

cartridge, especially wired for vertical response (with a 1 mil stylus).

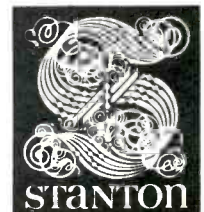
Today, thanks to Stanton, the scholars, authors and researchers, who are dependent on the Institute's materials to pursue their projects, can get perfect to adequate reproduction of any of the material in the collection. The Institute, which is crowded into small quarters, is open by appointment only to qualified people. For the future, it looks forward to the day when it will have the space in its own building to make its collection more readily available.

The work of the Institute is important work . . . Stanton is proud to be an integral part of it.

Whether your usage involves archives, recording, broadcasting or home entertainment, your choice should be the choice of the professionals . . . the Stanton 681 Triple-E.

Write today for further information to:  
Stanton Magnetics, Terminal Drive,  
Plainview, N. Y. 11803.

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# EAROTIC CATALOG

That's right . . . our tantalizing new hi-fi catalog *is hot* off the press! And more than ever, we offer earotic music systems and single components from all the best brands — at *huge discounts*. Call me, Brillo Bob, or any of the guys and you'll get friendly advice and low price-quotes right over the phone . . . **805 / 544-9700**

Send in the coupon below and you'll quickly receive our 96-page color-wonder, free! Include \$1 for postage, and we'll also zip you the 1976 Music Machine Almanac: it's a full-color 100-page reference guide to hi-fi equipment complete with photos and specifications!



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805/544-9700

Here's \$1 for my catalog & the 1976 Music Machine Almanac, sent via PRIORITY FIRST CLASS MAIL.

Just slip me a free catalog via 3rd. class mail.

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M 1

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You bought the works. You have ever since. At the time, that was radical, even courageous in a business sense. Though, curiously, the earliest prototype if I remember rightly was not a full range system but only a woofer, in an enclosure. You provided your own high end. That is, until AR saw the light and added an upper range as well in the AR-1. Just shows how the prevailing thought ran. The new AR principle involved only the bass; therefore it was normal thinking to leave the rest, the top end, for your own optional choice.

We still see occasional separate tweeters today but we are rarely offered a woofer in a box, complete and ready to go in all its muffled glory! Like an Add-A-Part record. You add the melody.

It was indeed the bass end which impressed in the AR. It was the innovative part, both in the method of production and in the sound itself, low, clean, and totally boom-free. Sensational, and only later did AR make modifications towards a more imaginative high end, to match its fine bass via such improvements as the little dome-type tweeters—leading to those intriguing AR model conversions with the exponential names—AR 4ax. (Even now there are continued improvements in the AR high end, such as the new flush surface to avoid cavity distortions.) In all of this, every single AR system has had its built-in set of driving speakers, straight from the start. After awhile, after AR, the old cabinets in all their empty prolificity began to fade from the market and so did the loose speaker units that once had filled up the stores and the hi-fi displays. AR killed them. A really big change, you must admit.

### The Air Spring

But that was not all. The striking thought that hit the inventive Edgar Villchur was to build a speaker /driver as a *part of the cabinet*, specifically, to replace the standard independent springy system of sturdy cone and spider with a different elasticity, an air spring. It was produced, an infinitely elastic restoring force, by sealing up the space behind the speaker as it had never been sealed before, airtight. And instead of the old self-sustaining cone he mounted a new limp, flabby thing which would derive its springiness almost entirely from the air pillow behind it. That air had to be carefully calculated in volume—the problem was not to make the box small but to make it *big* enough to work in this

fashion. Do I remember how that impressed me!

(Am I hearing faint echoes of the War again? Don't bother arguing, folks. Worrying about acoustic suspension today is a bit like fighting Eleanor Roosevelt. If I've got things wrong, don't blame AR, blame me.)

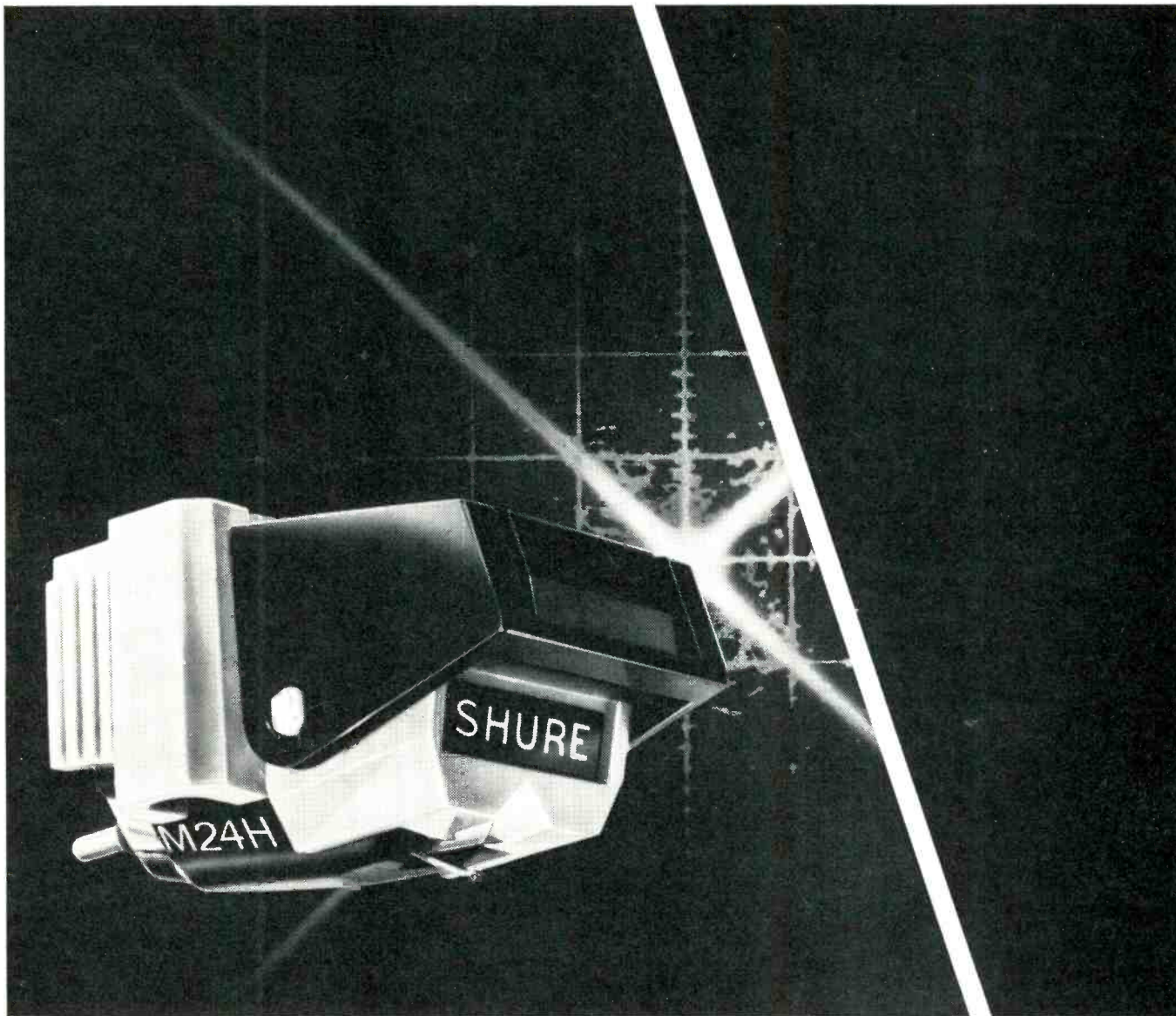
So the limp speaker took over and so did the newly clean, astonishingly low and uncluttered bass that came out of this one-sided system, the back wave swallowed up and suppressed, the front wave smoothed out and extended 'way down, into the Klipschorn range. Yes, people said and still say that no limp-speaker bass will ever sound like the solid stuff from a horn enclosure and they may be right. But the point is academic. There simply is no comparison in a living room sense between a big horn and a small box. The miracle was that we could get any sort of clean low bass out of a bookshelf speaker, even if no bookshelf was ever devised that would hold one of them, let alone two.

Wasn't it Klipsch himself who in the end capitulated a bit and came out with a smallish thing he called the Heresy? Honestly put! It was no horn. Reminds me somehow of the AM Gremlin, so curiously named.

### Heat & Efficiency

Power, now, was to be the new name of the hi-fi game, to cope with this one-sided speaker inefficiency, and power came out of tubes. AR-type speakers needed very heavy pushing to make them work. By the time we got into stereo, with everything doubled including AR, power began rather ominously to be translated into heat. Even now, I can warm up my living room via the old Fisher 300 stereo, or the hefty Dyna 70, the egg fryer. I have an old borrowed H. H. Scott Type 208, too, its considerable warmth from seven tubes gently irradiating one side of my turntable, catching me up with surprise—we don't expect heat like that any more. This matter of efficiency grew more important as the new AR speakers began conquering much of the hi-fi world, and still more when other companies swung over to similarly inefficient speakers.

But the answer to low efficiency, the solid-state amplifier, was a long time in coming. During those numerous years when tubes were receding and high power from solid state was still decidedly impractical, the acoustic suspension speaker spread ever more surely as the standard for good quality hi fi sound. The definitive AR-3 and



## Uncompromised stereo/quadrphony —Undeniably Shure.

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MODEL M24H  
STEREO +  
QUADRIPHONIC  
CARTRIDGE

The new Shure M24H Cartridge offers audiophiles the best of both worlds: It is the only cartridge on the market that does not compromise *stereo* reproduction to add discrete quadriphonic capability. It eliminates the need to change cartridges every time you change record formats! This remarkable performance is achieved at only 1 to 1½ grams tracking force—comparable to that of some of the most expensive conventional stereo cartridges. Other M24H features include the lowest effective stylus mass (0.39 mg) in quadrphony, a hyperbolic stylus tip design, an exclusive “Dynetic® X” exotic high-energy magnetic assembly, and a rising frequency response in the supersonic carrier band frequencies that is optimized for both stereo and quadriphonic re-creation. If you are considering adding CD-4 capability, but intend to continue playing your stereo library, this is the ONE cartridge for you.

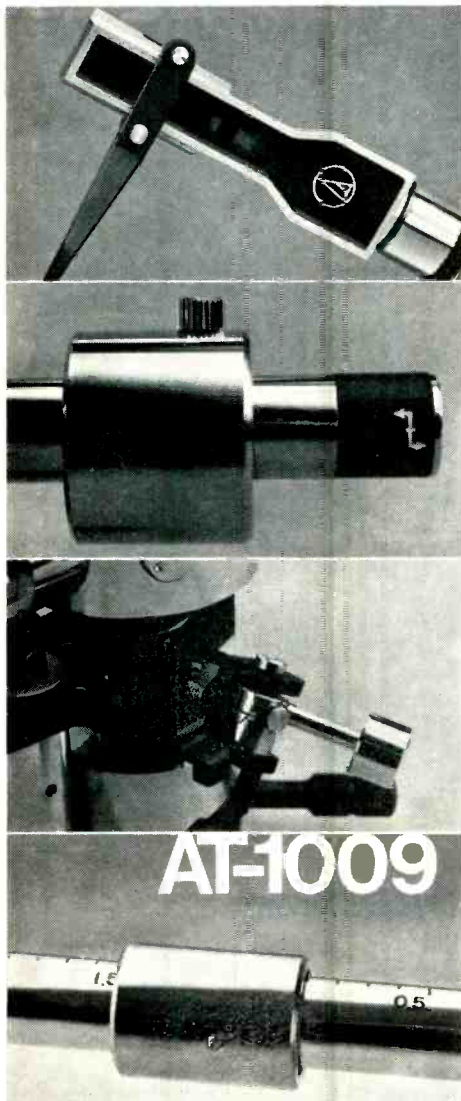
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Manufacturers of high fidelity components, microphones, sound systems and related circuitry.

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## Audio Magazine needed a state-of-the-art tone arm to test\* the finest stereo & CD-4 cartridges on the market.



\*March, 1974 Issue

They chose this one:  
The Audio-Technica AT-1009.  
We're proud. But not surprised.  
\$139.95 and worth every penny.

Write and we'll tell you why.  
Or see for yourself at leading  
audio showrooms everywhere.

### audio-technica.

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In Canada: Superior Electronics, Inc.



then the 3a, with better highs, bulky for any bookshelf (and much too heavy—just try lifting one!) were everywhere, and still there was a power problem. Obviously a LOT of amplifier was now needed to drive these things, more than we had ever thought would be necessary. And that power had to be cool, as only the solid-state amplifier could make it. No go! Again and again I was told that transistor circuitry allowed only a maximum of around 30 watts output (averaging the various watt rating systems). That was not enough.

In the end, of course, the big solid-state breakthroughs came and all of a sudden we had power and to spare—as I quickly discovered via a beautiful white solid-state job which shall be nameless (I forget the name) that arrived in my house, produced really superb low-efficiency speaker sound for awhile, then quietly liquified itself all over the floor while lazy smoke arose to assail the nostrils. A replacement, heavily redesigned, played somewhat longer but one day that, too, blew up with a puff and all the fuses out. Quite a time passed before we got solid-state power and reliability—with heat sinks and circuit-breaker protection. The next such amp I got to use was a Crown and that one is still going strong. Absolutely unflappable.

Now we have gone further, into really potent solid state, in a geometric power progression that has taken us up into the hundreds of watts per channel and onwards. At last we have the power we need to drive all the low-efficiency speakers you could ever want, and maybe burn them out at that!

Wouldn't you know it, then, right now is the time we start back, towards the old high efficiency speakers that don't need much power! Crazy.

Not hard to explain, though. The low-efficiency speaker really spoiled us for good, convenient low bass, given the power to get it out of the box. In the earlier period the more efficient speaker systems, bass reflex and so on, were for the most part haphazardly assembled out of separate components, usually untuned to each other. They inevitably boomed and blurred. Good tuning, for a properly clean bass, was a rare, half-accidental accomplishment. Aside from the big horns, then, only the acoustic suspension speakers could guarantee us a smooth, clean low bass and so these speakers moved in the thousands into homes everywhere. It was worth the sacrifice in efficiency just to have that

sort of sound conveniently available, in small packages.

### Computer Design

Now we have calculators and computer techniques to design and precisely predict an optimum shaping for those old-fashioned ports and back-wave escape tubes. But most of all, we can design new high-efficiency systems as integrated units, even down to the simplest, the speaker and enclosure permanently matched. Result, a far better sound, right down the line, than in the old days of empty boxes and free speaker choice. With all this going for us, is it surprising that we should now begin to back away from the low-efficiency speakers even though we have plenty of power to drive them? The new speaker systems play louder, easier, and they now sound just as good, bass and treble, give or take a bit for the argument.

We now have some lovely power options. We can simply play louder, and LOUDER, as plenty do. Better, we can play our music at reasonable levels and yet have the reserve to cover the most exquisitely extensive transient peaks which, we know, are momentarily far more potent than the lowly average level shown by the VU meters. We like this new power headroom. We can hear it. We want more and more power. More speaker efficiency, too. We can use them both.

Yes, we will be seeing a lot of modest four-way speaker installations in these coming years; the idea is too good to drop and music will not let it fail. We will need small speakers for this, four for two, inconspicuously. (With four, bass is not a great problem.) I see headroom needed, everywhere. Small speakers, efficient, yet smooth in the bass end. Four-way amplifiers with a lot more power, modestly presented, than most of our present showy quadraphonic receivers now offer. Too little! What we will want is a reasonable 50/50/50/50 and on upwards to 100 x 4 and more. Not louder! Cleaner. That's the headroom. More headroom at every level of price. Power to spare, along with simplicity and sparseness of controls.

Super hi-fi? There's always a place for that, at any price. So let's go straight forward on our present track—to amps rated as 1000/1000, common as chickens used to be, and superb new speakers the size of a house, or at least a chicken coop, which respond to one watt of power (electrical) with a roar you can hear a mile away. Now that'll be headroom for you.

# Not everyone can sell you a receiver that looks as good as this.

The RS4744 is the top stereo receiver in our line. And we think it looks good from any angle—value, performance and specs.

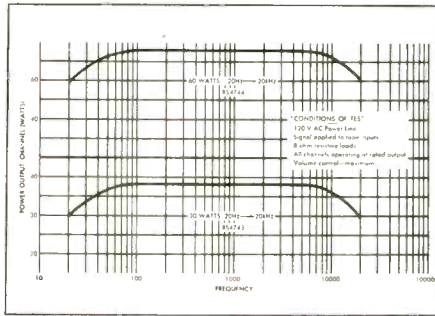
Audio magazine said "...we note that most receivers in this price range offer less power (usually 50 or fewer

Amplifier	Rating
Power, min. RMS, at 8 ohms, 20 Hz to 20 kHz	60 Watts
Total harmonic distortion at rated power output	0.25%
FM Tuner	Rating
Usable sensitivity (IHF) 300 ohms	1.8 $\mu$ V
50 dB quieting sensitivity	3.0 $\mu$ V
Signal/noise ratio 100% mod.	67 dB

Typical specifications

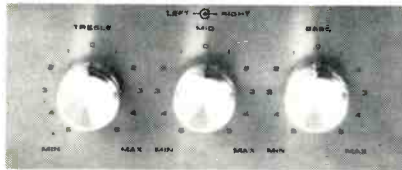
watts per channel) and don't have as many control features as this top-of-the-line entry from Sylvania."\*

But, don't just take other people's word for it, check the specs out for yourself.



Power from 20 Hz—20 kHz

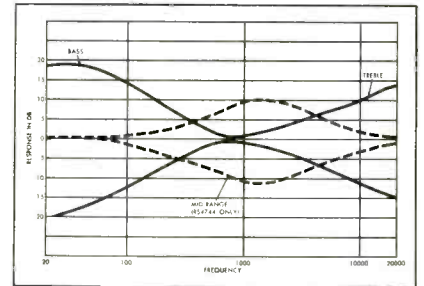
Power output of 60 Watts min. RMS per channel at 8 ohms from 20 Hz to 20 kHz with no more than 0.25% total harmonic distortion.



Active tone controls

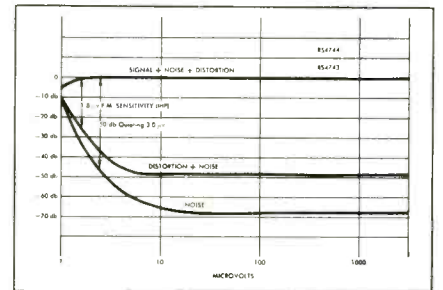
Three wide-range tone controls that let you tailor bass, mid-range and treble response to your speakers, room and ears.

Active high- and low-cut filters that have a sharp 12 dB/octave slope to reduce noise and rumble with minimum effect on music.



Tone control action

In the tuner section, you'll find features such as a phase-locked loop for long-term stability. An IHF sensitivity of 1.8  $\mu$ V and a 3.0  $\mu$ V level for 50 dB quieting.



FM Quieting

And the front panel doesn't get by on just its good looks alone. Its functionally designed pushbutton bank puts a wide range of control capabilities right at your fingertips for mode selection, scratch and rumble filters, three-stage FM muting and loudness control.



Functional design

Listen to the RS 4744 at your Sylvania dealer's today. You'll find its specs sound every bit as good as they look.

## GTE SYLVANIA

Check No. 12 on Reader Service Card

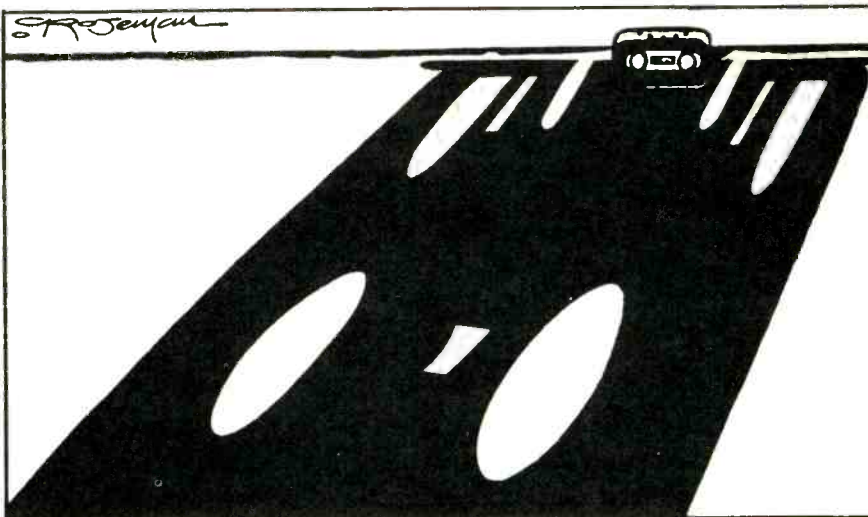
# Behind The Scenes

Bert Whyte

IN THE AUGUST, 1974 issue of *Audio*, I reported that at the 48th convention of the Audio Engineering Society in Los Angeles the BASF tape people had introduced their "Unisetette." This was a scaled-up version of the Phillips compact cassette—some 40 per cent larger—which used quarter-inch tape and operated at a 3 ¾ ips tape speed. Among its claimed advantages, aside from the obvious benefits of wider tracks and higher tape speed, were openings in the cassette shell to accommodate erase, record, and separate playback head for true monitoring capabilities, the option of single- or dual-capstan tape drive, and a method of tape tension control. Very significant was the fact that tape guidance was a function of the playback machine, rather than the cassette, as is the case with the current "compact cassettes." Thus accuracy of tape guidance remained invariable for all Unisetettes, with the advantages of stable azimuth and low wow and flutter.

BASF envisioned the Unisetette in such applications as high-quality automated radio programming, language laboratory machines, "audiophile quality" cassette recording. . . they even had a track layout for quadrasonic sound in their technical manual. It was reported that the first Unisetette machines would be built by Willi Studer and that negotiations were "under way" with Sony and TEAC to produce Unisetette recorders.

It is now close to two years since the introduction of the Unisetette, and the anticipation of an early entry of this product into the audio market seems to have been overly optimistic. I have checked with the BASF people a number of times in these intervening months on the progress of the Unisetette, but they had little to report. Ultimately at the March AES convention in Zurich this year, Willi Studer did show a prototype Unisetette machine which was obviously slanted towards the professional market and priced accordingly. As far as the audiophile segment of the potential Uni-



sette market was concerned, nothing seemed to be forthcoming from any quarter.

Ironically, just a few weeks after I made one of my periodic checks with BASF about the Unisetette, rumors began to circulate that several Japanese companies would soon be introducing Unisetette machines. On April 21st, Panasonic/Technics invited the audio press corps to a preview of some new cassette decks (about which, more at a later date), with Mr. Toshio Morimoto, chief engineer of the tape recorder products division on hand. After a runthrough and demonstration of the new decks, we had luncheon, and then the bombshell was dropped. . . instead of verifying the rumors about the Unisetette, it was announced that Sony Corporation, Matsushita Electrical Industrial Company (parent company of Panasonic/Technics), and TEAC Corporation had jointly developed a new audio recording system known as the "Elcaset". . . meaning large cassette. It was also announced that the Aiwa Company and JVC (Victor Company of Japan) had agreed to adopt the Elcaset system.

## Another Format

What is the Elcaset system? Simply put, it is a variation on the Unisetette

theme, with modifications and embellishments which the Japanese feel have significant advantages. Like the Unisetette, the Elcaset uses standard quarter-inch magnetic tape at a speed of 3 ¾ ips. The Elcaset measures 152 mm wide by 18 mm in height by 106 mm in depth. . . approximately 40 per cent larger than the standard compact cassette. While the width of the Elcaset tracks are naturally greater than those in the cassette, since it uses quarter-inch tape, the disposition of the tracks is the same as the cassette for mono/stereo compatibility. However, in between the two pairs of stereo tracks are two narrow "control tracks," which can be used for such purposes as automated programming, slide changing, etc. A prototype Elcaset shell was circulated among us, and we were furnished diagrams explaining the functions of the many holes and openings in the shell.

There are large "positioning" holes, and openings that obviously are for dual capstan tape drive. As with the Unisetette, once the Elcaset is inserted in the recorder, it remains rigidly fixed in place. Unlike the Unisetette, in use, tape is pulled out of the Elcaset shell and is transported on what is essentially an open-reel drive system. This allows the use of separate erase, record, and playback heads, per-

# Size isn't everything



Japan. Land of the audio giants. Companies like Pioneer, Sony, Yamaha. Each with 100 times the engineers, production efficiency, research facilities, marketing resources, and sales — than your average good-sized U.S. or U.K. manufacturer.

November 3rd, 1975, Prince Hotel, Tokyo. The scene of a hallmark event — the 5th annual Japan Stereo Components Grand Prix Contest. An occasion which has indeed become the Grand Prix of the Japanese audio scene. Stereo components from Japan, the U.S., the U.K., and Europe — to be judged on the basis of performance and design by eight famous Japanese hi-fi journalists. Among the entrants: a small speaker, the UL6, recently launched by a not-so-big company: Celestion of England.

January 1976 — the results. **AMONG ALL THE ENTRANTS, WORLDWIDE AND JAPANESE, ONLY ONE SPEAKER WINS THE GRAND PRIX: CELESTION'S DIMINUTIVE UL6.**

Surprising? Not really. All the engineers, efficiency, marketing and money in the world are not sufficient to build a great speaker. Intangible resources are needed: experience, intuition, and dedication. Resources which Celestion has more of than any other speaker company in the world.

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Now for the guts. UL6 deploys the new HD1000 ultra-wide dispersion 1" dome tweeter, a new Celestion mid-bass unit with massive magnet system and specially treated Bextrene diaphragm, and a new ABR (auxiliary bass radiator) which extends bass response, raises sensitivity and reduces distortion to negligible limits. These advanced precision components were totally researched, designed and built by Celestion to optimize overall performance in the UL6. The result is clean, tight, smooth response from 35 Hz-28 kHz. Performance so superlative that we realistically predict that UL6 will become the reference standard for bookshelf-size speakers.

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mitting monitoring in normal open-reel fashion. This stationary shell/open-reel transport system assures accuracy of tape guidance and independence from irregularities and imperfections in the Elcaset shell which could affect azimuth and wow and flutter. The Elcaset will be available in three different types of magnetic tape material including (rather surprisingly, in view of the 3 ¾ ips speed), chromium dioxide. There will be LC60 (30 minutes each side), and an LC90 (45 minutes per side) Elcasets available. Some special "holes" in the Elcaset shell afford automatic "code" selection of proper bias and equalization for the three tape types, as well as automatic Dolby selection. The time constant of the Elcaset tapes will be 3180 microseconds, plus 70 microseconds, and the reference recording level will be 185 nWb/m, as in normal 3 ¾ ips open-reel tape. As a comparison of tape thickness...regular cassette is 0.012 mm in a C90, 0.013 mm for an Elcaset LC90, and 0.038 in open reel. Performance claims for the Elcaset system include full spectrum frequency response, wide dynamic range, and greater "head room," plus lower distortion because of less possibility of tape saturation.

### What Will It Cost?

Needless to say, we all found this Elcaset announcement quite surprising but nonetheless very exciting. Mr. Morimoto graciously divulged as much information as he could, including the fact that quadrasonic Elcasets were a distinct possibility. As to cost, while specific figures were not given, a "ballpark" estimate is that a typical Elcaset recorder would be around the 700-800 dollar mark, with blank Elcasets at about 25-20 per cent higher than the equivalent open-reel tape. Recorded music Elcasets would seem a natural consequence, especially with JVC in the picture.

Why did the Japanese choose to develop the Elcaset system rather than adopt the Uniset? A good guess would be that the mechanism needed for the Uniset concept would have been too expensive to produce...so much so as to preclude it from the consumer audio market. Perhaps there were licensing problems with the Uniset. It may simply be national pride or that ever-present attitude called "face." Whatever the reasons, I am bound to say, with all due respect to BASF for their pioneering work on the Uniset, that with the considerable "clout" of the five Japanese

companies currently committed to the Elcaset system, the future of the Uniset...at least in the consumer audio market...is uncertain.

Inevitably, we get to the question... "who needs it?" What is the Elcaset in aid of? Why still another tape configuration to further complicate the market? As seen by the Japanese backers of the Elcaset system, it is primarily intended to satisfy the demands of those people who want higher audio quality than the cassette, but are too fumble-fingered to use or are intimidated by open-reel recorders. The Elcaset would appear to bridge the gap between upper-end cassette machines at about the 500-600 dollar range and the open-reel machines from 1000-1200 dollars upwards. Whether it is called the Uniset or the Elcaset, my feeling toward the concept of a quarter-inch tape/3 ¾ ips "jumbo" cassette hasn't changed...I think it is a commercially viable product, that will fill a distinct need, as well as create an entire new market. I look too at the potential of the Elcaset...for example, with a two-speed capstan motor, one could operate at 7 ½ ips speed for still greater sound quality...or conversely at 1-7/8 ips speed for 90 minutes of recording per side on an LC90. The possibilities for bringing true discrete quadrasonic tapes to the audio consumer at moderate cost is particularly attractive as well.

As to availability, the folks at Technics by Panasonic hedged a bit, but allowed as how they might have a machine ready for the market sometime this fall. A later press release, however, from Superscope, tells us that two models from the Sony line, both front loaders, will be previewed at the June Consumer Electronics Show in Chicago. The release goes on to say that the Elcaset system will find its way into both the Superscope and Marantz lines by early 1977. We'll keep a close watch on developments with this Elcaset concept.

### Headphones and Amps

As a rule I don't do very much listening to music via headphones... maybe because I did so much of it in my binaural experiments way back in 1950-53. Be that as it may, I have had reason to do a lot of headphone work recently in conjunction with some cassette experiments... which will be reported on in due course. I have quite a collection of headphones, but decided to try the new Yamaha HP-1



# PART TWO: THE END OF THE DOUBLE STANDARD.

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Because, with the exception of the very deepest rumblings of a pipe organ, all music is produced within this range. In fact, few if any commercially available stereo pressings have frequencies below 100 Hz and above 15,000 Hz.

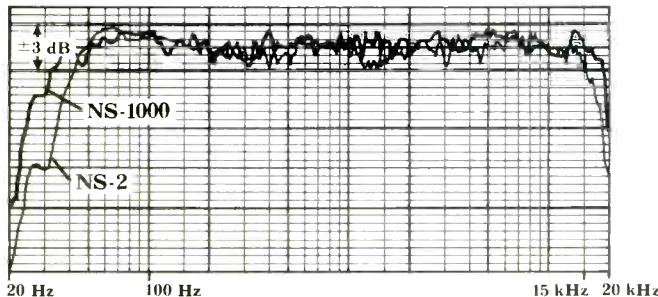
Yamaha's success in achieving a single standard of accuracy in all our speakers is confirmed in the chart above.

Unlike the frequency response curves of other speaker manufacturers which indicate unnatural booming in the bass, added sparkle in the treble, and extreme loudness level variations of as much as 10 dB, Yamaha's frequency response curves show a relatively straight line, which indicates uncolored, natural sound.

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While many manufacturers offer accurate reproduction only in their top-end speakers, Yamaha brings you an extremely high degree of accuracy in all models throughout the line.

The above curves, comparing the NS-1000 with the NS-2, were recorded under the following conditions: 1. **Equipment used**—Bruell & Kjaer (B&K) 4131 microphone, 1022 oscillator, 2113 spectrometer, and 2305 recorder. 2. **Input**—A "pink" noise source used with an input level of 3 watts (significantly higher, more rigorous, and more closely corresponding to actual home listening levels than the commonly used industry standard of 1 watt). 3. **Measurement**—Each loudspeaker was placed in a "free field" (off the floor and no closer than 5 feet to any wall boundary in an average size listening room). A multiplicity of curves were taken at various points in the listening room and averaged, to produce the total energy curves pictured.

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other three-way types: the NS-690, NS-670, and NS-3. Our least expensive, but still highly accurate, is the two-way NS-2.

Since each is built to the same high quality standard, you're probably wondering what those extra dollars are buying.

It's very simple.

To satisfy the most demanding audiophiles, those extra dollars buy extended response at the frequency extremes. Higher sound levels with equal or lower distortion. More power handling capacity. More tone controls to contour the tonal balance of the speakers with the characteristics of the room.

More specifically, on our model NS-670 and above, Yamaha offers die-cast speaker frame baskets to eliminate potential resonance. Luxurious wood enclosures (even rare ebony wood!). Tangential-edge

suspension for midrange and tweeter domes to provide smooth response. Acoustic equalizers on tweeters to flatten frequency response and enhance dispersion. Diagonally edge-wound voice coils for greater diaphragm control and increased transient response. Plus thick felt lining inside the cabinetry to isolate rear sound waves for distortion-free bass response.

But regardless of how much you pay, every Yamaha speaker is built to the same essential construction criteria and tonal accuracy.

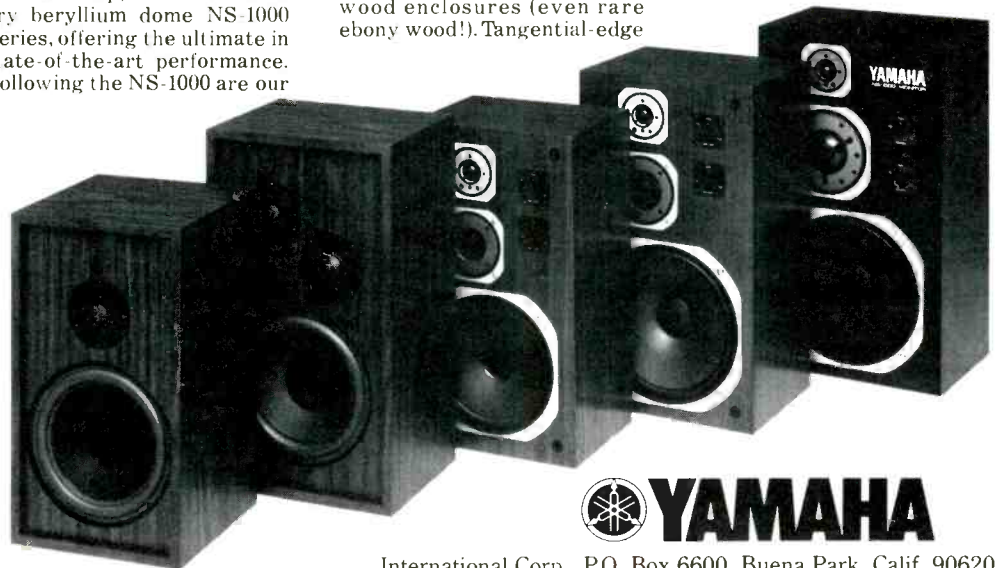
Proven acoustic suspension design. Dome drivers for better high frequency dispersion. Carefully matched crossover networks. And heavily reinforced, extremely rigid enclosures.

#### The End of the Double Standard.

The single standard of performance found throughout the entire line of Yamaha speakers is a demonstration of product integrity that no other manufacturer can claim.

But in the final analysis, only your ears can be the judge.

That's why we invite you to visit your Yamaha audio dealer soon. His knowledgeable salesmen and extensive demonstration facilities can save you time and trouble in selecting the speaker that's right for your budget. And right for your ears.

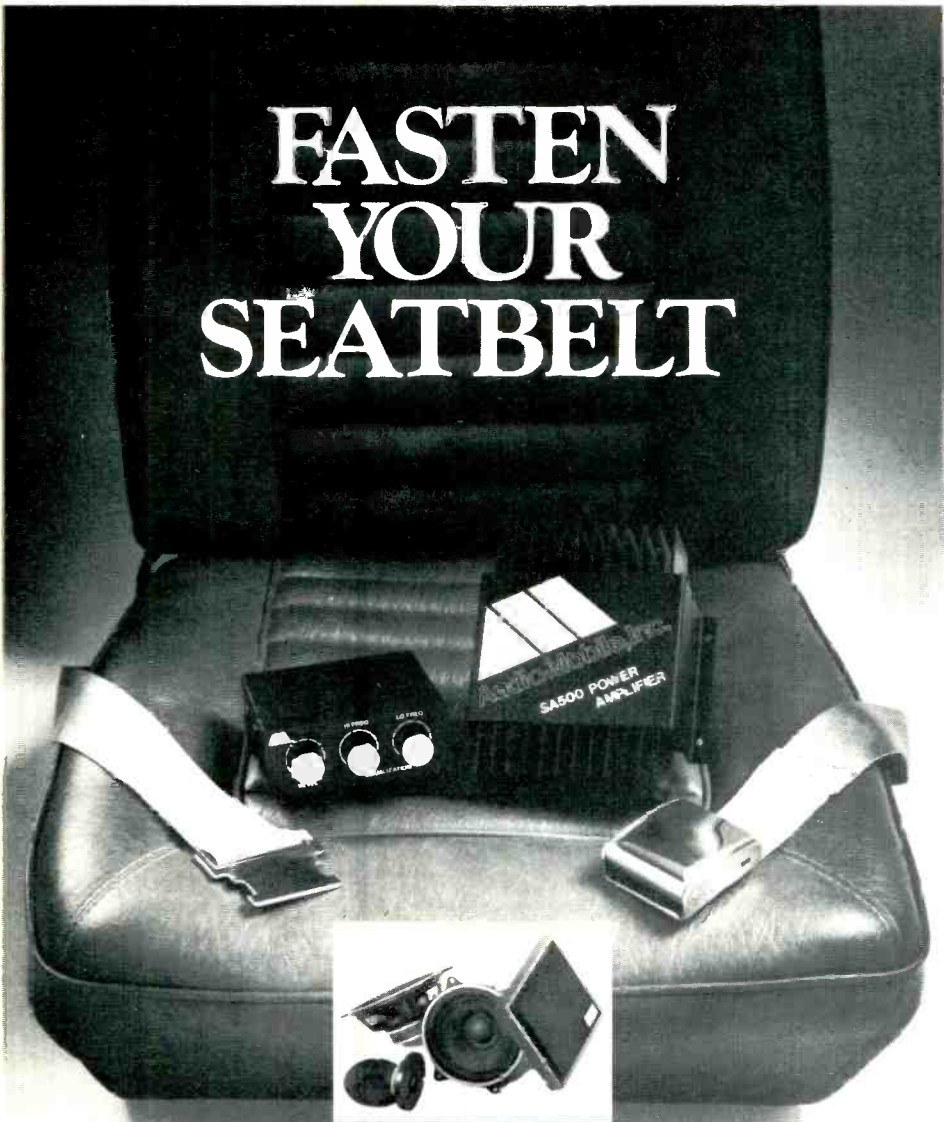


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model which was recently sent to me. These headphones are of a rather unusual design. The diaphragm is a gossamer-light polyester film, to which is bonded (in some fashion) a voice-coil of flat aluminum wire wound in a spiral so as to drive the entire area of the diaphragm. Two discs of ferrite magnetic material, with holes punched in them to permit transmission of sound, "sandwich" the diaphragm. The phones are open-backed, but appear to have more isolation than usual with this construction. As an added bonus, the HP-1 phones are very light, and easy to adjust. I am reporting on these phones, because I was singularly impressed with their performance. Overall response was very smooth and wide, with obviously low distortion. The sound was very clean, with exceptional transient response. But what really raised my eyebrows was the superb bass response. . .solid, clean, well-damped bass that certainly extended well below 30 Hz. It was possible to hear a distinct "attack" and "skin-tone" on tympani and bass drum, and contrabassi had a most natural sound both pizzicato and arco.

Speaking of headphones, it appears that there are quite a few high-quality pre-amplifiers and amplifiers, which do not have headphone input jacks. According to some designers there are some very pertinent reasons, in matters of added distortion, why these units do not have this facility. If you want to use these amplifiers for headphone listening, you will have to interface your phone plug with either a screw barrier output strip or wrestle with banana plug outputs. There is the added problem of coping with high wattage output from these amplifiers, as most of these units which do not have headphone jacks, do not have volume control pots either. If the kind of people who own these fancy units want to do some high quality headphone listening. . .what to do? At their friendly Crown dealer they will find a most versatile slim-line amplifier, the D-60. This 32-watt per channel unit is widely used in bi- and tri-amplification set-ups and, increasingly, for headphone listening. It has a headphone jack whose output impedance is perhaps half an Ohm and will handle phones of the 8 Ohms and higher values usually found in consumer models. The input is 25 kil-Ohms, and left and right control pots are furnished. Not cheap at \$289.00, but the answer for high quality headphone listening, when there just aren't any facilities on the main units.



# Soundcraftsmen

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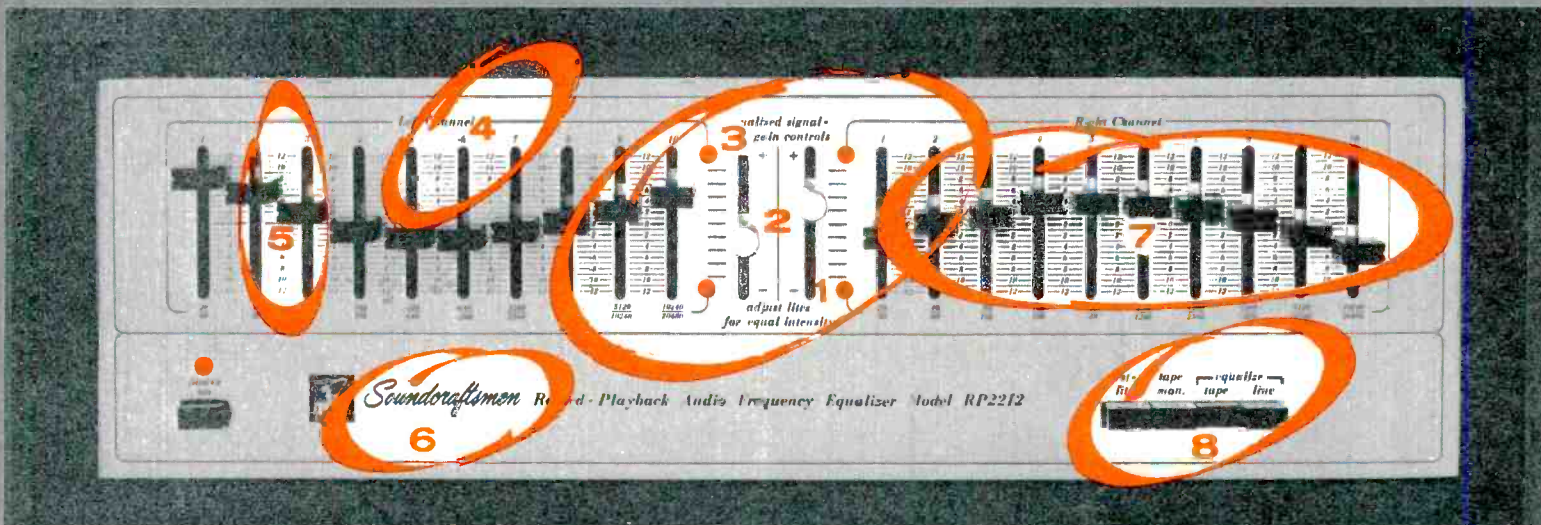
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- 8 YOU NEED THE ABILITY TO EQUALIZE TAPE RECORDINGS**



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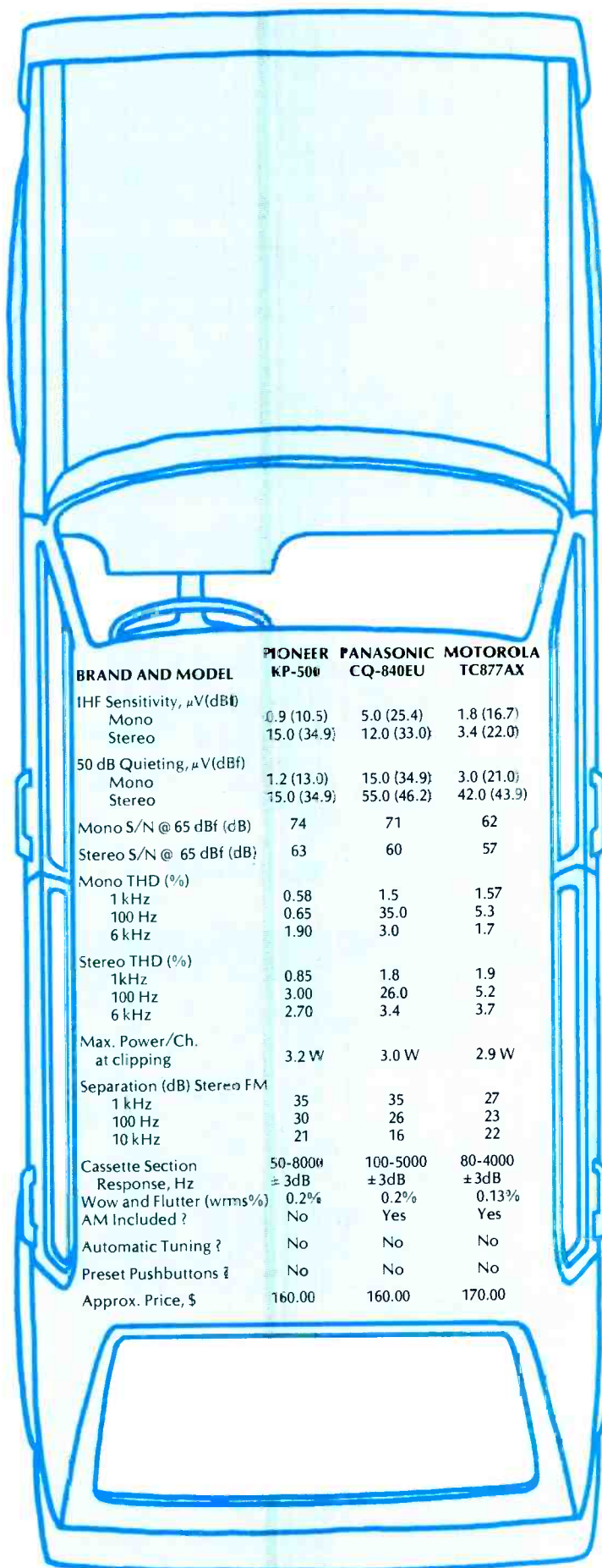
# Three Car Stereos Tested

LEONARD FELDMAN

**E**XACTLY ONE YEAR ago we examined five car radios produced by as many manufacturers and intended for add-on installation in an automobile after the car leaves the factory. Prices of the units tested ranged from a low of around \$170.00 to a high of over \$800.00 and all of the units measured had provisions for either cassette or 8-track cartridge playback. Results were disappointing if one were to compare the performance of any of these units with that from even the least costly, low-powered, high-fidelity AM/FM stereo receiver intended for home use. In fact, considering their fairly low power output capabilities, their high distortion measurements, and their relatively poor sensitivities and 50-dB quieting points, we were rather surprised at the fairly pleasant kind of sound these car units delivered when hooked up to a pair of speakers typically used in automobile installations.

Recently we were contacted by Pioneer of America (one of whose models had been tested for that report last year), who told us that they had developed and were going to market a "true" high-fidelity car stereo FM radio with cassette playing facilities. Rather than test that new model by itself, we decided that it might be a good idea to have another look at a few more of the current crop of car add-on radio/tape units. So, this current test report includes not only the Pioneer KP-500 unit, but a new unit from Motorola as well as a current model from Panasonic.

All three units tested operate from 12 to 15 volt power sources, with ground or chassis returned to the negative terminal of the car battery. All of the units employ 75-ohm unbalanced antenna inputs and use coaxial connectors of the type which normally feed car antennas to built-in factory supplied radios. The Pioneer KP-500 has only FM reception, while both the Panasonic and Motorola model offer AM reception as well. All three units can play back prerecorded cassettes. The Pioneer unit is intended for under-the-dash mounting, while the other two units are intended for in-dash installation. The Motorola unit employs a clever cassette insertion arrangement, which has also appeared elsewhere, in that the entire dial scale, pointer and all, simply flips up and inward as a cassette is inserted (with its long dimension running from front to back). This not only makes the unit extremely compact (7 in. wide by 7 in. deep by 1-7/8 in. high) but helps discourage theft, since one cannot tell by looking at the unit that it does have provision for cassette tape playing, thus making it less desirable. Both the Panasonic and the Pioneer units have separate cassette doors, but in each case the cassette is inserted with its short dimension running from left to right to conserve panel space.



BRAND AND MODEL	PIONEER KP-500	PANASONIC CQ-840EU	MOTOROLA TC877AX
IHF Sensitivity, $\mu$ V(dBf)			
Mono	0.9 (10.5)	5.0 (25.4)	1.8 (16.7)
Stereo	15.0 (34.9)	12.0 (33.0)	3.4 (22.0)
50 dB Quieting, $\mu$ V(dBf)			
Mono	1.2 (13.0)	15.0 (34.9)	3.0 (21.0)
Stereo	15.0 (34.9)	55.0 (46.2)	42.0 (43.9)
Mono S/N @ 65 dBf (dB)	74	71	62
Stereo S/N @ 65 dBf (dB)	63	60	57
Mono THD (%)			
1 kHz	0.58	1.5	1.57
100 Hz	0.65	35.0	5.3
6 kHz	1.90	3.0	1.7
Stereo THD (%)			
1 kHz	0.85	1.8	1.9
100 Hz	3.00	26.0	5.2
6 kHz	2.70	3.4	3.7
Max. Power/Ch. at clipping	3.2 W	3.0 W	2.9 W
Separation (dB) Stereo FM			
1 kHz	35	35	27
100 Hz	30	26	23
10 kHz	21	16	22
Cassette Section	50-8000	100-5000	80-4000
Response, Hz	$\pm$ 3dB	$\pm$ 3dB	$\pm$ 3dB
Wow and Flutter (wms%)	0.2%	0.2%	0.13%
AM Included ?	No	Yes	Yes
Automatic Tuning ?	No	No	No
Preset Pushbuttons $\bar{1}$	No	No	No
Approx. Price, \$	160.00	160.00	170.00



### Pioneer of America KP-500

The Pioneer unit was the only one of the three tested which is supplied with a really complete set of published specifications, and quite impressive they are too. Usable sensitivity is listed as 12.0 dBf (1  $\mu$ V @ 75 ohms), and 50-dB quieting in mono is 14.3 dBf (1.4  $\mu$ V @ 75 ohms). Selectivity is given as 74 dB, while a capture ratio of 1.8 dB is claimed. S/N ratio (presumably in mono) is given as 68 dB. Audio power output is listed at 3.8 watts per channel (with no qualifying values of THD or power band), and—surprise of surprises—the bass and treble controls offer 10 dB of boost or cut at 100 and 10,000 Hz (unlike the usual single control "treble cut" tone control systems offered on most car units). Wow and flutter for the cassette tape mechanism is listed at 0.3%. The KP-500 has a suggested retail price of \$160.00.

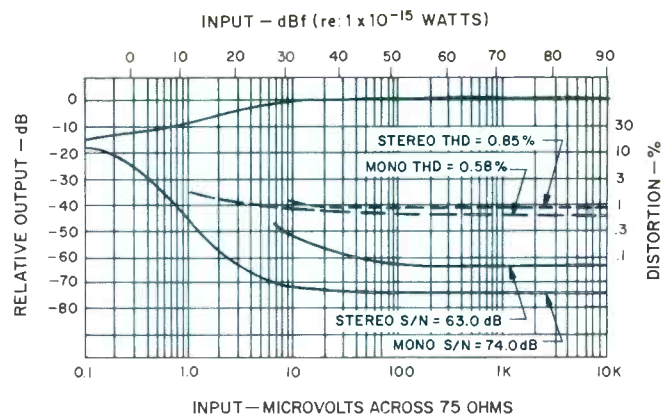
The front portion of the KP-500 slopes slightly upwards which provides improved visibility of controls and dial settings. At the right is a circularly calibrated FM frequency dial with a clock-type rotating pointer. Frequency calibration is at every 2 MHz and is almost, but not quite, linear. Along the upper edge of the panel, to the left of the circular dial, are tiny bass, treble, and balance controls and somewhat larger knobs for volume adjustment and station tuning. Below the tuning control are three tiny toggle switches, one of which introduces interstation muting, another providing two levels of FM sensitivity for *Local* or *Distant* reception, and the third for turning on the radio. Even with this *Radio On* switch in its off position, power is automatically turned on when a cassette is introduced into the nearby compartment. To the right of the cassette compartment door is another toggle switch which actuates a loudness control circuit. Below the cassette door are three rectangular transport controls, stop/eject, fast-forward, and rewind. No "play" button is needed since normal tape transport at 1-7/8 ips occurs when the cassette is fully inserted. The multi-conductor cable at the rear of the unit terminates with a socket, a plug connected to the positive supply lead (fused, with in-line fuseholder supplied), and speaker connecting leads, including ground returns. A recessed receptacle on the rear surface accepts the coaxial antenna connector referred to earlier.

### FM Performance Measurements

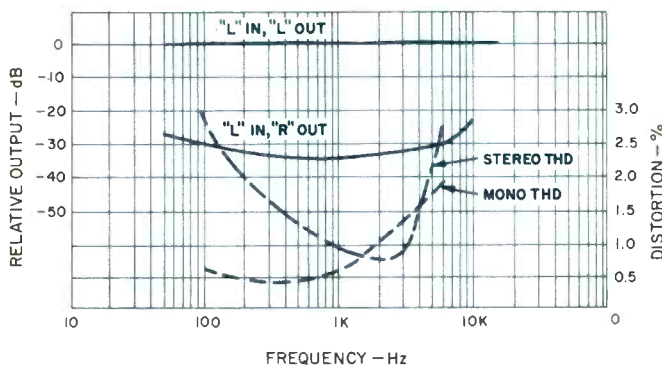
Quieting and distortion characteristics for the Pioneer KP-500 in both mono and stereo operation are plotted in the graphs of Fig. 1. IHF usable sensitivity in mono was 0.9  $\mu$ V (10.5 dBf), as opposed to the 1.0  $\mu$ V claimed. Best S/N ratio in mono was 74 dB, while 50 dB of quieting in mono was

reached with a signal input of only 1.2  $\mu$ V (13.0 dBf). Stereo sensitivity and 50-dB quieting were both governed by the stereo switching threshold which occurred at 15  $\mu$ V (34.9 dBf), by which time S/N was already 52 dB, reaching a maximum of 63 dB for strong signals. THD in mono was 0.58%, increasing to 0.85% in stereo for a 1-kHz signal.

Figure 2 shows stereo separation capability, as well as dis-



Pioneer KP-500 FM quieting and distortion.



Pioneer KP-500 separation and distortion vs. frequency.

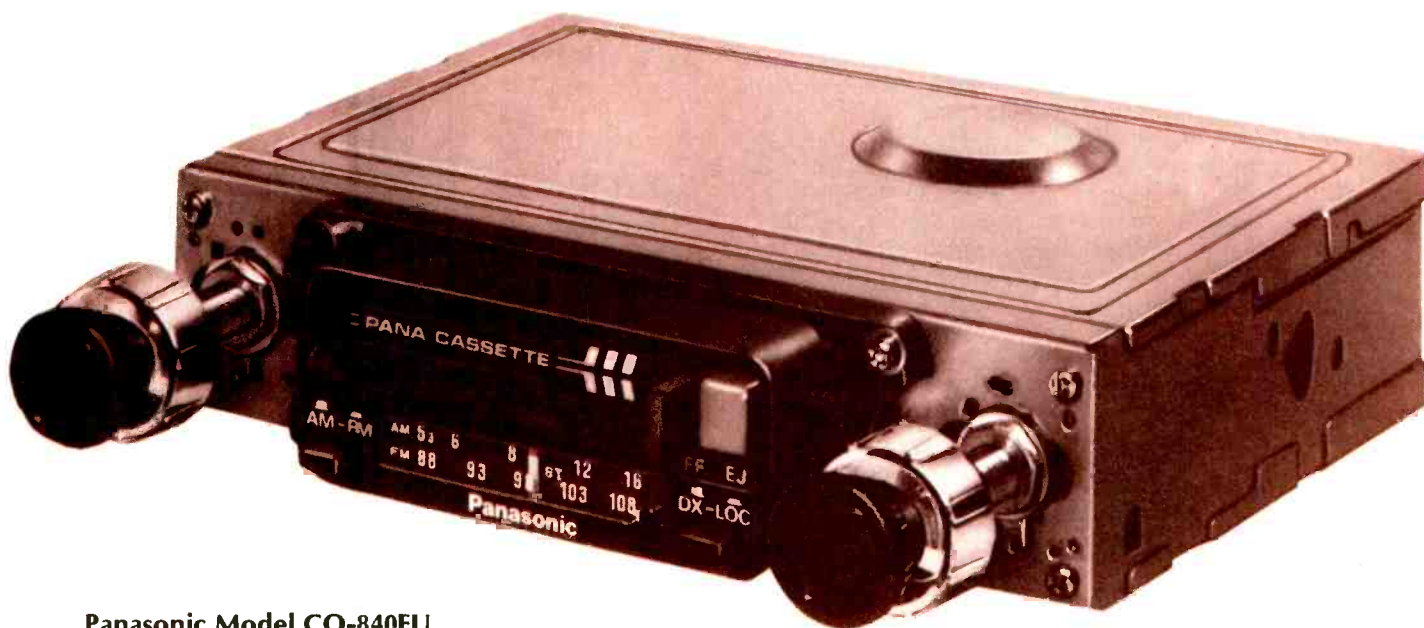
tortion in mono and stereo, for different audio frequencies. THD at the low frequencies was rather high, in stereo, reaching 3.0% at 100 Hz. Separation at 1 kHz was 35 dB, decreasing to 21 dB at 10 kHz. Audio response generally followed prescribed 75 microsecond de-emphasis at the mid and high frequencies, but is deliberately rolled off at the low end, probably to prevent distortion from the limited response of loudspeakers generally used in automobile installations.

Capture ratio measured just under 1.8 dB, while measured alternate channel selectivity was 70 dB—quite excellent for a unit of this type, even if a bit short of claims. Muting was overcome with a signal input of 8.4  $\mu$ V (29.9 dBf). While dial calibration was off in the worst case by 1.5 MHz at 98 MHz, we understand that our sample was subjected to some severe environment and shock tests before being submitted to us and perhaps this degree of error in calibration may have resulted from these earlier tests. Certainly, the calibration could be easily adjusted and we do feel that in a car radio calibration is particularly important, since drivers cannot spend much time peering down at the dial while operating their vehicles.

### Amplifier and Cassette Section Measurements

All measurements were made with a supply voltage of 14.0 volts d.c., and 4-ohm resistive loads were used for all power measurements of this and the other receivers tested. For a 1.0% THD level at 1 kHz, the unit delivered 2.75 watts per channel (with both channels driven). At 10% THD, power delivered was 3.2 watts per channel, still somewhat short of the 3.8 watts claimed. Had a 3.2 ohm load been used (the nominal impedance of car speakers), perhaps the unit would have managed to “squeak through” at the claimed 3.8 watts per channel, albeit at 10% total harmonic distortion. Tone control action was as described, and it was nice to finally find a car unit that actually incorporates separate bass and treble controls that really work. Loudness control circuitry also worked as expected and seemed well calibrated in terms of the action of the master volume control.

Wow and flutter of the cassette mechanism measured 0.2% W rms. Using a test cassette tape, which we recorded for this purpose on our Nakamichi 1000 deck (known to have response out to 20,000 Hz) using low-noise high output tape, playback response of the KP-500 cassette player extended from 50 Hz to 8 kHz for the -3 dB rolloff points.



### Panasonic Model CQ-840EU

The Panasonic unit tested also retails for just under \$160.00 and lists a power output capability of the amplifier section of 3.5 watts per channel (at 400 Hz, for 10% THD, into a 4-ohm load). Wow and flutter for the cassette section is given as less than 0.4% W rms and frequency response for the cassette section is claimed to be from 50 Hz to 10,000 Hz (with no “plus or minus dB tolerance given”). The only meaningful FM performance specification listed by the manufacturer is stereo FM separation, at 25 dB. The unit is also extremely compact, measuring 7 in. by 7 in. by 1-23/32 in. high.

Since this unit is intended for in-dash mounting, major controls are arranged much like those found on factory-installed radios, that is, concentric volume on/off and tone control knobs are at the left, while the tuning control is at the right. There is no balance control provided. The cassette insertion slot is centered above the frequency dial, which

contains only a few frequency notations, thus serving only as a guide to the frequency being tuned in. An FM stereo light is also included in the dial area. Slide switches at either side of the dial area select AM or FM operation and DX (distant) or LOC (local) sensitivity. Eject and Fast Forward pushbuttons are located to the right of the cassette door. A short length of coaxial cable emanates from the rear of the unit for connection of the car antenna's cable and plug. Separate speaker cables and power wire (with built-in fuse) plug into appropriately labeled sockets on the rear of the chassis.

### FM Performance Measurements

Figure 3 plots quieting and distortion characteristics of the Panasonic CQ840EU for mono and stereo reception. IHF sensitivity measured 5.0  $\mu$ V (25.4 dBf for 75-ohm input), while in stereo, sensitivity was 15  $\mu$ V (34.9 dBf). Ultimate S/N

in stereo was 60 dB, 71 dB for mono. THD measured 1.5% in mono and 1.8% in stereo for a 1-kHz audio signal at 100% modulation. The 50-dB quieting points for mono and stereo were 18  $\mu\text{V}$  (36.5 dBf) and 60  $\mu\text{V}$  (47.0 dBf), respectively. Stereo threshold (switching) occurs at a signal input of 3  $\mu\text{V}$  (21 dBf). Limiting is poor in comparison to home units, as evidenced by the rather high signal strength required before audio output levels off at its highest value. Separation and distortion as a function of frequency are plotted in Fig. 4.

Best stereo FM separation measured 35 dB at 1 kHz, decreasing to 16 dB at 10 kHz. Useful response of the radio portion of this unit does not extend much below 200 Hz, by which frequency distortion is already above 4.0%. The rising distortion is, however, compensated for by the fast roll-off in response built into the set. At 200 Hz, response is already down some 9 dB below the 1-kHz reference point. With the tone control fully clockwise, high end response rolls off rapidly too and is down some 11 dB at 10 kHz compared to the required de-emphasis characteristic called for in FM. With the tone control in its counterclockwise position, response at 10 kHz is down 32 dB at 10 kHz relative to mid-frequency response, 21 dB down at 5 kHz.

### Cassette Section Performance

Wow and flutter of the cassette section of the Panasonic CQ-840EU measured 0.2% W rms, exactly equalling the readings obtained with the Pioneer unit. Playback frequency response extended from 100 Hz to 5000 Hz with reference to the -3 dB roll-off points.

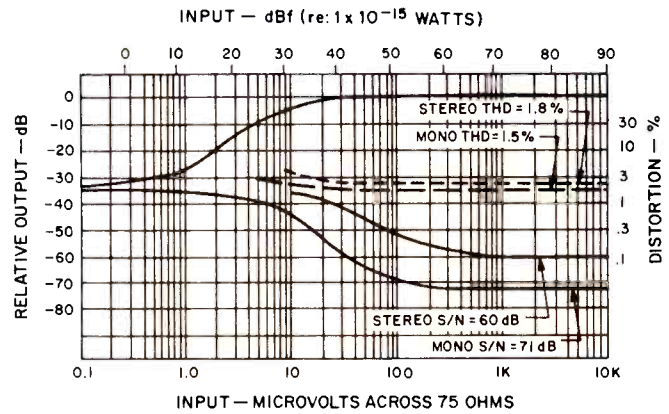
### Amplifier Section

At 1.0 watt output per channel of a 1 kHz signal, THD of the Panasonic unit (using 4-ohm loads) measured just under 2.0%. The 10% THD point was reached when 3.08 watts per channel were delivered to the resistive loads. With a 200-Hz input signal, the 10% THD point was reached at a power output of 2.5 watts, indicating a limitation at the low end of the audio spectrum.

### Motorola Model TC877AX

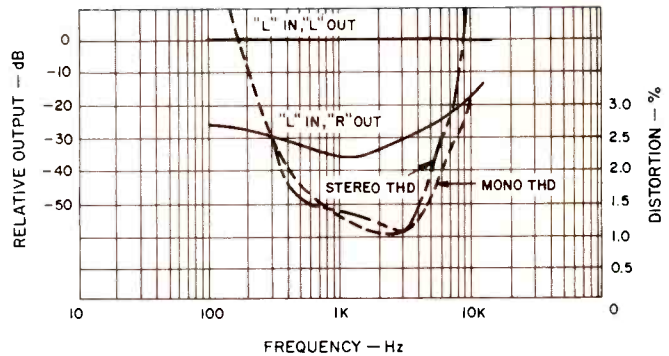
The third automobile radio/cassette unit tested was a Motorola Model TC877AX which is offered for sale at an average retail price of \$170.00. This unit is almost identical in size to the Panasonic unit and, like it, is intended for in-dash mounting. The control layout includes dual concentric knobs at left and right, with volume and tone controls forming one pair, and tuning knob plus balance control constituting the second pair of rotary controls. Long threaded shafts associated with these control pairs make for easy installation of the unit, and the distance between these control pairs can be varied by loosening hex nuts which retain the controls in place and sliding the entire control from left to right in wide slots provided.

As we noted earlier, the dial area pivots out of the way to accept a standard tape cassette inserted with long dimension oriented from front to back. A cassette Eject button is located above and to the left of the dial/cassette opening, and below it are three illuminated indicators which spell out Stereo, AM or FM and Tape, depending upon type of programming selected or tuned to. A fast-forward button (which must be held in to work) is located below these indicators. Along the bottom of the exposed section of the panel are four thin push buttons; one is a local/distance



Panasonic CQ-840EU FM quieting and distortion.

Panasonic CQ-840EU separation and distortion vs. frequency.



switch, the second selects AM or FM reception, the third selects mono or stereo, and the fourth is labelled *Power Boost*, about which we shall have more to say presently. Emanating from the rear of the chassis are a short length of cable with the standard coaxial connector and sets of color-coded wires terminated in polarized speaker plugs for connection to the pair of speakers used. A separate black wire, with built-in line fuseholder and fuse, connects to the positive voltage supply of the automobile.

While supplied with well-written installation and operating instructions and the necessary brackets and hardware for easy mounting, there were no performance specifications supplied with the receiver. A full schematic diagram is included in the owner's manual though, and we were somewhat surprised to note that AM and FM circuitry are completely independent in this little unit. Three tuned circuits are used in the r.f. section of both the FM and AM tuners (tuning is accomplished inductively rather than by means of variable capacitors—typical practice in automotive radios).

### What is Power Boost?

Flipping Motorola's *Power Boost* switch raises the sound level by changing the voltage divider action of the volume



control circuitry and also gives a different frequency response characteristic. In other words, when the switch is depressed, gain is increased by a finite amount so that program material sounds louder with a different frequency response. There is no increase in total power output capability regardless of which of the switch positions is selected—just a change of gain! The point of this, says Motorola, is to quickly change the unit's output to a higher level with a response tailored to mask ambient noise, which is, of course, much higher on the road than in the home. An interesting ap-

proach to the problem of road noise but we would rather have had a higher powered amp section.

Circuitry is otherwise quite conventional with bi-polar transistors used even in the r.f. amplifier of the FM section, quadrature detection of FM, and a phase-lock-loop multiplex decoder section incorporated. Two-stage tape pre-amplifiers are used for the cassette playback section. Selection of AM or FM is effected by simply applying supply voltage to the appropriate circuits. Power output stages are push-pull and use PNP-NPN complementary pairs, with 1000  $\mu\text{F}$  capacitive coupling to speakers.

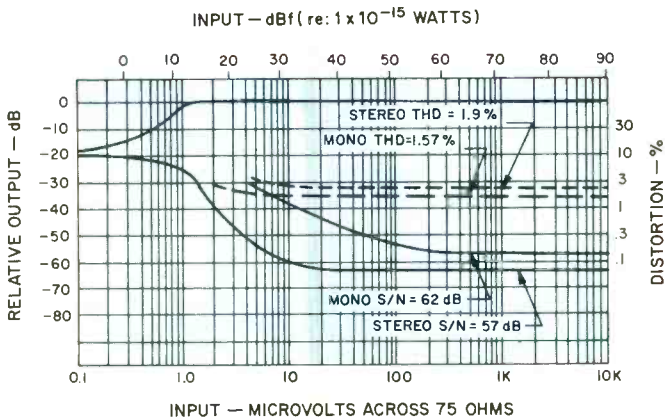
### FM Performance Measurements

Quieting and distortion characteristics of the Motorola TC877AX unit are plotted in Fig. 5. IHF sensitivity in mono measured 1.8  $\mu\text{V}$  (16.5 dBf), while in stereo the sensitivity was 3.4  $\mu\text{V}$  (22.0 dBf). To reach 50 dB of quieting, 2.9  $\mu\text{V}$  (20.7 dBf) of signal was required in mono, 42  $\mu\text{V}$  (43.9 dBf) for stereo. Signal-to-noise ratio in mono reached 62 dB with strong signal inputs and 57 dB in stereo. Mono THD was 1.57% in mono and 1.9% in stereo for a 1-kHz modulating signal. Stereo threshold was the lowest of all three, measuring 1.0  $\mu\text{V}$ . This might prove to be a disadvantage (at these low signal levels, stereo reception is all but impossibly noisy) were it not for the stereo/mono switch provided on the front panel which allows the user to switch back to quieter mono reception when weak-signal stereo reception is too noisy.

As shown in Fig. 6, stereo separation at 1 kHz measured 27 dB for the Motorola unit and remained relatively good out to 10 kHz, at which frequency it measured 22 dB. The use of that phase-lock-loop IC circuit (Motorola's own) no doubt is helpful here. Distortion at low audio frequencies was up (5.2% at 100 Hz), though frequency response is not rolled off quite as rapidly in this unit as in the Panasonic. Response was down some 5.5 dB at 50 Hz and was accurate to within 3 dB up to 15 kHz at the high end (with tone control in the maximum clockwise position, of course). We measured a selectivity of 65 dB and a capture ratio of 2.5 dB for this receiver. Dial calibration was quite accurate though again, only a few numbers (without precise points or marks) are inscribed for AM or FM station selection.

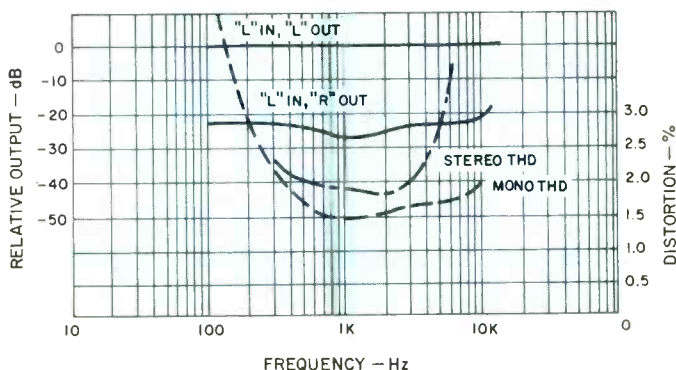
### Cassette Tape Section

The Motorola unit had the best wow-and-flutter measurements of all three units tested, 0.13% W rms, though its playback response extended only from 80 Hz to 4 kHz  $\pm 3$  dB.



Motorola TC-877AX FM quieting and distortion.

Motorola TC-887AX separation and distortion vs. frequency.





## Amplifier Section Measurements

The amplifier section of the Motorola unit delivered 2.9 watts per channel at 10% total harmonic distortion using a 1-kHz input signal. Distortion decreased to 2.0% at 2.0 watts output but remained higher than 1.0% down to power output levels of 1.0 watt.

## Conclusions

The table summarizes the important measurements made for the three units tested. Clearly, Pioneer's claim that they have succeeded in producing a "true hi-fi" car radio/cassette player comes close to being fulfilled in terms of the unit's FM reception capability and cassette performance. The Motorola unit runs a not-too-close second in FM performance but is clearly worse insofar as cassette playback response is concerned, though it did have excellent wow-and-flutter numbers for the transport system. As the table clearly shows, power output was quite similar for all three units, within a couple of tenths of a watt. This raises an interesting point. According to the Federal Trade Commission rule on power disclosure for home entertainment amplifiers, all of these units should have had to disclose power output in the now-approved and complete fashion required by the FTC for all amplifiers delivering more than 2.0 watts per channel. Is the loop-hole in the word "home entertainment?" If so, that loop-hole needs plugging we think. As it stands, all three amplifiers are rated at around 3 watts, yet there were fairly substantial differences in the power band which would have had to be published had these products been subject to the FTC rule.

In listening tests (performed in our lab, and not in a mov-

ing vehicle), the Pioneer KP-500 also won hands down and was noticeably more sensitive (receiving a greater number of stations than the other two when hooked up to a simple indoor dipole antenna with a suitable matching transformer for unbalanced 75-ohm connection).

In the test report we did for five car radios last year I concluded with the following statement: "Maybe I'm letting my audio snobbery show by suggesting that I'd like to put a small d.c.-to-a.c. converter in my car trunk to power a small home-type hi-fi receiver for serious listening on the highway. Since that's difficult and pretty expensive, I will admit that FM stereo listening can be fairly pleasant using one of these medium-fi auto units." It appears time to modify that statement somewhat, if only insofar as the Pioneer entry is concerned. While still a long way from meeting the performance of the amplifier sections of even the most moderately priced home stereo receivers, the FM section has made a great step forward and is the equal of some home-bound hi-fi components. Its cassette reproduction, while not equal to that of home stereo cassette decks (and not equipped with record or Dolby playback facilities) does provide response that is far better than you can get from many AM transmissions and not very much worse than that obtained from some FM broadcasts. Since FM on the road is, at best, a hit and miss proposition, having cassette facilities on these relatively low-cost units is a worthwhile addition, particularly if you are in the habit of recording and preserving your favorite selections on home cassette decks. Such recorded cassettes can be tucked in your pocket next time you travel and popped into such units for added listening pleasure in your car.

# BREAK THE SOUND BARRIER.

The ADS-2002/Nakamichi 250 music system opens up a new era: genuine high fidelity from a miniature system for your automobile and your home.

For the first time ever, you now can enjoy the same high quality music reproduction that you have come to expect from the finest component stereos in your automobile, boat, and motor home.

ADS and Nakamichi Research, both famous for their superb home and professional audio equipment, have jointly developed a unique stereo system to bring you your own 55 mph concert hall. But, you can also remove the entire set in seconds and convert it to AC-operation: then take it to your summer cottage, dormitory, office, or wherever you like.

This miniature music system is so small, it easily fits in your briefcase; it consists of two high performance 2-way loudspeakers, six built-in, ultra modern power amplifiers and a tiny studio quality cassette player equipped with Dolby® circuits and all controls for the system. For home use there is an optional AC-power pack. — Drive to your nearest ADS dealer and ask him about the 55 mph Concert Hall.

You will hear a dream come true.

# ADS 2002

## with NAKAMICHI 250



(Right ADS2002 shown without mounting bracket. Left ADS2002 shown with back panel removed)

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# The \$900 Sony Turntable.



# Study this page, because we don't want the price to suck you in.

It would be a shame.

People responding to something because it costs \$900\*. Not because it's worth \$900.

People captivated by price, not performance.

We at Sony don't want anyone spending good money for a great turntable for a bad reason like an impressive price tag.

Especially because there's so much technology in the PS-8750 for you to fall back on. After you spring for the \$900.

So before you spend a lot of money on us, spend at least a little time with us.

## Total speed accuracy is our speed.

Speed accuracy can be a problem for turntables because the stylus continually puts pressure on the record (and, in turn, on our engineers.)

In fact, as little as one gram of stylus pressure can cause a slow-down in record speed. A slow-down that is particularly noticeable in loud passages.

Up till now, most good turntables achieved accuracy with a direct drive motor and a servo-system to control speed variations.

It was fine for most people. And it still is.

But for those with more elegantly attuned hearing, it's just not good enough.

That's because the servo-system will not serve when it comes to small, low-frequency speed variations. It is not sensitive enough, and the result is there to be heard — if you have the discernment to hear it.

To get around this, Sony took the conventional servo-system and revolutionized it by adding a quartz reference and a phase lock circuitry.

That mouthful is really easy to digest. The stable quartz generator emits a constant frequency. Any variations in speed monitored by the magnetic head are converted to changes in the phase of the signal. This is then compared against the quartz generator's phase signal.

If they do not match, our Xtal-Lock corrects the speed variation instantly.

A conventional servo-system has to wait for the error to appear as a change in frequency, and then it takes time to correct it.

Sony can make the corrections 10 times faster. And within one cycle. All because Sony uses the phase difference as a source of information on speed error, rather than using the angular velocity.

Chart A dramatically illustrates the dramatic difference.

## Why our tone-arm costs an arm and a leg.

After conquering the drive system, Sony sped along to the tone-arm. The problem: constructing a light, strong tone-arm that has a low resonance quality.

A high resonance quality means the tone-arm vibrates — performing a duet with whatever record is playing.

Sony wrestled with the arm problem and

ating both the drive system and the return mechanism. Meaning that the turntable is linked to the tone-arm. And very often, this linkage produces a drag on the arm.

The PS-8750, however, proves that two motors are better than one. The motor that runs the tone-arm is totally isolated from the other motor that runs the turntable.

This eliminates the drag, particularly the drag at the very end of the record.

This drag is really a drag, because the return mechanism is preparing to activate itself, and the friction is therefore increased.

Sony further innovates by designing pick-up and return cues that are optically activated. Like the doors in a supermarket, if you will.

With the PS-8750, you get the best of the direct drive manual and the best of the semi-automatic. With none of the worst of either.

## Does your turntable give you bad vibrations?

The same sound waves that travel from your speakers to your ears also travel to your turntable.

This transference excites the equipment. Becoming acoustic feedback, or IM distortion. And the louder you play your record, the more of it you get. There's cabinet resonance. Caused by sound waves.

And there's something called record resonance. Caused by the friction of the stylus in the groove of a warped record.

Sony, however, deals resonance a resounding blow.

We have built the PS-8750's turntable base of an inorganic material that is acoustically dead.

We have also undercoated the platter with an absorbing material that prevents it from transferring any bad vibrations to the good vibrations on the record.

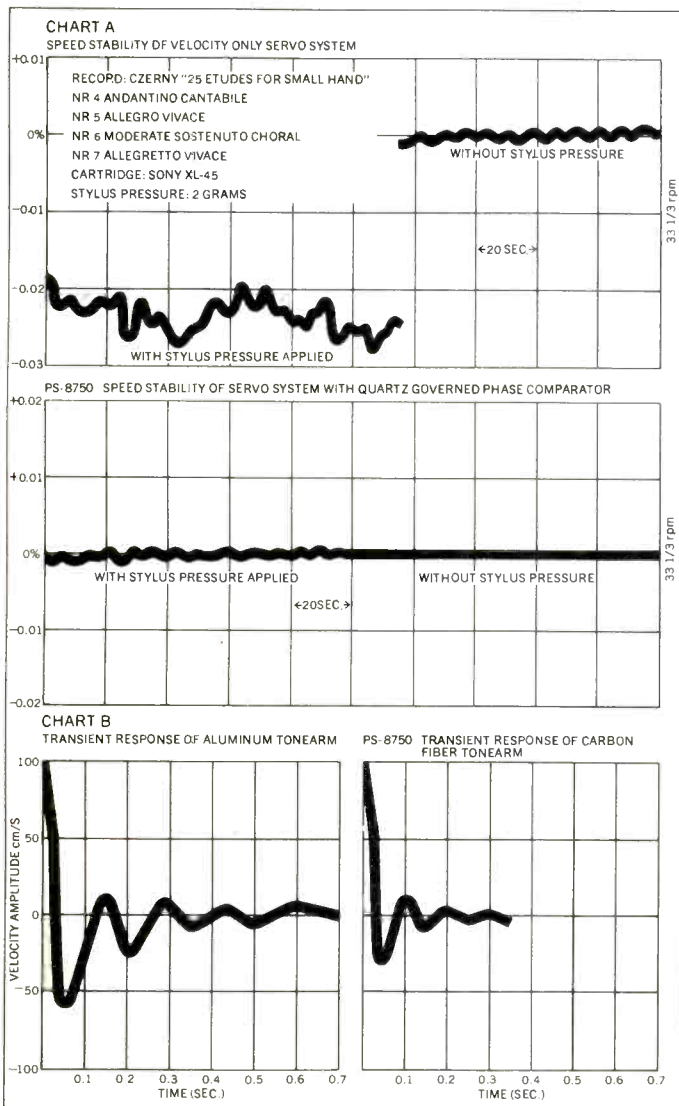
And we cut down on record resonance by pumping a silicone damping material into the record mat itself. By having contact with the entire record surface, it offers more support.

## Not for people who want the latest. But the greatest.

The PS-8750 represents a tonnage of innovation and a couple of real breakthroughs.

It is not for those who want to spend \$900 so they can say they spent it.

It is for those who want to spend \$900 so they can hear they spent it.



came up with a different material: a carbon fiber of enormous strength and equally enormous lightness. Moreover, it has a much smaller resonance peak than the aluminum alloy commonly used. (See Chart B, where the difference is demonstrated.)

The carbon fiber worked so well that it was even incorporated into the head shell of the PS-8750. But Sony didn't stop at the tone-arm's construction. Next came the actual operation of it.

Most turntables have one motor, oper-

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\*Cartridge sold separately.

# SONY®

# CAR STEREO DIRECTORY

Car stereo equipment is proliferating, particularly in the wide variety of AM/FM radio, cassette, and eight-track tape gear available for post-sale or add-on installation.

In this issue *Audio* presents a directory of add-on equipment in many different configurations. It should be

added that car manufacturers use some of these same suppliers to construct sets to fit the contours of their particular automobile for original equipment installation. Loudspeakers are listed in their own specific section.

It must be noted that the data in these listings are supplied to *Audio* by

the manufacturers for this directory and are not the results of *Audio's* own laboratory tests.

The prices listed for these units are only guidelines since passage of the law banning fair-traded items; and since competition is fierce on many items, discounts may be obtained.

## Directory of Manufacturers

**Acoustic Fiber Sound**  
7999 Knue Rd., Suite 116  
Indianapolis, Ind. 46250

**ADS**  
64 Industrial Way  
Wilmington, Mass. 01887

**AFCO**  
471 Roland Way  
Oakland, Cal. 94621

**Astrosonix**  
Boman Industries  
9300 Hall Rd.  
Downey, Cal. 90241

**B&B Import-Export, Inc.**  
185 Park St.  
Troy, Mich. 48084

**Becker Autoradio, USA, Inc.**  
613 S. 24th St.  
Phila., Pa. 19146

**Blaupunkt**  
Robert Bosch Corp.  
2800 S. 25th St.  
Broadview, Ill. 60153

**Caltron**  
9180 Kelvin Ave.  
Chatsworth, Cal. 91311

**Comm. Industries, Inc.**  
1 Gateway Center  
Newton, Mass. 02158

**Component Specialties, Inc.**  
393 S. Franklin St.  
Hempstead, N.Y. 11550

**Craig Corp.**  
921 W. Artesia Blvd.  
Compton, Cal. 90220

**CTS of Paducah, Inc.**  
1565 N. 8th St.  
Paducah, Ky. 42001

**Evadin**  
Aiko Corp.  
2020 W. 16th St.  
Broadview, Ill. 60153

**Arthur Fulmer**  
260 Monroe Ave.  
Memphis, Tenn. 38103

**Hanabashiya, Ltd.**  
39 W. 28th St.  
New York, N.Y. 10001

**Herald Electronics**  
6611 Lincoln Ave.  
Lincolnwood, Ill. 60645

**Inland (IDI)**  
10 Horizon Blvd.  
South Hackensack, N.J. 07606

**J.I.L. Corp. of America**  
737 W. Artesia Blvd.  
Compton, Cal. 90220

**Kraco Enterprises, Inc.**  
2411 N. Santa Fe Ave.  
Compton, Cal. 90224

**Lear Jet Stereo, Inc.**  
140 Corum Rd.  
Excelsior Springs, Mo. 64024

**Medallion**  
Midland International  
1137 Saline St.  
North Kansas City, Mo. 64116

**Magitran Co.**  
311 E. Park St.  
Moonachie, N.J. 07074

**Metro Sound**  
11144 Wedington St.  
North Hollywood, Cal. 91601

**Motorola, Inc.**  
9401 W. Grand Ave.  
Franklin Park, Ill 60131

**Nakamichi Research**  
220 Westbury Ave.  
Carle Place, N.Y. 11514

**Neosonic Corp. of America**  
57 Old Country Rd.  
Westbury, N.Y. 11590

**Nuvox Electronics**  
150 5th Ave.  
New York, N.Y. 10011

**Oxford Speaker Co.**  
4647 W. 47th St.  
Chicago, Ill. 60632

**Panasonic**  
1 Panasonic Way  
Secaucus, N.J. 07094

**Philips**  
Amperex Electronic Corp.  
182 Duffy Ave.  
Hicksville, N.Y. 11802

**Pioneer Electronics of America**  
1555 E. Del Amo Blvd.  
Carson, Cal. 90746

**RCA**  
Distributor Div.  
Cherry Hill Offices,  
Building 206-2  
Camden, N.J. 08101

**Royal Sound Co., Inc.**  
409 N. Main St.  
Freeport, N.Y. 11520

**Solar Sound Systems, Inc.**  
339 5th Ave.  
New York, N.Y. 10016

**Sony-Superscope, Inc.**  
8150 Vineland Ave.  
Sun Valley, Cal. 91352

**Sparkomatic Corp.**  
Milford, Pa. 18337

**Utah Electronics**  
1124 E. Franklin St.  
Huntington, Ind. 46750

**Xtal**  
Far Eastern Research Labs  
8749 Shirley Ave.  
Northridge, Cal. 91324

# The Garrard 990B. And the argument ends.

There are almost no limits to what you can spend for a turntable. Nor to the refinements that can be built in.

The argument has been whether you can find a turntable at a sensible price, that really performs—giving away nothing important. Now with the belt-driven 990B, the argument is over. The 990B gives nothing away in any vital area, yet is priced to make it eminently accessible.

We believe the 990B is the best value Garrard has ever offered in its quarter century of designing and manufacturing high fidelity turntables.

The 990B is a single-play/multiple-play turntable and is fully automatic in both modes. That is, its arm indexes, returns to its rest and shuts off automatically. All of which is more dependable than a hand . . . that can be shaky or careless. And the mechanism that does all of this is disengaged *during* play. You get the gentlest handling of records *plus* convenience.



But more. In the multiple-play mode, your records rest on a *two* point support. You don't have to balance them on a single center support. And pray.

And still more. A precision anti-skating device eliminates distortion and record wear caused when the stylus is forced against the inner wall of the groove by rotation of a record. Even cueing is viscous damped in *both* directions.

All well and good. But what about performance?

A glimpse at some specifications tells the story. Rumble: -64dB. Wow: 0.06%. Flutter: 0.04%. These are possible because your records are cushioned on a full size, 5 lb., die-cast, dynamically balanced platter—belt driven by a motor that *combines* an induction rotor for starting power and a synchronous section for constant speed. You can even solve the problem of off-pitch recordings with the variable speed control monitored by a strobe disc.

One final word. The S-shaped, lightweight, aluminum tonearm boasts low mass and low friction. But here's the thing. The 990B's tonearm can track as lightly as 1/2 gram. Protection and performance indeed.

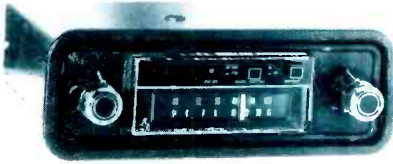
There are other turntables in the price range of the 990B that offer *some* of these features and specifications. The 990B has them *all* and at a price that's sensible—under \$170!

Which clinches the argument.

For a copy of the Garrard Guide, write: Garrard, Div. of Plessey Consumer Products, Dept. C, 100 Commercial St., Plainview, New York 11803.

**Garrard**  
The Automatic Choice

Check No. 11 on Reader Service Card



AFCO ID-300



# Car Radio/Tape Players

MANUFACTURER	MODEL	PRICE, \$	Stereo (S), Mono (M), or 4-channel (D)?	FM Sensitivity, $\mu$ V ? (for 30-dB queuing)	Local/Distant Switch?	AFC?	Pushbuttons? If Yes, Number, AM, Number FM?	Signal-Seeking Tuning?	Bass control?	Treble Control?	Cassette?	8-Track?	Auto Reverse?	Fast Forward?	Tape Rewind?	Includes Speakers?	In-Dash (I) or Under Dash (U)?	Control Shaft Spacing, Inches?	Dimensions, inches, H x W x D
AFCO ELECTRONICS	IDC-600	149.95	S	2	No	Yes	No	No	Yes	Yes	—	No	Yes	Yes	No	—	Adj		
	IDC-500	159.95	S	3	Yes	Yes	No	—	Yes	Yes	—	No	Yes	Yes	No	—	Adj		
	IDC-650	159.95	S	3	Yes	Yes	No	—	Yes	Yes	—	No	Yes	Yes	No	—	Adj		
	DID-1010	119.95	S	3	No	Yes	No	—	Yes	Yes	—	No	No	No	No	—	Adj		6 1/2 x 4 3/4 x 1 1/2
	AG-52	139.95	S	2	Yes	Yes	No	—	Yes	Yes	—	No	No	No	No	—	Adj		6 1/2 x 1 1/2 x 5 1/2
	ID-300	149.95	S	2	Yes	Yes	No	—	Yes	Yes	—	Yes	No	No	No	—	Adj		6 1/2 x 2 x 6
ASTROSONIX	BM-1950		Q/S						No	Yes						U	Adj	3 x 7 1/2 x 8 3/8	
	BM-950		Q/S						No	Yes						U	Adj	3 x 7 1/2 x 8 3/8	
	BM-911		S						No	Yes						U	Adj	2 1/2 x 5 x 8 3/8	
	BM-909B		S						No	Yes						U	Adj	2 1/2 x 5 x 8	
	AP16		S						No	Yes						U	Adj	2 1/2 x 5 1/2 x 7 1/2	
	CT-2200		S						No	Yes						U	Adj	2 1/2 x 7 1/4 x 7 1/2	
	CT-2100		S						No	Yes						U	Adj	2 1/2 x 7 1/4 x 7 1/2	
	BM-1070		Q						No	Yes						U	Adj	2 1/2 x 7 1/4 x 7 1/2	
	BM-595		S						Yes	No						U	Adj	2 1/2 x 7 1/4 x 7 1/2	
	BM-590		S						Yes	No						U	Adj	2 x 5 1/4 x 7 1/4	
	BM-298		S						No	Yes							Adj	2 1/2 x 7 x 6	
	BM-294		S						No	Yes							Adj	2 1/2 x 7 x 6	
	BM-1150		S						No	Yes							Adj	2 1/2 x 7 x 6	
	BM-1335		S						No	Yes							Adj	2 1/2 x 7 1/4 x 6 1/2	
	BM-1332		S						Yes	No							Adj	2 1/2 x 7 1/4 x 6 1/2	
	BM-1330		S						Yes	No							Adj	2 1/2 x 7 1/4 x 5 1/2	
	BM-1127		S						No	Yes							Adj	2 1/2 x 6 1/2 x 7	
BM-1126		S						No	Yes							Adj	2 x 7 x 6		
BM-1125		S						No	Yes							Adj	2 1/2 x 7 x 6 1/2		
BM-1123		S						No	Yes							Adj	2 x 7 x 6		
BM-1120		S						No	Yes							Adj	2 1/2 x 7 x 4 1/2		
BM-1115		S						No	Yes		Yes					Adj	2 x 7 x 6 1/2		
B & B	RY-900	\$49.95	S		No	No	No		No	Yes	Yes	No	Yes	No	No	U		8 x 5 1/2 x 3	
	RY-891	\$22.95	S		No	No	No		No	Yes	Yes	No	Yes	No	No	U		7 1/2 x 5 1/2 x 2 1/2	
	RY-890/B	\$24.95	S		No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	No	U		5 1/2 x 7 x 2 1/2	
	RY-898	\$51.95	S		Yes	Yes	No		Yes	Yes	No	Yes	No	No	No	U		8 x 6 1/2 x 2 1/2	
	RY-700	\$26.95	S		No	No	No		Yes	Yes	Yes	No	Yes	No	No	U	Adj	6 1/2 x 6 1/2 x 2	
	RY-861	\$69.95	S		Yes	Yes	No		Yes	Yes	No	No	Yes	No	No	I		7 x 6 1/2 x 2 1/2	
	RY-702	\$69.95	S		No	Yes	No		Yes	Yes	Yes	No	No	Yes	No	I		7 x 6 1/2 x 2 1/2	
	BECKER	Mexico	\$844.28	S	2.5	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	I & U	5
	Europa	\$379.95	S	2.0	Yes	Yes	2 AM/3 FM	No	Yes	Yes	No	No	No	No	No	No	I & U	5	1 1/2 x 7 1/4 x 5 1/2
	Grand Prix ST	\$614.31	S	2.0	Yes	Yes	2 AM/3 FM	Yes	Yes	Yes	No	No	No	No	No	No	I & U	5	1 1/2 x 7 1/4 x 5 1/2
BLAUPUNKT DIV., BOSCH CORP.	Frankfurt	\$107.00	M	1.6	Electr.	Yes	2 AM/3 FM	No	Yes	Yes	No	No	No	No	No	No	I	5	1 1/2 x 7 x 5
	Frankfurt	\$172.00	S	1.4	Auto. Electr.	Yes	2 AM/3 FM	No	Yes	Yes	No	No	No	No	No	No	I	5	1 1/2 x 7 x 5
	Bamberg	\$795.00	S	1.8	Auto. Electr.	Yes	1 SW/1 LW 2 AM/2 FM	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	I	5	1 1/2 x 7 x 5
	Berlin	\$1015.00	S	1.4	Auto. Electr.	Yes	1 SW/1 LW 2 AM/2 FM	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	I	N/A	
	Combo II	\$197.00	S	5	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	I	5	1 1/2 x 7 x 5 1/2
	Combo I	\$209.50	S	5	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	I	5	2 x 6 1/2 x 7
Combo 8	\$162.40	S	5	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	Yes	No	I	5	2 x 6 1/2 x 7	
CALTRON/JET SOUNDS	JS 200	34.95	S	—	No	—	—	—	No	Yes	Yes	No	No	Yes	No	No	U	—	1 1/2 x 5 1/2 x 5 1/2
	JS 400	39.95	S	—	No	—	—	—	No	Yes	Yes	No	No	Yes	Yes	No	U	—	2 x 5 1/2 x 6 1/2
	JS 600	69.95	S	—	No	—	—	—	No	Yes	Yes	No	Yes	Yes	Yes	No	U	—	2 1/2 x 5 1/2 x 6 1/2
	JS 3500	99.95	S	2	Yes	Auto	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	U	—	2 1/2 x 7 x 7 1/2
	JS 8000	129.95	S	2	Yes	Auto	No	No	No	Yes	Yes	No	Yes	Yes	Yes	No	1	Adj.	6 1/2 x 7 x 2
	JS 8120	89.95	S	2.5	Yes	Auto	No	No	No	Yes	No	Yes	No	No	No	No	1	Adj.	7 1/2 x 4 1/2 x 2 1/2
	CT 4310	79.95	S	2.5	No	Auto	No	No	No	Yes	No	Yes	No	No	No	No	1	Adj.	7 1/2 x 4 1/2 x 2 1/2
	CT 4355	89.95	S	2	Yes	Auto	No	No	No	Yes	No	Yes	No	No	No	No	1	Adj.	7 1/2 x 4 1/2 x 2 1/2
	CT 9300	89.95	S	2	Yes	Auto	No	No	No	Yes	Yes	No	No	Yes	Yes	No	1	Adj.	7 1/2 x 5 1/2 x 2

You make a tape with time and thought. Carefully chosen selections recorded in the sequence that most pleases you. The musical coherence and perception is yours, a personal expression. And when the time is right to share



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when you don't want the music to stop  
**TEAC A-4300**





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Check No. 6 on Reader Service Card

# Introducing the world's most powerful With the world's least distortion.

The Technics SA-5760. 165 watts RMS per channel. That's more power than any other receiver in the world. And an even more important specification, 0.08% THD (Max.). That's less distortion than any other receiver in the world at rated power.

To achieve this unequaled power and uncompromising performance, we used single-packaged dual transistors in the differential amplifier stage of each channel. As well as high capacitance filtering and a bridged rectifier with high current reserve. And the amplifier is also direct coupled, with no transformers or capacitors from input to output. There's also heavy power supply regulation. So transient bursts in one channel remain isolated from the other.

And you'll hear your records precisely the way they were recorded. Thanks to "current mirror loading"—a radi-

cally new circuit found in the phono equalizer section of the SA-5760's pre-amp. The results are impressive. Double the amplifier gain. An unsurpassed S/N ratio of 78dB. A frequency response that's accurate to within  $\pm 0.2\text{dB}$  of the ideal RIAA equalization curve. And an overload-resistant input that will sail through high-level signal inputs without a trace of distortion.

For FM performance, we didn't just settle for outstanding specifications in selectivity, sensitivity and interference rejection. We also use flat group delay filters in the IF section so that the time delay is constant for all frequencies. That means the signal being broadcast is the signal you'll receive and without phase distortion.

And there's a Phase Locked Loop IC which improves tuner performance even more. Like a well-defined 38dB of



# receiver. 165 watts per channel. Only 0.08% THD.\*

stereo separation at 10kHz and much higher at mid-band. Inaudible distortion. A frequency response that actually exceeds the response of FM broadcasts (+0.2dB -0.8dB from 20Hz to 18kHz with the exclusive delay time switch in the CONST position). As well as a S/N ratio of 85dB for super-quiet FM broadcasts.

The SA-5760's controls are as sophisticated as its circuitry. A 26-step true attenuator click-stop volume control. Calibrated from -60 to 0dB. Low distortion negative feedback tone controls with turnover selectors for both the low end and high end frequencies. A linear FM/AM dial scale. A zero-center tuning meter for FM as well as a truly linear signal-strength meter for AM and FM that works the way other meters don't: accurately.

There are also multiple speaker and amplifier protection

circuits, with a front panel overload indicator. Two-way tape-to-tape dubbing. Two phono inputs with variable impedance selectors for each. And all the inputs and outputs you'd expect from the world's most powerful receiver.

And to complement the SA-5760, Technics has five other receivers. Each with excellent power. Outstanding performance. Sophisticated circuitry. And at a good price. The concept is simple. The execution is precise. The performance is outstanding. The name is Technics.

\*165 watts per channel, minimum RMS, into 8 ohms from 20Hz to 20kHz with no more than 0.08% THD (total harmonic distortion).

## Technics

by Panasonic



Check No. 34 on Reader Service Card



Motorola TC-876AX



# Car Radio/Tape Players

MANUFACTURER	MODEL	PRICE, \$	Features														Dimensions, inches, H x W x D
			Stereo (S), Mono (M) or 4-channel (Q)?	FM Sensitivity $\mu V$ ? (For 30-dB quieting)	Local/Distant Switch?	AFC?	Pushbuttons? If Yes, Number AM, Number FM?	Signal-Seeking Tuning?	Bass control?	Treble Control?	Cassette?	8-Track?	Auto Reverse?	Fast Forward?	Tape Rewind?	Includes Speakers?	
KRACO	KR-1220	M	1.0	No	Yes	2 AM, 3 FM	No	No	Yes	No	No	No	No	No	I/U	Adj.	5x7 $\frac{1}{2}$ x2 $\frac{1}{2}$
	KR-1230	S	1.0	No	Yes	2 AM, 3 FM	No	No	Yes	No	No	No	No	I/U	Adj.	5x7 $\frac{1}{2}$ x2 $\frac{1}{2}$	
	KID-560A	S	4	Yes	Yes	No	No	No	Yes	No	Yes	No	No	I/U	Adj.	7x7 $\frac{1}{2}$ x2	
	KID-565A	S	4	Yes	Yes	No	No	No	Yes	No	Yes	—	—	I/U	Adj.	5 $\frac{1}{2}$ x7 $\frac{1}{2}$ x1 $\frac{1}{2}$	
	KID-570A	S	1	No	Yes	No	No	No	Yes	No	Yes	—	—	I/U	Adj.	7x7 $\frac{1}{2}$ x3	
	KID-580A	S	1	Yes	Yes	No	No	No	Yes	Yes	No	No	Yes	I/U	Adj.	5 $\frac{1}{2}$ x7 $\frac{1}{2}$ x2 $\frac{1}{2}$	
	KS-340	S	—	—	—	—	—	—	Yes	No	Yes	No	No	U	—	7 $\frac{1}{2}$ x6x2 $\frac{1}{2}$	
	KS-400C	S	—	—	—	—	No	No	Yes	No	Yes	No	No	U	—	7 $\frac{1}{2}$ x6x2 $\frac{1}{2}$	
	KS-440	S	—	—	—	—	No	No	Yes	No	Yes	No	No	U	—	6 $\frac{1}{2}$ x5 $\frac{1}{2}$ x2	
	KS-480B	Q	—	—	—	—	—	—	Yes	No	Yes	No	No	U	—	6 $\frac{1}{2}$ x5 $\frac{1}{2}$ x2	
	KS-690	S	1	Yes	Yes	No	No	No	Yes	No	Yes	No	No	U	—	7 $\frac{1}{2}$ x7 $\frac{1}{2}$ x3	
	KS-890	S	—	—	—	—	—	—	Yes	No	Yes	No	Yes	U	—	7x6 $\frac{1}{2}$ x2 $\frac{1}{2}$	
	KS-950	S	—	—	—	—	—	—	Yes	Yes	No	Yes	No	U	—	7x6x2	
	KS-960	S	—	—	—	—	—	—	Yes	Yes	No	No	Yes	U	—	6 $\frac{1}{2}$ x4 $\frac{1}{2}$ x2	
	KS-980	S	—	—	—	—	—	—	Yes	Yes	Yes	No	Yes	U	—	8x5 $\frac{1}{2}$ x2 $\frac{1}{2}$	
KR-1250	M	5	No	Yes	No	No	No	Yes	No	No	No	No	U	—	5 $\frac{1}{2}$ x4 $\frac{1}{2}$ x1 $\frac{1}{2}$		
KCB-2370	S	<8 $\mu V$	Yes	Yes	No	No	No	Yes	No	No	No	No	No	I/U	Adj.	6 $\frac{1}{2}$ x7 $\frac{1}{2}$ x2 $\frac{1}{2}$	
KCB-2390	S	<8 $\mu V$	Yes	Yes	No	No	No	Yes	No	No	Yes	No	No	I	Adj.	7 $\frac{1}{2}$ x7 $\frac{1}{2}$ x2 $\frac{1}{2}$	
LEAR JET STEREO	A-10	59.95	S	—	No	No	No	Yes	Yes	No	Yes	No	No	U	—	2x5 $\frac{1}{2}$ x7 $\frac{1}{2}$	
	A-12	69.95	S	—	No	No	No	Yes	Yes	No	Yes	No	Yes	U	—	2x5x6	
	A-146	139.95	S	5	Yes	Yes	No	No	Yes	No	Yes	No	No	U	—	2x7x7	
	A-226	149.95	S	5	No	Yes	No	No	Yes	No	Yes	No	No	U	—	2 $\frac{1}{2}$ x8 $\frac{1}{2}$ x8	
	A-73	119.95	S	5	Yes	Yes	No	No	Yes	No	Yes	No	No	I	Adj.	2 $\frac{1}{2}$ x7 $\frac{1}{2}$ x6 $\frac{1}{2}$	
	A-83	149.95	S	5	Yes	Yes	Yes 5 AM or 5 FM	No	Yes	Yes	No	Yes	No	No	I	Adj.	2 $\frac{1}{2}$ x7 $\frac{1}{2}$ x5 $\frac{1}{2}$
MEDALLION	65-498	179.95	S	8	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	I	Adj.	2x7x6 $\frac{1}{2}$
	65-496	139.95	S	15	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	I	Adj.	2x8x6
	65-494	159.95	S	10	Yes	Yes	Yes 1 FM 3 Any, 1 AM	No	No	Yes	Yes	No	Yes	No	I or U	Adj.	2 $\frac{1}{2}$ x3 $\frac{1}{2}$ x7 $\frac{1}{2}$ x5 $\frac{1}{2}$
	65-558	125.95	S	10	Yes	Yes	No	No	Yes	No	Yes	No	No	I	Adj.	2x7x6	
	65-554	119.95	S	12	Yes	Yes	No	No	Yes	No	Yes	No	No	I	Adj.	1 $\frac{1}{2}$ x7 $\frac{1}{2}$ x5 $\frac{1}{2}$	
	65-485	89.95	S	—	No	No	No	No	Yes	No	Yes	No	Yes	U	Slide	2x5x7	
	65-489	119.95	S	8	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	U	Controls Slide Controls	2 $\frac{1}{2}$ x7x7 $\frac{1}{2}$	
METROSOUND	MS7550	149.95	S	2	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes	I	Adj.	2x7 $\frac{1}{2}$ x6 $\frac{1}{2}$
	MS7560	159.95	S	2	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	I	Adj.	1 $\frac{1}{2}$ x7x6 $\frac{1}{2}$
	MS7450	139.95	S	3	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	I	Adj.	2x7x6
	MS7250	129.95	S	2	No	Yes	No	No	Yes	Yes	No	No	Yes	No	I	Adj.	1 $\frac{1}{2}$ x6 $\frac{1}{2}$ x4 $\frac{1}{2}$
	MS7150	114.95	S	2.5	Yes	Yes	No	No	Yes	Yes	No	No	Yes	No	I	Adj.	2x7x6 $\frac{1}{2}$
	MS8550	179.95	S	3.0	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	I	Adj.	2 $\frac{1}{2}$ x7x6 $\frac{1}{2}$
	MS8560	179.95	S	2.5	Yes	Yes	No	No	Yes	Yes	No	Yes	Yes	No	I	Adj.	1 $\frac{1}{2}$ x7x6
	MS817	109.95	S	2.5	Yes	Yes	No	No	Yes	No	No	No	No	No	I	Adj.	1 $\frac{1}{2}$ x6 $\frac{1}{2}$ x4 $\frac{1}{2}$
	MS804	109.95	S	3.5	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No	I	Adj.	2x7x6 $\frac{1}{2}$
	MS816	119.95	S	2.0	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No	I	Adj.	2x7x4 $\frac{1}{2}$
	MS120	109.95	S	—	—	—	—	—	Yes	Yes	No	Yes	Yes	No	U	No	2 $\frac{1}{2}$ x5 $\frac{1}{2}$ x7
	MS308	39.95	S	—	—	—	—	—	Yes	Yes	No	No	Yes	No	U	No	2x4 $\frac{1}{2}$ x6
	MSC8	69.95	S	—	—	—	—	—	Yes	Yes	Yes	No	Yes	No	U	No	2 $\frac{1}{2}$ x5 $\frac{1}{2}$ x8
	MS887	39.95	S	—	—	—	—	—	Yes	Yes	No	Yes	No	No	U	No	2x4 $\frac{1}{2}$ x6 $\frac{1}{2}$
MOTOROLA	TC877AX	S	4	Yes	Yes	No	No	Yes	Yes	No	No	No	Yes	No	I	Adj.	2x7x6
	TC876AX	S	4	Yes	Yes	5 FM or AM	No	Yes	Yes	No	No	Yes	No	I	Adj.	3x7x6 $\frac{1}{2}$	
	TF875AX	S	4	Yes	Yes	4 FM or AM	No	No	Yes	No	Yes	No	No	I	Adj.	2 $\frac{1}{2}$ x7x6	
	TF756S	S	4	Yes	Yes	No	No	Yes	No	Yes	No	Yes	No	U	—	2 $\frac{1}{2}$ x7x7 $\frac{1}{2}$	
	TF874AX	S	4	Yes	Yes	5 FM or AM	No	No	Yes	No	No	No	No	I	Adj.	3x7 $\frac{1}{2}$ x7 $\frac{1}{2}$	
	FM485AX FM775AXI	S S	4 4	Yes Yes	Yes Yes	4 FM or AM 4 FM or AM	No No	Yes Yes	No No	Yes Yes	No No	No No	No No	No No	I I	Adj. Adj.	2 $\frac{1}{2}$ x7 $\frac{1}{2}$ x5 $\frac{1}{2}$ 2x6 $\frac{1}{2}$ x4 $\frac{1}{2}$

Pioneer KP-500



Royal Sound RS-2500



Sony TC-30



# Car Radio/Tape Players

MANUFACTURER	MODEL	PRICE \$	Stereo (S), Mono (M), or 4-channel (Q)?	FM Sensitivity, µV? (for 30db quieting)	Local/Disturb Switch?	AFC?	Pushbuttons? If Yes, Number	AM, Number	FM?	Signal Seeking Tuning?	Base control?	Treble Control?	Cassette?	8-Track?	Auto Reverse?	Fast Forward?	Tape Rewind?	Includes Speakers?	In-Dash (I) or Under Dash (U)?	Control Shaft Spacing, Inches?	Dimensions, inches, H x W x D
NAKAMICHI	250	275.00	S							Yes	Yes	Yes	No	No	Yes	Yes	No	U			3½x7¼x9½
NUVOX ELECTRONICS	CP-8400	39.95	S	—	No	Yes	No			Yes	No	No	Yes	No	No	No	No	U			2x7x6
	AFX-830	119.95	S	10	Yes	Yes	No			Yes	No	No	Yes	No	No	No	No	I	Adj.		2x7x6
	AFX-3000	129.95	S	15	Yes	Yes	No			Yes	No	Yes	No	No	Yes	Yes	No	I	Adj.		2x7x6
	AF-410	59.95	M	10	No	No	Yes	5 FM/AM		Yes	No	No	No	No	No	No	No	I	Adj.		2x7x4½
	AF-413	79.95	S	10	No	Yes	Yes	5 FM/AM		Yes	No	No	No	No	No	No	No	I	Adj.		2x7x4½
	A-881	79.95	S	20	No	No	Yes	3 FM/2 AM		Yes	No	No	No	No	No	No	Yes	I	Adj.		2x7x4½
	NVX-1740	29.95	S	—	No	Yes	No			No	No	No	No	No	No	No	No	U			2x7x6
	NVX-1850	29.95	S	—	No	Yes	No			No	No	No	No	No	No	No	No	U			2x7x6
NVX-1900	39.95	S	—	Yes	Yes	No			No	No	No	No	No	No	No	No	U			2x7x6	
PANASONIC	CX-375	49.95	S		No	No				No	No	Yes					No	U			2¼x5½x6½
	CX-475	69.95	S		No	No				No	No	Yes					No	U			2¼x6x7¼
	CX-675	89.95	S		No	No				No	No	Yes					No	U			2¼x6x7¼
	CX-567	89.95	S		No	No				No	No	Yes					No	U			2¼x6½x6½
	CX-601	149.95	Q		No	No				No	No	Yes					No	U			3x8½x8½
	CO-898	139.95	S		Yes	Yes				No	No	Yes					No	U			3½x8½x7½
	CO-252	119.95	S		No	No				No	No	Yes					No	I	Adj.		2½x7½x8
	CO-969	159.95	S		Yes	Yes				No	No	Yes					No	I	Adj.		2½x7½x7½
	CO-979		S		Yes	Yes				No	No	Yes					No	I	Adj.		2½x7½x7½
	CO-999		Q		Yes	Yes				No	No	Yes					No	I	Adj.		2½x7½x6½
	CX-232	79.95	S		No	No				No	Yes	No					No	U			2x4¼x6½
	CX-141	119.95	S		No	No				No	Yes	No					No	U			2½x6½x7
	CO-840		S		Yes	No				No	Yes	No					No	I	Adj.	5%	1¼x6½x4
	CR-143	44.95	M		No	No				No	No	No					No	I		5%	1¼x6½x5¼
	CR-514	94.95	M	Yes	Yes	Yes				No	No	No					No	I		5%	1¼x6½x6
	CR-714	119.95	S	Yes	Yes	Yes				No	No	No					No	I			1¼x6½x6
CR-501	49.95	M		No	No				No	No	No					No	I				2x7x6½
CR-656	99.95	M		Yes	Yes				No	No	No					No	I	Adj.		2x7x6½	
CR-701	124.95	S		Yes	Yes				No	No	No					No	I	Adj.		2x7x6½	
PIONEER	TP-252	49.95	S	No radio	—	—	—	—	No	Yes	No	Yes	No	No	No	No	No	U			2x4x6½
	TP-200	99.95	S	N/A	No	Yes	None	No	No	Yes	No	Yes	No	No	No	No	No	U			2¼x7¼x7½
	KP-212	79.95	S	No radio	—	—	—	—	No	No	Yes	No	Yes	No	Yes	No	No	U			2x5x7
	KP-250	119.95	S	N/A	No	Yes	None	No	No	Yes	Yes	No	No	Yes	Yes	No	No	U			2x6¼x6½
	TP-727	79.95	S	No radio	—	—	—	—	Yes	Yes	No	Yes	No	Yes	No	No	No	U			2½x5¼x6¼
	TP-6001	119.95	S	N/A	Yes	Yes	None	No	No	Yes	No	Yes	No	No	No	No	No	I		Adj.	2x7¼x6¼
	TP-7000	159.95	S	N/A	No	Yes	4 AM/FM 4 station	No	No	Yes	No	Yes	No	No	No	No	No	I	Adj.		2x7¼x6¼
	KP-4000	149.95	S	N/A	Yes	Yes	No	No	No	Yes	Yes	No	No	Yes	Yes	No	No	I	Adj.		2x7¼x6¼
	TP-900	149.95	S	1	Yes	Yes	No	No	Yes	Yes	No	Yes	No	Yes	No	No	No	U			3x6½x7½
	KP-500	159.95	S	1	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	Yes	No	U			3x6½x7½
	TP-7005	179.95	S	1	Yes	Yes	Yes	5 AM/FM 5 station	No	Yes	Yes	No	Yes	No	No	No	No	I			3¼x6½x7¼
RCA	12R150	104.95	S		No	No	No	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes	No	U	No		2¼x5½x6¼
	12R301	58.20	S		No	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No	U	No		3x7¼x7¼
	12R490	38.95	S		No	No	No	No	No	Yes	Yes	No	Yes	No	No	No	No	U	No		2¼x5½x7
	12R500	49.95	S		No	No	No	No	No	Yes	No	Yes	No	No	No	No	No	U	No		2¼x5½x7¼
	12R606	74.95	M	4	No	Yes	2 AM/3 FM	No	Yes	Yes	No	No	No	No	No	No	No	I	Adj.		2x7x4
	12R607	104.95	S	4	Yes	Yes	2 AM/3 FM	No	Yes	Yes	No	Yes	No	No	No	No	No	I	Adj.		2x7x4½
12R703	124.95	S	10	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No	I	Adj.		2¼x7¼x7¼	

# You're looking at our attitude about cassette decks. The HK2000.

harman/kardon

We make only one cassette deck. We certainly are capable of making more. Perhaps some day we will. But it's unlikely — unless there are compelling mechanical or sonic reasons for doing so.

We have an attitude about high fidelity instruments: to give the finest expression to every function of music reproduction. And wherever we feel we have something to contribute, to do so without compromise. The HK2000 (with Dolby\*, of course), represents our attitude about cassette decks.

Its predecessor (the HK1000), was evaluated by High Fidelity Magazine as, "the best so far." When our engineering explorations suggested that improvements were feasible, we replaced it. With the HK2000.

We consider that the cassette deck has a definite and honorable utility as a means of conveniently capturing, retaining and reproducing material from phonograph records, tapes or radio broadcasts.

With one major caveat. It must perform on a level equivalent to the source.

The HK2000's specifications offer measurable evidence of its quality. For example. Wow and flutter: 0.07% NAB WRMS. Frequency response: 20Hz-16kHz.

But performance specifications are only one influence on sound quality. Just as in all Harman Kardon amplifiers and receivers, the wide-band design characteristic of the HK2000 produces sound quality that transcends its impressive specifications.

It utilizes narrow gap, hard-faced, permalloy metal heads (the only heads used in professional studio tape machines) for extended frequency response and low distortion. Low frequency response is so linear that the HK2000 required the incorporation of a sub-sonic filter control that can be used to remove signals issued by warped discs.

These few factors, not individually decisive in themselves, indicate the attitude with which we conceived, designed and built the HK2000.

There is, of course, a good deal more to say. Please write *directly* to us. We'll respond with information in full detail: Harman Kardon, 55 Ames Court, Plainview, New York 11803.

\*Dolby is a registered trademark of Dolby Laboratories, Inc.





# Car Radio/Tape Players

MANUFACTURER	MODEL	PRICE, \$	Stereo (S), Mono (M), or 4-channel (D)?	FM Sensitivity, $\mu\text{V}$ ? (for 30 db quieting)	Local/Distant Switch?	AFC?	Pushbuttons? If Yes, Number AM, Number FM?	Signal Seeking Tuning?	Bass control?	Treble Control?	Cassette?	8-Track?	Auto Reverse?	Fast Forward?	Tape Rewind?	Includes Speakers?	In-Dash (I) or Under Dash (U)?	Control Shaft, Spacing, Inches?	Dimensions, inches, H x W x D
ROYAL SOUND	RS-900	70.00	S					No	No	Yes	No	No	Yes	No	No	U		1 3/4 x 5 x 5 1/4	
	RS-1000	100.00	S					No	No	Yes	No	No	Yes	Yes	No	U		1 3/4 x 5 1/4 x 6 1/2	
	RS-1500	130.00	S					No	No	Yes	No	No	Yes	Yes	No	U & I		2 x 5 x 7	
	RS-1600	200.00	S	2	No	Yes	No	No	No	Yes	No	Yes	Yes	Yes	No	U		1 1/2 x 5 1/2 x 7	
	RS-2050N	190.00	S	2	No	Yes	No	No	No	Yes	No	No	Yes	No	I	Adj		1 1/2 x 6 1/4 x 4 1/4	
	RS-2100N	225.00	S	2	No	Yes	No	No	No	Yes	No	No	Yes	Yes	I	Adj		1 1/2 x 7 x 5 1/2	
	RS-2500	275.00	S	1	Yes	Yes	No	No	No	Yes	No	No	Yes	Yes	I	Adj		2 x 7 x 6 1/4	
	RS-2900	335.00	S	1	Yes	Yes	5 FM/5 AM	No	No	No	Yes	No	Yes	Yes	I	Adj		2 1/2 x 7 x 6 1/4	
SOLAR SOUND	CS-88	59.95	S		No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	U		2 1/2 x 5 1/2 x 8	
SDNY	TC-10	129.95	S	-	No	No	No	No	No	Yes	No	No	Yes	Yes	No	U	No	2 1/2 x 7 1/4 x 8	
	TC-24FA	149.95	S	-	No	No	No	No	No	Yes	No	No	Yes	No	I	Adj		2 x 7 x 6	
	TC-26F	159.95	S	-	No	Yes	No	No	No	Yes	No	No	Yes	Yes	No	U	No	2 1/2 x 8 x 8 1/2	
	TC-30	179.95	S	-	No	No	No	No	No	No	No	Yes	Yes	Yes	U	No		3 x 7 1/4 x 9 1/2	
SPARKOMATIC	AM-10	19.95	M	-	No	No	-	No	No	No	No	No	No	No	Yes	U	-	1 1/2 x 4 1/2 x 5 1/2	
	FM-10	19.95	M	5	No	Yes	-	No	No	No	No	No	No	No	No	U	-	1 1/2 x 4 1/2 x 5 1/2	
	FMX-10	49.95	S	5	No	Yes	-	No	Yes	Yes	No	No	No	No	No	U	-	1 1/2 x 6 1/4 x 5 1/2	
	AFM-10	49.95	M	5	No	Yes	-	No	Yes	Yes	No	No	No	No	Yes	U	-	1 1/2 x 6 1/4 x 5 1/2	
"XTAL" FAR EASTERN RESEARCH	XA-81	39.95	M								Yes					U		6 1/4 x 7 1/4 x 2	
	XA-86	79.95	S					Yes	Yes	Yes	Yes					U		7 1/2 x 2 x 7	
	XA-88	89.95	Q					Yes	Yes	Yes	Yes					U		8 x 2 1/2 x 7 1/2	
	XA-803	119.95	S		Yes											I/U		7 x 2 x 6 1/4	
	XA-805	139.95	S													Adj		7 x 6 x 2	
	XA-806	119.95	S													Adj		7 1/2 x 6 1/4 x 2 1/2	
	XA-93	89.95	M							Yes						U		5 1/2 x 2 1/2 x 7 1/2	
	XA-94	49.95	M							Yes						U		4 1/2 x 6 1/4 x 1 1/4	
	XA-903	109.95	S							Yes						Adj		7 x 2 1/2 x 6 1/4	
	XA-905	119.95	S							Yes						Adj		7 1/2 x 5 1/4 x 1 1/4	
	XA-906	199.95	S							Yes		Yes				I		7 1/2 x 2 x 6	
	XR-3	99.95	S				2 AM/3 FM						Yes			I	Adj		6 1/4 x 2 x 5 1/4

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KEF engineers never do. Every aspect of KEF drive unit technology reflects their no-compromise approach... to materials, specification, quality standards. In the vital diaphragm for example, advanced laminated constructions absorb unwanted energy that otherwise would be heard as colouration of the original sound. KEF pioneered this concept and every unit benefits... **B139**, a 30 by 21cm bass driver with solid flat diaphragm acting as a rigid piston to give clean, low-distortion bass over frequency range 20-1,000Hz. **B200**, a 200mm low-frequency driver with consistent rubber-modified polystyrene diaphragm, visco-elastically damped, covering frequency range 25-3,500Hz. **B110**, a 110mm mid range driver with the same diaphragm construction, and frequency range 55-3,500Hz. **T27** ultra-high frequency driver with dome radiator in Mylar giving wide dispersion up to highest audio levels, frequency range 3,500-40,000Hz.

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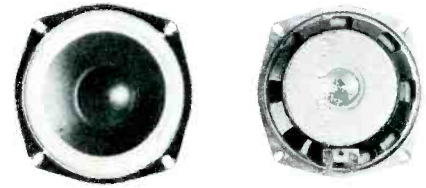
ADS 2001



Acoustic Fiber



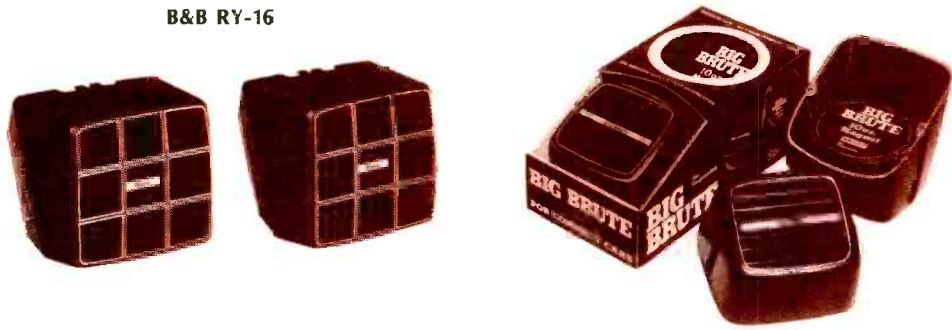
AFCO WP12



# Car Speakers

MANUFACTURER	MODEL	Price, \$ (If sold individually)	Price, \$ (If sold in pairs)	Recommended Power, Watts	Driver Size, Inches?	Impedance, Ohms?	Frequency Response, Hz to kHz ± dB	Co-axial?	Flush Mount (F) or Surface Mount (S)?	Overall Dimensions	NOTES
ACOUSTIC FIBER SOUND SYSTEMS, INC.	KC 3035		5	3%	8	150-10k	No	S	4½x5½x4¼		
	KC 3045		5	3%	8	150-10k	No	S	7x5x5		
	KC 3055		7	5	8	80-10k	No	S	5½x5½x4¼		
	KC 3085		5	3%	8	150-10k	No	S	4½x5½x4¼		
	KK 4060							F	10½x7½x4¼		
	KK 5030		6	4	8	75-20k	No	S	5x7x5¼		
	KK 5040		8	5	8	70-20k	No	S	6x8x6¼		
	KK 5050		10	5	8	65-20k	No	S	7x9x7¼		
ADS	2001-b	549.00		1+4		80-20k ±3	No	S	3½x6½x9½	Sep. tweeter & woofer, two electronic crossovers	
	2002	395.00		1+4		85-20k ±3	No	S	7x4¼x5	Sep. tweeter & woofer, 3 power amps & electronic crossover	
AFCO	AF-20CX	16.95	-	12	4/8	50-12k	Yes	F	6x9	Convertible Wedge	
	WP-12	24.95	10	-	8	100-10k	No	F	5½		
	WD-6	16.95	6	-	8	100-10k	No	F	5		
	AFR-10CA	21.95	12	-	4/8	50-12k	Yes	F	5½		
	Mini-DM	12.95	10	-	8	100-10k	No	F	3½		
B & B	RY-10	5.95	5	3%	8	120-13k ±5	No	M	5½		
	RY-16	4.95	5	2%	8	120-13k ±5	No	S	5½x5½x3¼		
BECKER	200 Z 1915	26.79	7		5	100-12k ±5	No	F	5½ round		
	200 Z 1620	27.31	7		5	100-12k ±5	No	S	7½x5½x1¼		
	200 Z 1080/381 with fader	49.56	7		5	100-12k ±5	No	F	4x10		
CALTRON/JET SOUNDS	J5W 500 S	12.95	5		8		No	F	5	3 oz. Mag.	
	J5W 1200 S	19.95	10		8		No	F			
	JS 25	9.95	5		8		No	F	5½	3 oz. Mag.	
	JS 35	10.95	5		8		No	F	5½	3 oz. Mag.	
	JS 55	12.95	10		8		No	F	5½	5 oz. Mag.	
	JS 4810 AS	19.95	20		4/8		No	F	5½	10 oz. Mag.	
	JS 4820 AS	24.95	40		4/8		No	F	5½	20 oz. Mag.	
	JS 220 C.X	29.95	40		4/8		Yes	F	5½	20 oz. Mag.	
	JS 920 C.X	14.95	40		4/8		Yes	F	6x9	20 oz. Mag.	
	COMM INDUSTRIES	E-10	31.25	20	3%	8	100-12k	No	S	4¼x4¼	
CBM-10		14.95	8	3x5½	8	150-10k	No	S	7x3½x3¼		
CBT		14.95	8	4	8	150-10k	No	S	4¼		
COMPONENTS SPECIALTIES	SK69CA10C	51.10	30		8	55-20k	Yes	F	6x9x3¼	Kits complete with grillas, wire, hardware, and instructions	
	SK69CA10W	33.15	30		8	55-15k	No	F	6x9x2½	As above	
	SK69CA20W	47.50	50		8	55-15k	No	F	6x9x3	As above	
	SK69CA20C	63.05	50		8	55-20k	Yes	F	6x9x3¼	As above	
	SK69CA27W	63.65	50		8	50-15k	No	F	6x9x3	As above	
	SK51CF3W	19.35	10		8	125-20k	No	S	5½ round	As above	
	SK51CF5W	21.50	10		8	125-20k	No	S	5½ round	As above	
	SK51CA10W	30.85	30		8	80-15k	No	S	5½ round	As above	
	SK51CA10C	38.15	20		8	130-20k	Yes	S	5½ round	As above	
	CTS OF PADUCAH, INC.	5KFR 14	41.50	10	5%		70-18k		F		
5½FR14-BG		42.80	10	5%		70-18k		F			
69STK14		43.90	10	6x9		40-18k		F			
69RSK14		29.68	10	6x9		40-18k		F			

B&B RY-16



# Car Speakers

MANUFACTURER	MODEL	Price, \$ (If sold individually)	Price, \$ (If sold in pairs)	Recommended Power, Watts	Driver Size, Inches?	Impedance, Ohms?	Frequency Response, Hz to kHz ± 3 dB	Co-axial?	Flush Mount (F) or Surface Mount (S)?	Overall Dimensions	NOTES
ARTHUR FULMER	7493		60.00		8		No	F	6x9	Two 45-watt amps built-in	
	7486		17.25		4/8		No	F/S	5 round	5 oz. magnet	
	7489		27.00		4/8		No	F	5 1/2 round	12 oz. magnet	
	7487	16.95			4/8		No	F	6x9	27 oz. magnet	
	7484	14.95			4/8		No	F	6x9	17 oz. magnet	
	7483				4/8		Yes	F	6x9	10 oz. magnet	
	7481		17.95		8		No	F	5 1/2 round	10 oz. magnet	
	7476		10.95		8		No	F	5 1/2 round	3 oz. magnet	
	7492				8		No	F	3 round	3 oz. magnet	
	7480		18.95		8		2-way	S	3x5	3 oz. magnet	
	7479		11.95		8		No	S	5 1/2 round	3 oz. magnet	
	7478		10.95		8		No	S	5 round	2 oz. magnet	
7477		8.95		8		No	S	3x5	2 oz. magnet		
7475		6.95		8		No	S	3x5	1.7 oz. magnet		
HANABASHIYA	MS80		8.95	5	5	8		S	-		
	525P		9.95	5	5	8		F	-		
HERALD ELECTRONICS	S-690A		22.95	20	5 1/2	8	No	F/S	7x6 1/2 x 4 1/4		
	S-688A		14.95	10	5	8	No	S	7x6 1/2 x 4		
	S-658A		9.95	8	5	8	No	S	7x3 1/2 x 4		
INLAND	CSK-20		7.95		4	8	No	F			
	W-36		11.50		3x5 1/2	8	No	S			
	CSK-201		10.40		5	8	No	S			
	RM-755	10.95	14.95		6 1/2	8	No	F			
	SK-1069		19.95		6x9	8	No	F			
SMA-85V				5	8	No	S/F				
KRACO	KS-150F			5 1/2	8	-	No	F		2.3 oz. magnet	
	KS-251R			5 1/2	8	-	No	S		2.3 oz. magnet	
	KS-299F			5 1/2	8	-	No	S		2.3 oz. magnet	
	KS-111F			5 1/2	8	-	No	F		3.0 oz. magnet	
	KS-222F			5 1/2	8	-	No	S		3.0 oz. magnet	
	KS-44-4F			4	8	-	Yes	S/F		4.0 oz. magnet	
	KS-260F			4	8	-	No	S/F		5.3 oz. magnet	
	KS-275F			4	8	-	Yes	S/F		5.3 oz. magnet	
	SST-101F			5 1/2	8	-	Yes	F		10 oz. magnet	
	SST-202F			5 1/2	8	-	Yes	F		10 oz. magnet	
	SS-1-20F			5 1/2	8	-	Yes	F		20 oz. magnet	
	SS-2-20F			5 1/2	8	-	Yes	S		20 oz. magnet	
	K-157-2F			5x7	8	-	No	S		2 oz. magnet	
	K-169-3F			6x9	8	-	No	S		3 oz. magnet	
	K-169-10F			6x9	8	-	Yes	S		10 oz. magnet	
	K-269-10F			6x9	8	-	Yes	S		10 oz. magnet	
	K-269-20F			6x9	8	-	Yes	S		20 oz. magnet	
	KS-235F			3x5x2 1/4	8	-	No	S		3 oz. magnet	
	KS-255F			3x3x2 1/4	8	-	No	S		5 oz. magnet	
	CX-1-20F			5 1/2	8	-	Yes	S		20 oz. magnet	
	CX-2-20-CF			5 1/2	8	-	Yes	S/F		20 oz. magnet	
	CX-269-20-F			6x9	8	-	Yes	S		20 oz. magnet	
	LEAR JET STEREO	7703		13.95	7	5	8	-	No	F	5
7710			23.95	10	5	8	-	No	F	5	
7140			18.95	8	5	8	-	No	F	5x5	wedge
7120			15.95	7	3	8	-	No	S	3x5	
7910		15.95		15	6x9	8	-	No	F	6x9	
7920		19.95		25	6x9	8	-	Yes	F	6x9	
MAGITRAN COMPANY		A4000S		29.95	10	4 1/2 x 8 1/2	8	90-20k	No	S	1 1/2 x 5 1/2 x 9 1/2
	A3000S		24.95	10	5 1/2	8	80-20k	No	S	7x2x3 1/2	Round; soft vinyl grille
	A2000V		22.95	10	5 1/2	8	70-20k	No	F	6 1/2 x 1	Round; foam grille
	A2000F		22.95	10	5 1/2	8	70-20k	No	F	6 1/2 x 1	Black, white or brown
	A500		22.95	10	4 1/2 x 8 1/2	8	80-20k	No	F	1x6x10	Black, white or brown
	G51P	11.50		10	4 1/2 x 8 1/2	8	80-20k	No	F	1x6x10	Black, white or brown



Sonosphere SPR-12

Utah Electronics



Sparkomatic SK-62C



# Car Speakers

MANUFACTURER	MODEL	Price, \$ (If sold individually)	Price, \$ (If sold in pairs)	Recommended Power, Watts	Driver Size, Inches?	Impedance, Ohms?	Frequency Response ? Hz to ? kHz ± ? dB	Co-axial?	Flush Mount (F) or Surface Mount (S)?	Overall Dimensions	NOTES
METRO SOUND	MS-525-122CO		24.95	5%	8	100-12k	Yes	F	5/4		
	MS-525-202CO		29.95	35	8	80-12k	Yes	F	5/4		
	MS-69-120CO	15.95	20	6x9	8	100-12k	Yes	S	6x9		
	MS-69-200CO	17.95	35	6x9	8	80-12k	Yes	S	6x9		
	MS-514		16.95	20	5%	8	100-12k	No	F	5/4	
	MS-516		24.95	35	5%	8	60-12k	No	F	5/4	
	MS-712		20.95	20	4	8	100-12k	No	F	5/4	
	MS-500		9.95	8	5%	8	100-10k	No	F	5/4	
	MS-452		19.95	20	5%	8	80-10k	No	F/S	5/4	
	MS-401		9.95	8	5%	8	100-12k	No	S	5/4	
	MS-69-12	9.95	8	6x9	8	80-12k	No	S	6x9		
	NEOSONIC	Sonosphere SPR-12	24.95	10	4	4	100-16k	No	S/F	5x6	Flush mount with PMR-1 kit
		Sonosphere SPR-12	29.95	10	4	4	100-16k	No	S/F	5x6	
Sonosphere II SPR-20		49.95	10	5x1 1/2	8	80-18k	Yes	S	6x9		
Neosonic NCB-10		12.95	10	4	8	400-4k	No	S	5x5x6	CB use only.	
Neosonic NCB-20		14.95	20	4	8	400-3k	No	S	5x5x6	Filter switch; CB use only.	
NUVOX	ES-25		9.95	5	3		No	S			
OXFORD	SM5B		42.79	5	3.2		No	S			
	SM5C		42.79	5	3.2		No	S			
	SM5W		43.18	5	3.2		No	S			
	ST46BC		57.24	4x6	3.2		No	S			
	TSK-1		33.60		3.2		No				
	A5PC		34.71	5	3.2		No	F			
	A5PB		34.71	5	3.2		No	F			
	WJ4B	27.60		6x9	3.2		No				
	WJ4C	28.16		6x9	3.2		No				
	WJ4W	28.32		6x9	3.2		No				
	WF4B	24.95		6x9	3.2		No				
	WF4C	25.50		6x9	3.2		No				
	WF4W	25.74		6x9	3.2		No				
	CW69B	21.96		6x9	3.2		No				
	CW69C	22.53		6x9	3.2		No				
	57XH	14.82		5.7	3.2		No				
69XH	16.70		6x9	3.2		No					
PHILIPS	SA-20B		10	5	8	100-9k	No	F	5 Square		
	SA-50		20	5%	8	80-12k	No	F	5/4 Square		
	SA-500		20	5%	8	80-12k	No	S	7%		
	SA-1000		30	4x6	8	80-16k	No	S	9 1/2 x 7 1/2		
	SA-690		15	6x9	8	65-16.5k	No	F	6x9		
	SA-6900		50	6x9	8	45-20k	Yes	F	6x9		



# Car Speakers

MANUFACTURER	MODEL	Price \$ (If sold individually)	Price \$ (If sold in pairs)	Recommended Power, Watts	Driver Size, Inches?	Impedance, Ohms?	Frequency Response, Hz to kHz ± dB	Co-axial?	Flush Mount (F) or Surface Mount (S)?	Overall Dimensions	NOTES	
PIONEER	TS-160	29.95	20	6½	4	40-16k	No	F	—		TS-163  P-10L             100-12k	
	TS-161	32.95	20	6½	4	40-16k	No	F	—			
	TS-163	14.95	8	6½	4	70-10K	No	F	—			
	TS-164	44.95	20	6½	4	50-15k	Yes	F	—			
	TS-165	54.95	20	6½	4	50-15k	Yes	F	—			
	P-10L	16.95	8	4	4	100-10k	No	F	—			
	TS-100	19.95	8	4	4	50-10k	No	F	—			
	TS-101	21.95	8	4	4	60-14k	No	F	—			
	TS-690	9.95	10	6x9	4	60-14k	No	F	—			
	TS-691	19.95	20	6x9	4	50-16k	No	F	—			
	TS-692	24.95	20	6x9	4	40-16k	No	F	—			
	TS-693	29.95	20	6x9	4	35-16k	No	F	—			
	TS-694	34.95	20	6x9	4	40-18k	Yes	F	—			
	TS-5		19.95	8	5¼	4	45-18k	Yes	F	—		
	TS-22		36.95	8	4	4	70-10k	No	S	6x6¼x3¾		
	TS-35		36.95	40	5¼	4	100-15k	No	S	9x4x3¾		
	TS-40		39.95	8	4	4	80-13k	No	S	N/A		
						100-12k	No	S	8x7½x3¾			
RCA	12R400	15.75	16	5¼	3.2	50-10k	No	F/S	7x6½			
	12R401D	14.85	16	5¼	3.2	50-10k	No	F	6x6			
	12R403	7.50	10	5	8	90-13k	No	F	5¼			
	12R404	19.95	16	5¼	8	80-11k	No	F	6¼			
	12R405	22.95	16	6x9	8	50-15k	No	F	6¼x10			
	12R406	29.75	20	6x9	8	50-15k	No	F	6¼x10			
ROYAL SOUND COMPANY, INC.	AS525C10	20.00	8	5¼	4/8	100-18k	Yes	F	6¼x2¾			
	AS525C20	25.00	10	5¼	4/8	80-20k	Yes	F	6¼x2¾			
	AS525C30	37.50	10	5¼	4/8	80-20k	Yes	F	6¼x2¾			
	AS69C10	24.00	8	6x9	4/8	80-20k	Yes	F	6¼x9¼x3¾			
	AS69C20	30.00	10	6x9	1/8	80-20k	Yes	F	6¼x9¼x3¾			
	AS69C30	40.00	10	6x9	4/8	80-20k	Yes	F	6¼x9¼x3¾			
	RS-100		15.00	7.5	5	4/8	90-10k	No	S			
	RS-150		20.00	10	5	4/8	90-10k	No	F			
	RS-200		24.00	10	5	4/8	80-10k	No	F			
	RS-505		29.00	15	5	4/8	80-10k	No	F			
	RS-700		20.00	10	4	4/8	100-12k	No	S			
SPARKOMATIC CORPORATION	SK-620C	34.95	15		8	90-15k	Yes	F	5¼x4			
	SK-6920C	44.95	20		8	50-18k	Yes	F	6x9x3¾			
	SK-520C	39.95	10		8	130-15k	Yes	F/S	5x2½			
	SK-303	11.95	3		8	140-8k	No	S	3x1¼			
	SK-355	11.95	5		8	140-12k	No	F	4¼x1¼			
	SK-250	18.95	5		8	150-12k	No	S	3x5½x1¼			
	SK-203	12.95	5		8	150-8k	No	S	3x5½x1¼			
	SK-201	9.95	5		8	140-9k	No	S	5x1¼			
UTAH	SP57D	9.05	6	5x7	4/8	90-11k	No	F	5x7¼x2¾			
	SP58D-8	9.35	7	5x8	4/8	80-10k	No	F	5x8¼x2¼			
	SP69D	10.25	7	6x9	4/8	100-10k	No	F	6¼x9¼x3			
	SP410CPS-8	12.00	10	4x10	4/8	100-12k	No	F	4¼x10¼x2¼			
	SP410CPS-8A	12.00	10	4x10	4/8	100-12k	No	F	4¼x10¼x2¼			
	C69LXC-FR3	35.15	30	6x9	4/8	40-18k	Tweeter	F	6¼x9x3¾			
	C48HC	13.10	10	4x8	4/8	80-9k	No	F	4x8x2¾			
	C410JC-WCR	17.85	15	4x10	4/8	50-18k	Whizzer	F	4¼x10¼x2¾			
	C69RC-WFR	44.00	50	6x9	4/8	60-18k	Whizzer	F	6¼x9x4			
	SP48D-8	8.90	6	4x8	4/8	100-11k	No	F	4x8x2¾			
	SP52B-8	7.00	6	5¼	4/8	110-11k	No	F	5¼x2			
	C46FC	11.10	10	4x6	4/8	80-18k	No	F	4¼x6¼x1¼			
	C57JC-WCR	17.30	10	5x7	4/8	60-19k	Whizzer	F	5x7¼x2¾			
	C69JC-W	16.30	15	6x9	4/8	60-20k	Whizzer	F	6¼x9¼x3			
	C69JC-WCR	17.85	15	6x9	4/8	60-20k	Whizzer	F	6¼x9¼x3			
	C69JC-WCRD	19.10	15	6x9	4/8	60-20k	Whizzer	F	6¼x9¼x3			
	C69JC-CR3	25.85	15	6x9	4/8	50-16k	Tweeter	F	6¼x9¼x3			
	C69LXC-WFR	29.25	30	6x9	4/8	40-18k	6¼x9x3¾	F	6¼x9¼x3			
	C35EC	8.25	8	3½	4/8	100-13k	No	F	3½x9¼x1½			
	C5FC	10.65	11	5	4/8	130-11k	No	F	5x2			
	C55JFC-W	16.85	10	5	4/8	70-18k	Whizzer	F	5x2¼			
	C55JVC-W	19.45	12	5	4/8	80-20k	Whizzer	F	5x2¾			
	C52JC-WFR	14.75	10	5¼	4/8	60-20k	Whizzer	F	5¼x2¼			
C52JVC-WFR	16.75	10	5¼	4/8	60-20k	Whizzer	F	5¼x2¼				
C56JC-W	18.70	10	6	4/8	80-18k	Whizzer	F	6¼x2¼				
"XTAL" FAR EASTERN RESEARCH	XS-1W	13.95	5		8		No	S	3x5½			
	XS-3DR	14.95	5		8		No	S	5			
	XS-4DR	15.95	5		8		No	S	5¼			
	XS-6DR	39.95	40		4		No	S	5¼			
	XS-7D	39.95	40		8		No	S	6x9			
	XS-8D	15.95	5		8		No	S	5			
	XS-9H	15.95	5		8		No	S	5			
	XS-10D	21.95	10		4		No	S	5x2½			
	XS-11D	29.95	15		4		No	S	5¼			
	XS-12C	19.95	10		8		No	S	5			
	XS-17DR	24.95	15		4		No	S	5¼			
XS-18D	29.95	10				No	S					

**T**HE INTERACTION between loudspeakers and listening environments has been studied for home listening rooms and auditoria for many years. Recently, there has been increased interest in high quality reproduction in automobiles. Since loudspeakers can be expected to operate differently in the small, sealed space inside automobiles, we set out to measure some effects of these interactions. As a reference, a wide-range speaker system small enough for use in a car, the Advent Model 400 loudspeaker, was measured via pink noise and a real-time analyzer in various listening room locations, averaging three microphone positions for each, to arrive at an averaged composite curve. This curve, depicting the integrated frequency response of the loudspeaker operating into the type of environment for which it was designed, was used as our reference. Then the same speaker was placed in various positions in an Audi Fox and a cluster of measure-

ment microphones were located to simulate the driver's listening position. The curves taken in the car were then compared to the room response composite curve, and the *difference* between each of them and the room curve was plotted.

Figure 1 shows the difference between auto and listening room responses which results from placements on the left and right sides of the rear deck with the speakers facing forward. Figure 2 was derived by removing the drivers from their enclosures and installing them, along with the LCR frequency tailoring network which sets the octave-to-octave musical balance of the system, in the bottom front portion of the front doors. In this case the door serves as a baffle. Figure 3 gives a comparison of the overall average response that we measured in this car with the mean response in rooms. The difference is considerable and most pronounced between 100 to 500 Hz and 1600 to 8000 Hz.

Differences between the various placements are seen in these figures. In general, the high frequencies seem to hold up better in the door placement. The low end response between 160 and 800 Hz is complex and highly sensitive to position. At frequencies beyond 4 kHz, an effect was noted in the graphs and audibly confirmed—in this car the headrests have a shadowing effect which reduces the very high frequency response for rear deck placement and front seat listening. All in all, it appears that the door placement is best for this car.

We can guess at some reasons for the effects seen. The speaker drivers mounted in a car operate into a rather bizarre group of coupled cavities and boundary surfaces which affect the frequency dependance of the radiation resistance in odd ways, and so the power response is altered. Between 160 and 800 Hz, speaker placement is critical. In addition, the wavelengths involved are comparable to the interior dimensions of the car; standing wave problems occur at higher frequencies than in rooms due to the small size of the space. The listener does not usually have an unobstructed on-axis path to the speaker, and with less than perfectly dispersive drivers, aberrations in the



# CAR SPEAKER PLACEMENT

Tomlinson Holman\*

high end response and in localization cues for stereo effect are likely.

At the very lowest frequencies an interesting effect appeared (not shown in the graphs); when the windows and doors are closed, the listener is essentially inside an acoustic suspension loudspeaker system and the frequency response does not roll off at the predicted rate below resonance but, instead, remains flat to subsonic frequencies. This comes about from being inside a sealed box with dimensions much smaller than a wavelength where the rules for sound propagation in free space do not apply.

Next, the noise spectrum of the Audi was measured at 55 mph on a good highway. We found that this car produces the most noise in the 100 and 125 Hz one-third octave bands, with rapid fall-off both below and above these bands. Interestingly, this peak coincided with the region of maximum positive interaction for the speakers. This can prove to be a helpful interaction since loudspeaker output should be boosted in this range to avoid masking by car and road noise. In the high frequency band, too, the boost which the car environment produces is in the right direction since an elevation of high frequencies can produce both better intelligibility on voice and improved definition on music.

### Notes

1. The placement of drivers in the rear deck lid facing upwards was avoided for a number of reasons. First, one would expect some rather violent frequency response anomalies from the interaction of the space trapped between the rear window and deck, and the rest of the car—similar to a badly matched horn. Also, such placements result in more extreme temperature excursions and sunlight which may result in premature wear.

2. A distinct disadvantage to rear placements showed up on a long overnight trip. The driver, who needs the stimulation of the radio to prevent drowsiness, is the furthest from the sound source, while the rear seat passengers are blasted by the levels needed by the driver.

3. The Audi used had cloth interior seats; we made no measurements on sedans with vinyl interiors. We did measure the response for one location in a Buick Sport Wagon with vinyl interior—results had the same general direction and shape as in the Audi.

\*Advent Corp., Cambridge, Mass.

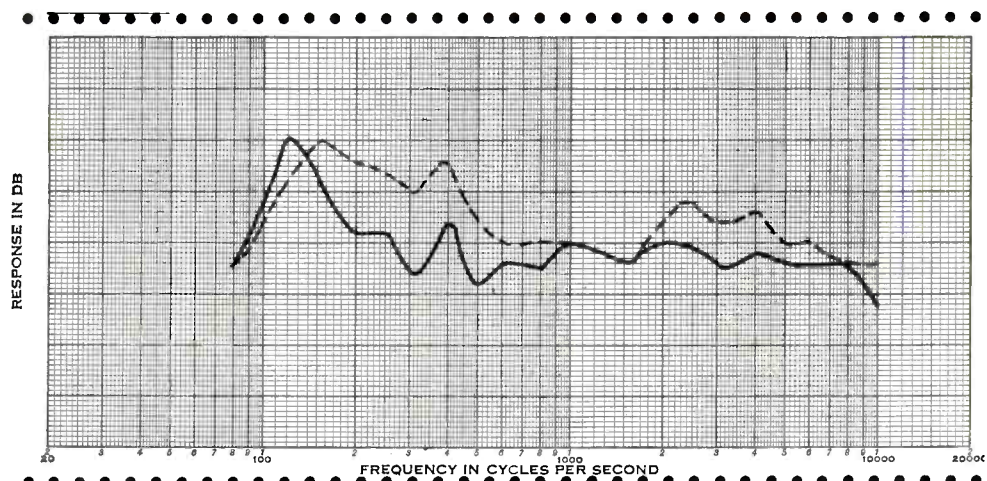


Fig. 1—Difference between car and room response for left rear (dashed) and right rear (solid) placements (5 dB per large division).

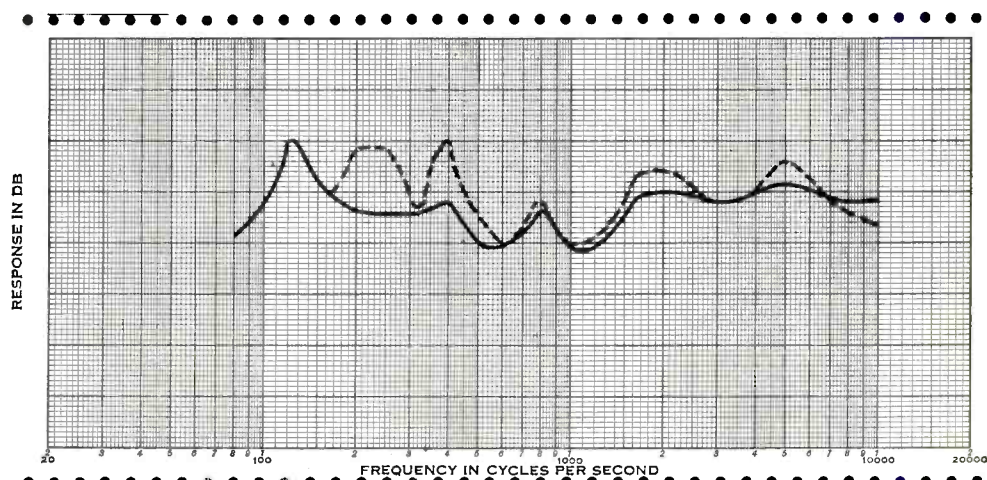
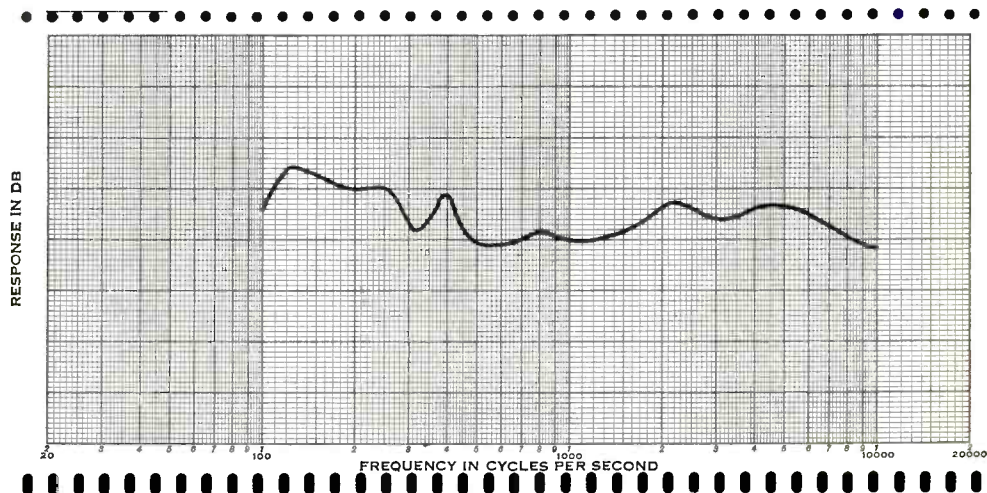


Fig. 2—Difference between car and room response for left and right (dashed and solid) front door placements (5 dB per major division).

Fig. 3—Difference between mean car response for the four positions and the room response (5 dB per major division).



# Equipment Profiles

## ESS "Eclipse" Model 2240 Electronic Crossover



**MANUFACTURER'S SPECIFICATIONS**  
**Available Frequencies:** 100, 150, 200, 250, 500, 800, & 1250 Hz, or (via multiplier button) 1.0, 1.5, 2.0, 2.5, 8.0 & 12.5 kHz per channel.

**Frequency Response:** Low Pass: Within 0.25 dB 20 Hz to -3dB at selected crossover; High Pass: -3 dB at crossover to within 0.25 dB up to 20 kHz.  
**Crossover Slopes:** 12 dB per octave.

**Gain:** 0 dB in pass bands.  
**Dimensions:** 19 in. W x 1¾ in. H x 9 in. D (48.3 x 4.4 x 23 cm.)  
**Weight:** 5 lbs. (2.3 kg.)  
**Price:** \$300.00.

The advantages of using electronic crossovers in a bi-amp or tri-amp sound reproducing system, as opposed to passive crossover networks built into multi-driver speaker systems, have been described in audio literature over the last several years in great detail. To summarize the advantages here, bi-amping or tri-amping of audio systems is said to require less power per individual amplifier for a given level of composite complex signals, elimination of passive components between amplifier and speaker driver, more accurate reproduction of frequencies in the vicinity of crossover points, and retention of high damping factors as seen by the speaker drivers themselves.

The ESS 2240 Electronic Crossover is basically a stereo device with bi-amping capabilities when used with a pair of stereo power amplifiers and a preamplifier or with a stereo receiver with preamp-main amp interruption facilities plus a second stereo power amp. Alternatively, the 2240 may be used monophonically to create a tri-amplification system, as shown in the hook-up diagram of Fig. 1, in which case two Model 2240s would be required for stereo.

The crossover network is intended for standard rack mounting and utilizes just one standard rack space (1¾ inches) in height. The brushed aluminum front panel has 4 rotary controls, a pair of overall channel gain controls for

left and right channels and two "frequency balance" controls (one for each channel) which adjust relative gain between low and high frequency output bands. A tiny red pilot lamp indicates that power has been applied as there is no on/off switch on the unit (a fact which poses no real problem since the unit would probably be connected to one of the switched convenience outlets on associated pre-amplifier equipment or to a switched outlet expander in a pro installation).

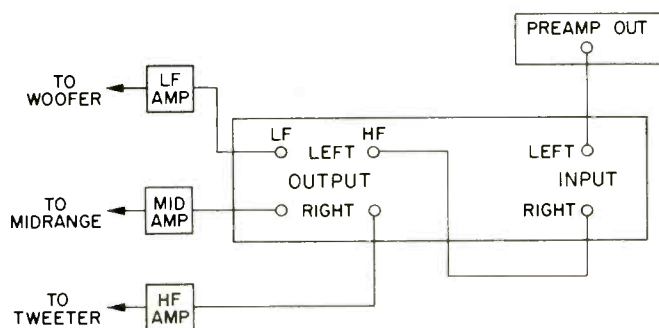
Actual crossover frequency selection is made via fourteen buttons (seven per channel) plus two "times ten" multiplier buttons, all located on the rear panel as shown in Fig. 2. A total of 14 crossover frequencies may be selected for each channel (see manufacturer's published specifications above). [Editor's Note: For this photo we have removed the metal shield which keeps inquisitive fingers from randomly selecting crossover points.] There are two standard phono-tip input jacks which accept signals from preamplifier outputs and four output jacks (two for low-pass and high-pass bands of each channel). The device is line fused on the rear-panel with a 1 ampere fuse.

The view of the internal construction of the crossover network (Fig. 3) discloses that active filter circuits are employed throughout. No inductive components are used, and three identical integrated circuits take care of all low- and high-pass filtering plus gain circuitry. The single large circuit board is made of glass epoxy and high-quality, tight-tolerance capacitors are used in critical frequency-determining circuits. The preliminary owner's manual supplied with our test sample did not contain a schematic diagram of the circuit, so we can only comment on end results attained in our measurements.

With some 28 individual response curves available in the 2240, we really appreciated having our Tektronix spectrum analyzer even more than we had up to now. Without it, we would still be plotting point-by-point responses, and this report might not have appeared until several months later! Be that as it may, Fig. 4 is a storage 'scope display of all 14 low-pass filter response curves available, while Fig. 5 shows the 14 complementary high-pass response curves. Since the fre-

(Continued on page 63)

**Fig. 1**—Wiring required to use the ESS 2240 as a mono three-way crossover.





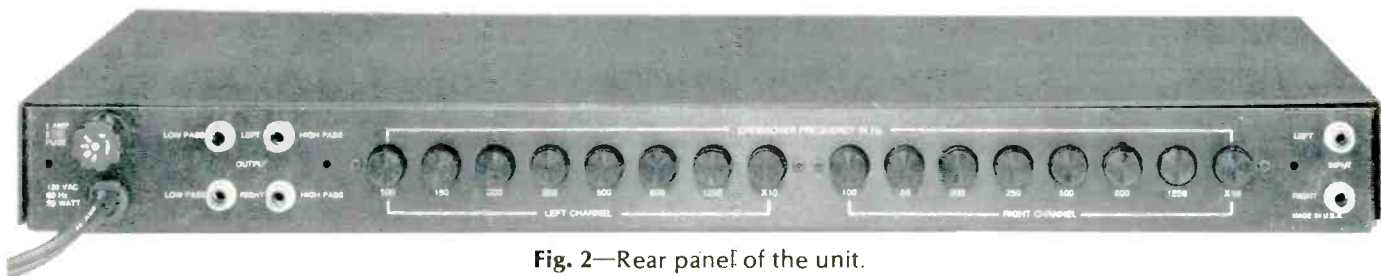


Fig. 2—Rear panel of the unit.

Fig. 3—Internal construction of crossover network.

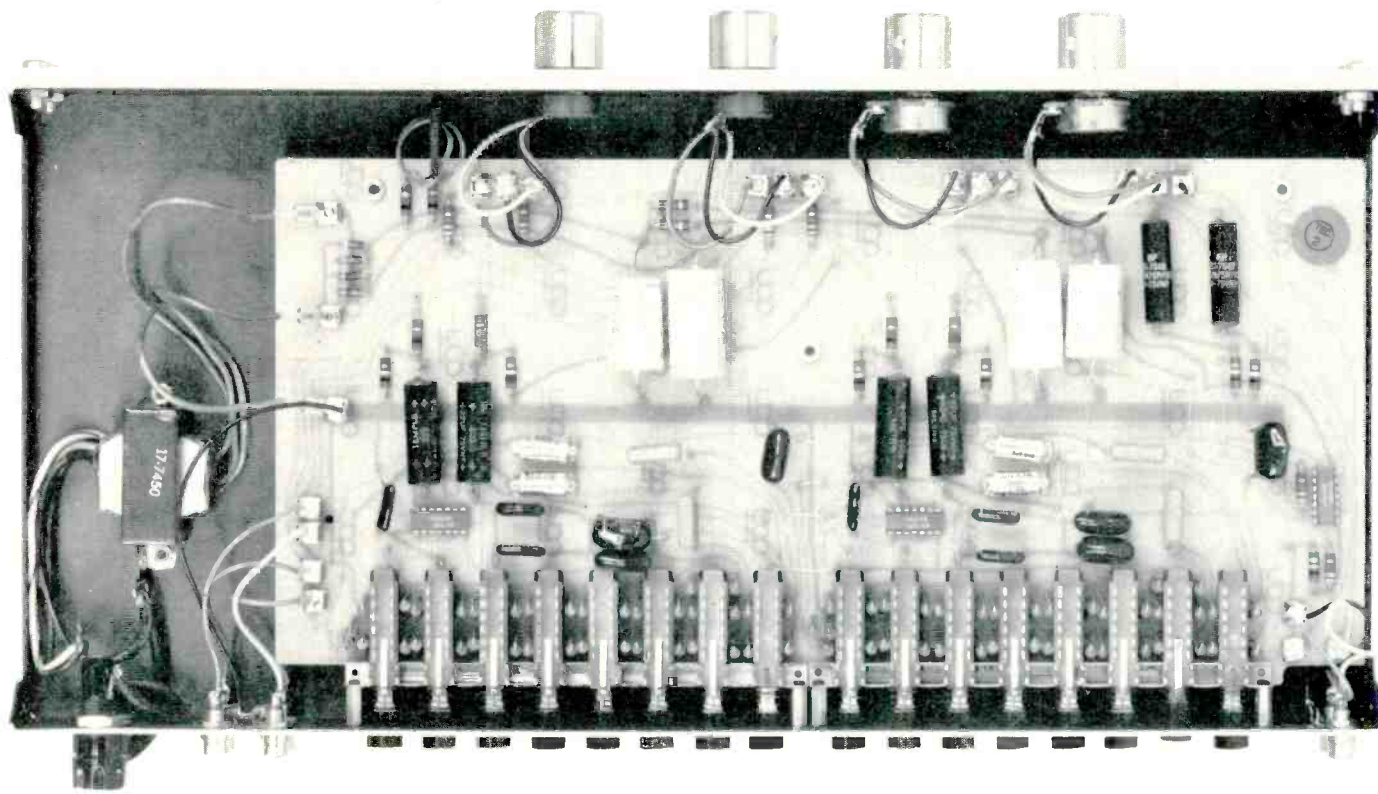


Fig. 4—The 14 available low-pass response curves.

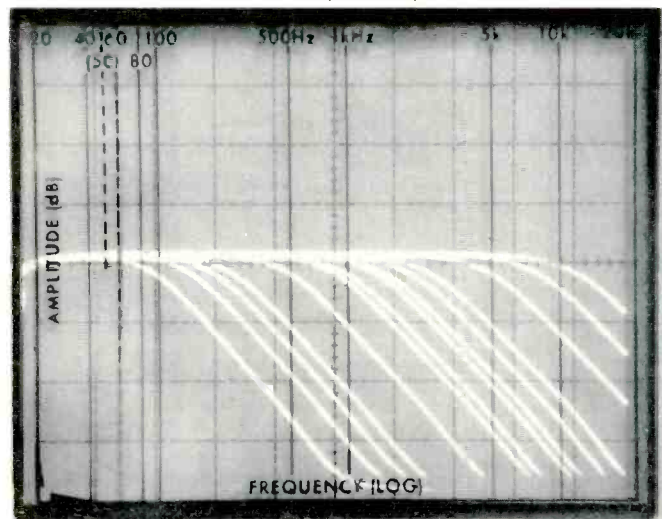
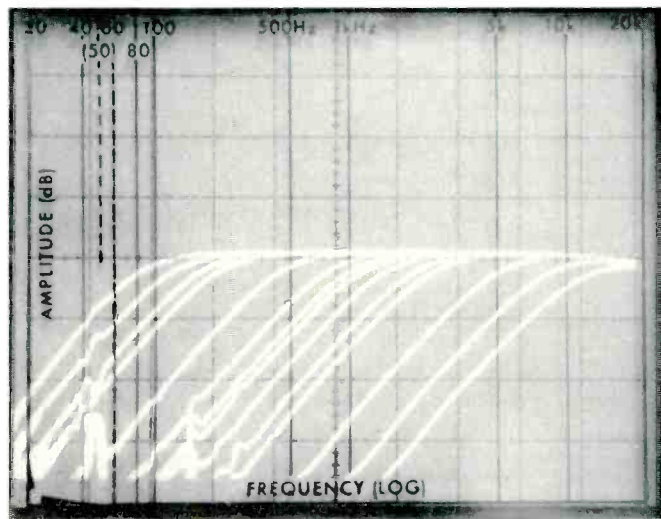


Fig. 5—The 14 available high-pass response curves.



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(Continued from page 56)

quency calibration of our analyzer is extremely precise and frequencies are swept logarithmically, verification of the -3-dB points for each curve can be made right from these scope photos and were found to be very precise, with variations (from -3 dB at the specified frequencies) never off by more than 0.5 dB in the worst case and generally much closer than that.

The display in Fig. 6 resulted from two separate frequency sweeps. During the first sweep (with crossover frequency set to 1 kHz) the input to our analyzer was connected to the "low pass" output jack of one channel of the 2240 to obtain the left-hand trace. After first reconnecting the analyzer's input to the high pass output jack of the same channel of the 2240, the sweep of frequencies was made once more, yielding the "text-book perfect" composite crossover characteristic which was photographed directly from the storage scope face.

The three-way crossover arrangement pictures in Fig. 7 was achieved by connecting the 2240 as suggested earlier in Fig. 1, and low-to-mid crossover of 500 Hz was chosen while mid-to-high crossover selected was 12,500 Hz.

The "frequency balance controls" described earlier are particularly useful if you plan to use power amplifiers which are not equipped with input level controls. Set to one extreme, these controls provide a low-pass output which is 10 dB lower than the high-pass output, while when set to the other extreme, the reverse situation is obtained. To illustrate the action, we rotated the control counterclockwise and obtained separate low-pass and high-pass output traces corresponding to sweeps of frequency as before. The results are shown in the photo of Fig. 8. Each vertical division in this (and every other) scope photo represents a level change of exactly 10 dB and the difference between the low-pass output level and the high-pass output level in Fig. 8 is very nearly 1 division, or the expected 10 dB.

### Other Lab Measurements

With reference to an output level of 0.4 volts rms, hum was -75 dB and random noise under the same output level conditions measured better than -85 dB. All slopes beyond cut-off points were precisely the specified 12-dB per octave rate, and response within the pass bands was well within the 0.25 dB specified.

Measurement of total harmonic distortion really put our Sound Technology 1700A through its paces. At 3 volts in/out (the 2240 is a unity gain device), THD varied from 0.002% to 0.004% depending on frequency and the precise crossover point selected. These figures are very near the bottom limit of the Sound Tech unit.

### Conclusions

Devotees of bi-amping and tri-amping may have already noted that the ESS 2240 provides only one rate of slope at any of the crossover frequencies selected—12 dB. Some tri-amping enthusiasts prefer a more gentle 6 dB/octave slope for certain driver combinations, while still others insist that in other cases 18 dB per octave is what's called for. Several leading authorities are, however, recommending 12-dB per octave slope rates, saying that they provide the best combination of performance factors. So if you want the flexibility of being able to try out several crossover frequency combinations (substitute frequencies can be incorporated fairly simply by ESS service personnel is none of the ones supplied suits your taste or that of your speaker elements), then the ESS Series Eclipse Model 2240 Electronic Crossover may well be just what you have been looking for.

Leonard Feldman

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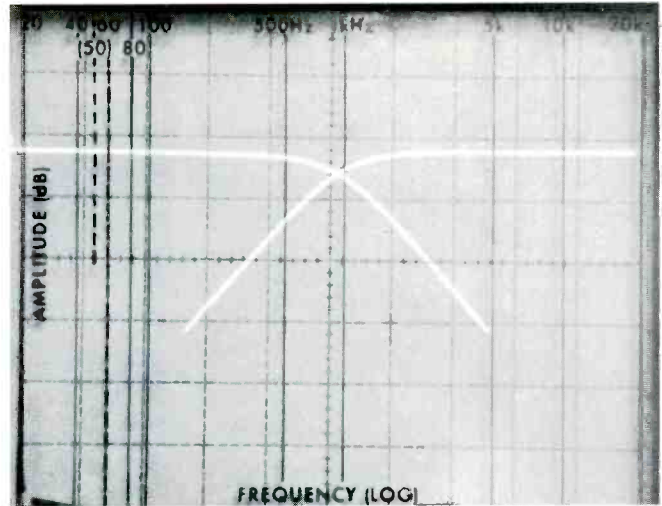


Fig. 6—Typical low and high-pass response curves at the selected 1 kHz crossover point.

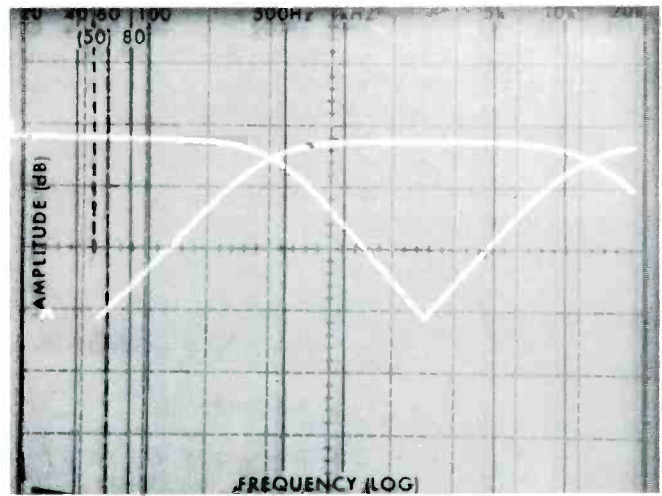
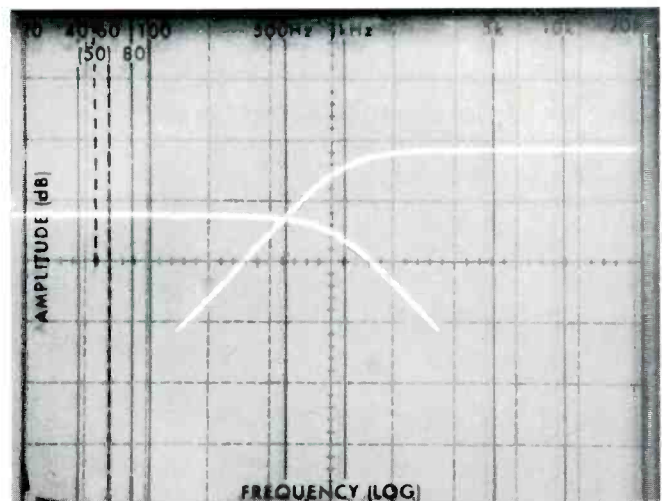


Fig. 7—Three-way electronic crossover on a single audio channel.

Fig. 8—The frequency balance control permits varying levels of low- and high-pass outputs to compensate for different driver efficiencies or amplifier gains.



## Garrard Model 86SB Turntable

### MANUFACTURER'S SPECIFICATIONS

**Speeds:** 33 and 45 rpm.

**Motor:** Synchronous type.

**Drive:** Belt to turntable.

**Wow & Flutter:** 0.06%.

**Rumble:** -64 dB.

**Dimensions:**

17¾ in. W  
x 15½ in. D  
x 7 in. H  
(45.1 x 39.4  
x 17.8 cm).

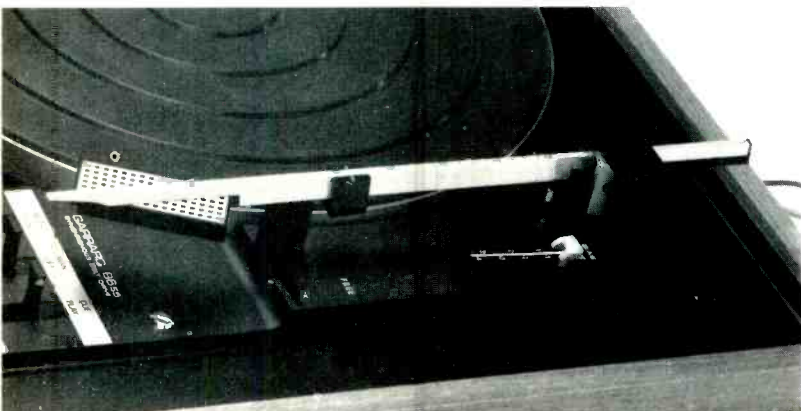
**Weight:**

25 lbs. (11.34 kg).

**Price:** \$159.95.



The Garrard Model 86SB is a two-speed automatic turntable costing only \$159.95, complete with base and dustcover. Like the Z-100-SB, it uses a belt drive mechanism with no variable speed. But as far as the basic performance is concerned, differences seem very slight. Styling is typically Garrard with a restrained black and silver finish contrasting with the light teak base. On the left, at the front, is a rotary dial, which controls the arm set-down positions for 7-, 10-, and 12-inch records, with a fourth position that also changes the



speed for 7-inch, 45-rpm records. On the right-hand side are three levers for *Start-Autostop*, *On/Off*, and *Cue*—the last named lever operating a narrow platform which raises or lowers the arm. Behind these controls is the knob which

locks the arm on its rest, and at the base of the arm is the anti-skating device. This last consists of a plastic bar with a sliding weight attached to the arm pivot. It is calibrated for both conical and elliptical styli with tracking weights up to 4 grams. The arm itself is tubular aluminum with an almost triangular cross-section, and the necessary offset is obtained by mounting the cartridge holder at an angle. A threaded counterweight is mounted at the rear, and the tracking force is adjusted by a small weight which can be moved over a portion of the arm in front of the pivot. This section, about 3 ½ inches long, is calibrated from 0-4 grams.

The turntable platter is dynamically balanced and weighs about 5½ pounds. As mentioned earlier, a belt drive is used instead of the idler wheel system generally employed by less expensive turntables. The motor is a standard Garrard Synchrono-Lab type used on several other models, and the speed change is effected by a fork which moves the belt drive up or down the dual-dimensioned motor spindle. Adjustment screws are provided for set-down positions as well as arm heights in the automatic and manual modes, and the unit comes complete with a 45-rpm adaptor, a plastic gauge for correct cartridge mounting, and a small bottle of oil to be applied to the turntable bearing. The attractive smoky plastic cover fits into a slot at the back of the base and is held in position by a spring loaded arm. The unit itself is spring mounted to the wooden base which has four small mounting feet.

### More Complete Information Dept.

In our May article "Record Cleaners Revisited," a poorly edited paragraph could easily have lead to the inference that the Zerostat gun is the only product which is truly effective in removing static from records. This is untrue, as a re-reading of our March, 1975 article "Do Record Cleaners Really Work?" will show that we found the Nuclear Products' Static Master "was highly effective in removing static charges . . ." and "after treatment . . . there was no measurable charge on the records."

We stand behind those tests of a year ago and commend the Static Master to our readers' attention. We also apologize to our readers, as well as to Nuclear Products, for this unintended misdirection.

### Measurements

As the cables supplied were low-capacity types, a CD-4 cartridge was used for the preliminary tests, changing over to a stereo model later. The two selected cartridges were an Audio-technica AT-20 and a Shure V-15 MkIII; neither presented any difficulties in mounting. A standard Garrard cartridge carrier is used, and after mounting the cartridge (using the gauge), it is simply plugged into the arm. The first tests were for wow and flutter, and the combined figure measured was 0.07% using the DIN standard. Rumble came out at -60 dB, also very commendable for a machine in this

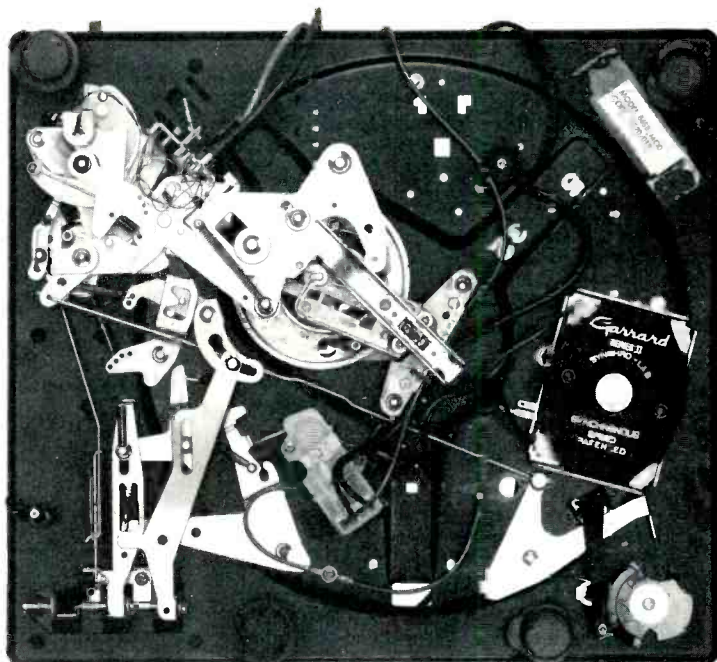
price range. No doubt about it, a well-designed belt drive is hard to beat! Tracking error was within the normal 0.5 degrees per inch, and the lateral arm friction was assessed at 0.1 gram—a bit higher than I would have liked. On the other hand, vertical friction was too low to measure—so was the arm resonance. This is due to the construction of the counterweight which has a flexible insert tending to decouple the mass from the arm and spreading the inherent resonance. Arms having a high-Q resonance will often misbehave on warped records, as well as causing other problems!

The anti-skating dial seems to be calibrated differently than the tracking force dial, since the optimum setting of the anti-skating mechanism was about 0.5 grams when set up for the 1 ½ grams preferred by the Shure cartridge. Calibration of the tracking force “slide rule” was extremely accurate—one advantage of this type of adjustment. The force required to operate the automatic arm return mechanism is quite small and not likely to bother the most fragile and compliant cartridge. Speed accuracy was exceptionally good, being right on the nose at both speeds and not affected by reasonable voltage variations.

### Listening Tests

No adjustments were found necessary—either for arm height or correct stylus-landing positions. In the automatic mode, the arm is returned to its rest position at the end of the record, and the motor is then switched off. If the auto control lever is moved to *Start* when a record is playing, the pickup will return to the beginning of the record, and complete manual operation is achieved by simply using the manual starting switch. The cue control is well-damped with a slow downwards movement and a fast retract, and the mechanism is quite positive with no annoying side-play.

The instruction book is written in four languages, but no



mention is made of the low-capacity cables actually supplied, the illustrations showing a DIN-type connection. The supplied leads terminate in standard RCA-type plugs with the grey wire for the left channel and brown to the right. A green wire is provided for the ground connection.

Summing up: The Garrard 86SB offers rather good performance for its modest price and should prove an ideal unit for a budget system where a top-quality phono cartridge is to be used.

George W. Tillett

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# The Column



**Cry Tough:** Nils Lofgren  
A&M SP-4573, stereo, \$6.98.

If Eric Carmen be the Sal Mineo of 1976, then Nils Lofgren is this year's James Dean. Certainly the lad's got his hot guitar licks and charming voice, but he never showed so much lyrical cool as he does on **Cry Tough**. Image sells, so I suppose it's a smart move. . . what's more, it works here—the whole album seems much more impressive than any other recording project he's embarked upon.

That's not to say it's better, or purer, or anything like that—it's an album designed to win those over who aren't already on his side, and to demonstrate his versatility to the fans who already believe. The album has two producers, David Briggs (who did Nils' last one) and Al Kooper. All of the Briggs-produced tracks sound very much like the last Nils album (except better. . . there's more spectacular guitar playing) save for *Mud in Your Eye* which sounds like nothing you've ever heard before, the quintessential Lofgren punk lyric and perhaps one of Nils' finest recorded achievements to date. That and the Kooper-produced title song, which is true to its handle, are the standouts on the record. The

rest of the Kooper-produced songs are a little weak, usually saved solely by the guitar playing—Al Kooper is an overproducer (which sometimes works but most times doesn't) but worse than that, he uses Jim Gordon on drums, who is too light a drummer to compliment Nils' guitar playing. Aynsley Dunbar plays on some of the other tracks, a drummer as precise as Gordon but with more bite.

Anyhow, the album is not the kind of thing to listen to while washing dishes. It takes more than one hearing to decide whether you're sold, but I am—most of my reservations about the lad are gone, and I anxiously await his next disc.

Jon Tiven

Sound: A — Performance: A

**Cry Tough:** Nils Lofgren  
A&M SP-4573, stereo, \$6.98.

Nils Lofgren has always had all the tools: dandy songs, presence, solid voice and guitar, and an appealing softer side to balance the rock. All that was ever lacked is consistently strong presentation. **Cry Tough** is his first uniformly excellent effort.

Where the Grin albums were spotty and sometimes rushed or sloppy or

not carefully recorded, **Cry Tough** works on all levels. Surprisingly the album is split between two very different producers and philosophies. Half was done by David Briggs who has produced the bulk of Nils output to date from the first Grin album through **Nils Lofgren**, the previous epee. Briggs places Lofgren in the sparse lyric rock trio setting that he has basically used exclusively until now. The rest was produced by Al Kooper, fresh from the Tubes album, in the arty hint of pretense approach Kooper has had from the first *Blood, Sweat and Tears* album on. Obviously a schizoid mess could have been an easy result, but Nils himself is so totally in control, his vision so clear and so fully permeating the record, that it is still a unified effort.

**Cry Tough** is a perfect opener, spelling out Lofgren's attitude, his utter belief in the rock and roll life. It is as direct an explanation as Nils is ever likely to offer. A spirited *It's Not a Crime* adds girl singers and unobtrusive orchestra to set the stage for *Incidentally. . . It's Over*, the first trio song of the album, and a mighty performance. A classy reading of the Yardbirds' oldie *For Your Love* ends side 1. Twin bass parts push the song from a reggae opening to pure thunder.

*Share a little, Mud in Your Eye* and *Can't Get Closer* are 3 Briggs productions to open side 2. *Share* is a perfect seriously rocking intro, leading to the acoustic *Mud*, no less a rock song despite its softer sound. *Can't Get Closer* is reminiscent of *Dreams* from the first Allman Bros. Band album, an ominous and scary number. Two final Kooper jobs close the show. *You Lit a Fire* nearly works. Here the orchestra gets a little out of hand, getting in the song's way. The redeemer is *Jailbait*, a terrific song about a 14 year old "who looks 23," another clever rock-out.

**Cry Tough** is really impressive. It is Nils Lofgren's finest moment. But only so far.

Michael Tearson

Sound: A — Performance: A

**At the Speed of Sound:** Wings  
 Capitol SW-11525, stereo, \$6.98.

What can one say about the first album Paul McCartney's made with a real rock 'n' roll band since The Beatles? It doesn't disappoint—if you weren't going to like this album, you made up your mind that you didn't like McCartney a long time ago—and for the most part it's one surprise after another. It's an album that is very difficult to evaluate unless properly digested, and half a dozen listenings should be the minimum before an opinion is rendered. Given all of these factors, I'd say that Macca has truly exceeded himself without overpowering the rest of the band, and the rest of Wings have also done well by the latest album.

There are two Classic McCartney songs, *Warm & Beautiful* (which could be covered by Frank Sinatra with ease) and *Must Do Something About It*, the latter tune sung splendidly by drummer Joe English. There's a could-have-been-written-by-Stevie-Wonder song called *She's My Baby* which is super, a very simple but no less thrilling song which opens the album called *Let 'em In*, and an extended rock 'n' roll tour-de-force called *Beware My Love*



which sounds like McC backed by Mott the Hoople/Vanilla Fudge on instruments/vocals respectively. Not to belittle the disco single (which sounds like the followup to *Live & Let Die*) *Silly Love Songs*, and the weird *San Ferry Anne*. Linda sings the mildly amusing *Cook of the House*, but her finest moments can be found singing harmony to Denny Laine on Denny's *Time to Hide*. Denny's other song, *The Note You Never Wrote* is a gem as well, although both of them literally make no impression until after the third or fourth listening. The only marginal moments to be found are on Jimmy McCulloch's *Time to Hide*, which is a shame because Jimmy's no slouch and I hope that next time he'll come up with something better and more original.

It's a fairly basic album—rarely do they get into heavy production numbers, and most of it is fairly sparse—and that's the best advertisement to see a band live that there is. There's no lyric sheet for record reviewers to tear apart, a fine cover, and very little not to like about **At the Speed of Sound**. And a lot to dig your teeth into, bubba.

Jon Tiven

Sound: A Performance: A+

## SECRETS FROM THE AUDIO FILE



# Sock that sibilant singer

**ADVICE FROM:** John Wilson, recording engineer, Capitol Records, Inc.

**PROBLEM:** Distortion and background wind. You're stalled by a sibilant singer. Or a performer who pops his p's. Or you're losing the wails of a howling wolf under the whistle of a howling wind.

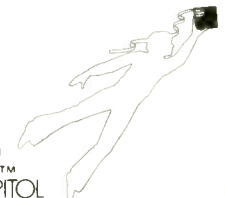
**RECORDING TIP:** You can improvise a windscreen by fastening an old woolen sock over the mike. It shields the mike diaphragm from those sudden blasts of wind. You'll lose some high frequency, but you'll lessen the pops, whistles and rumbles. This makeshift filter works best with the worst mikes and well worn socks. Experiment with it. Sure, it's unscientific, but it's a good tip to have up your sleeve. Or, in your sock.

**TAPE TIP:** Accurate, distortion-free recording starts with the best tape and equipment you can afford. If you record music, the most demanding of sounds, there's no better tape to buy than The Music Tape by Capitol.

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**Pistol Packin' Mama:** The Good Old Boys

Round RX-LA597-G/RX-109, stereo, \$6.98.

Make no mistake. The Good Old Boys album is the best bluegrass record in years, and is destined to be a landmark. It marks the first major label recording in many moons of banjo and fiddle greats Don Reno and Chubby Wise. Three relative youngsters round out the band: ex-New Rider David Nelson on guitar, Pat Campbell on bass, and flashy ex-Greenbriar Boy Frank Wakefield's spacy mandolin.

The pickin' is of the highest caliber, spread generously over 14 songs, several from the Reno song-bag with a couple each from Wakefield, Wise, and Nelson, and some country standards, too. Clearly a great time went down making this album which any self-respecting bluegrass fan owes it to himself to hear. *Michael Tearson*

Sound: A

Performance: A

**The Sun Sensations:** Elvis Presley  
RCA APMI-1675, mono, \$6.98.

That it took over 20 years to gather the historic Presley Sun records together is criminal. However, finally these 16 tracks are all in one place where they belong. From these recordings sprang rock and roll as we have known it ever since. No small statement perhaps, but to a large degree true. Elvis' versions of *That's All Right, Mama, Mystery Train, Good Rocking Tonight*, even Bill Monroe's *Blue Moon of Kentucky* are the stuff of legend. Even the ballads have a special electricity.

On most of these tracks Elvis' only accompaniment is Scotty Moore's extraordinary electric guitar and the late Bill Black's upright bass. D. J. Fontana adds drums on the later tracks to really propel them and flesh them out. The difference is crucial.

These old sessions have held up remarkably well. The sound still feels crisp for its era, and it has been left in its natural mono state undiluted by the phony electronic stereo of too many early Presley records.

In *Milk Cow Blues Boogie* Elvis busts the take, telling Moore and Black, "That don't move me. Let's get real, real gone...for a change" and kicks the tune off doubletime. The kid never looked back. *Michael Tearson*

Sound: B

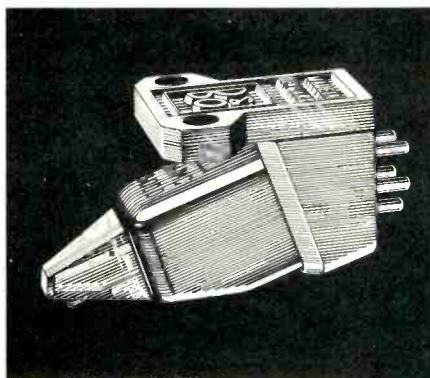
Performance: A+

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## Bang & Olufsen

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**Rock Of The Westies:** Elton John  
**MCA-2163**, stereo, \$6.98.

Well, here it is folks—this week's Elton John album, **Rock Of The Westies**. Hmm, a great title and record as usual, but a very different one (I suppose that's usual too).

I've lived with this one for awhile, partially out of respect for my neighbors because this record is loud. It is impeccably recorded and sounds like it cost a fortune to produce. It's almost impossible to hear the inner workings of this new Elton John Band unless you listen to it loud, cranked up to an unendurable blast. The new band is minus two stalwarts, Nigel Olsson and Dee Murry. The Bernie Taupin lyrics are as splendid as they are inaccessible. It rocks-and-rolls and excites in bulldozer-like fashion. I find *Feed Me*, *You Help* and *Island Girl* to be the headliners, but the whole album starts off good and stays that way. When it comes to quality, from concept to vinyl product, the Elton John crew cannot be faulted. By combining vast amounts of money and talent with great taste, they have put out another quality record. As usual, **Rock Of The Westies** is pure rock perfection from the seemingly tireless

machine we know as Elton John. Faultless, inimitable, and transitory rock!

*Fred De Van*

Sound: A Performance: A

**Lazy Afternoon:** Barbra Streisand  
**Columbia PCQ-33815**, SQ quadraphonic, \$7.98.

Can Barbra Streisand find love and happiness with a part of her audience which either left or never was? Can she pull off the hat-trick that has eluded so many of her peers? How do you grow when confronted by a wall of people who only spend millions on your records if you keep giving them the same old thing? Don't dare the unexpected, the folks won't buy surprises. In this way we are all guilty of strangling the scope of our idol's product.

Barbra Streisand with her **Lazy Afternoon** steps into the lofty areas of barrier crashing good taste that Morgana King laid out with her **New Beginnings** opus (Paramount PAS-606) and Peggy Lee's eclectic new entry **Mirrors** (A&M SP-4547). Could be that Barbra took a little of her film-and-acquired discipline and brought it to her

recording life. No matter what chemistry brought Streisand, Jeffrey Lesser, and Rupert Holmes together, the threesome does a masterful job creating a magic record. Streisand's voice is at its best on this album. When Holmes redoes his already lovely *Widescreen* for this album, it ends up with a definite added quality.

As much as it may irk some of us, this album does not allow dismissing Barbra as "pop-pap" and forces us to regard her as a serious, competent vocalist. True, some concessions have been made, but, on the whole, this album won't be recognized by the unknowing as "another Streisand pabulum-album." I frankly don't care if it's a Streisand album, it's that good.

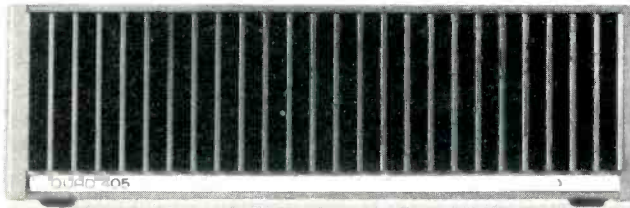
Incidentally, you can have a dress-rehearsal of a lot of this album on Holmes' own **Widescreen** (Epic KE-32864) and another entitled **Rupert Holmes** (Epic KE-33443).

Alas, it is not the perfect Streisand album, but that is simply because she is who she is. But, it is certainly the best I have heard from her and a high point in her recording career. Try it and be surprised.

*Fred De Van*

Sound: A- Performance: A

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**Short Cut Draw Blood:** Jim Capaldi  
**Island ILPS 9336**, stereo, \$6.98.

Jim Capaldi's third solo album is his first since Traffic officially disbanded. Clearly it is the one he has put the most personal care and effort into so far. Capaldi used two songs he didn't write this time. *Love Hurts* has had a checkered career from its original by the Everly Brothers, 1972 remake by Gram Parsons and Emmylou Harris on Gram's **Grievous Angel** to the recent screamer version by Nazareth. Capaldi's version is more up-tempo than

any before, charged up by some tasty disco-style strings and surprisingly ingratiating. *Johnny Too Bad* taken from the soundtrack of the film "The Harder They Come" retains some reggae feel, but lacks that slight edge of conviction.

Some of Capaldi's own songs are winners. The title song and *Living on a Marble* are angry and driving. *Marble* segues into the haunting *Boy With a Problem*, a fierce indictment of addicting drugs. *It's All Up to You* is a fine love song. The album finale is the

gentle *Seagull* recorded with Traffic mates Steve Winwood and Chris Wood. It is an affectionate farewell to a well-loved band.

Jim Capaldi is alive and well. **Short Cut Draw Blood** is a healthy effort.

Michael Tearson

Sound: B+ Performance: B+

**Third World:** Third World  
**Island ILPS 9369**, stereo, \$6.98.

Third World is a reggae band, a good one. Neither as evangelical as Toots and the Maytals, nor as fierce as Bob Marley and the Wailers, nor as slick as Jimmy Cliff, Third World is very much their own band with some ideas of their own. Especially laced with African rhythms, Third World has a sinewy, undulating sound, both slinky and seductive.

If *Sette Messgana* is dark and brooding with the anger that perpetually bubbles just behind most of the best Jamaican music, then *Slavery Days*, borrowed from fellow Island reggae band Burning Spear (ILPS 9377) is positively foreboding, featuring some devastating filtered vocal effects over the insistent chant "Do you remember the days of slavery?" It is a brilliant opening to a strong album.

*Brand New Beggar* sounds more American with a purely soul melody and harmonies but the dynamics remain absolutely reggae. Only the excessively slick *Got to Get Along* feels uncomfortable and forced. The album's closer *Freedom Song* is simply one of the most compelling songs yet to come out of reggae.

Reggae is opening up into a wholly fresh sound and beat, maybe, as others have noted as well, the first really new sound since the big beat of Rock & Roll reared its head. Toots Hibbert sings *You Got To Be There* and Third World is.

Michael Tearson

Sound: A Performance: B+

**Fast Annie:** Annie McLoone  
**RCA APL-1-1362**, stereo, \$6.98.

This one should never have been released. Annie has projection but utterly lacks dynamics. The band is adequate, but the recorded sound is as muddy and directionless as the material. Neither the artist nor the band were ready to record.

Michael Tearson

Sound: D Performance: F

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# Classical Reviews

Edward Tatnall Canby



**Schubert: "Wanderer" Fantasy. Schumann: Sonata No. 2 in G Minor, Op. 22.** Bruno-Leonardo Gelber, piano. **Connoisseur Pathé Marconi, EMI CS-2085, stereo, \$6.98.**

Connoisseur Society is supplementing its own extensive series of home-based recordings via some big-name licensing, as witness the above, Pathé Marconi being an illustrious French-Italian combine and EMI being, well, EMI. All neatly tied together with international strings. The base, in this case, seems to be Paris.

Without any question this version of the famed "*Wanderer*" *Fantasy* of Schubert, a piece that stands in all its horrendously demanding length as a challenge to every classical pianist, is the most *communicative* performance I have ever heard. I did it the timeless honor of playing it straight through twice, resetting the stylus just as fast as I could at the triumphant ending of the piece.

Schubert is tough to play, first, because of the vast mass of somewhat cluttered and un-pianistic accompaniment notes that always surround the big ideas and, secondly, because of his extraordinarily profound harmonic sense, the strange, moving changes of key—often going quite unheard even by some of the famous pianists. Third, in this and other big works—

the last Sonatas—there is a huge time span and an architectural drama to keep going, to sustain, behind all the Romantic details. Not easy! Many otherwise good pianists fail on one or all of these counts.

To use an old phrase, this Gelber makes it all sound ever so easy. He manages even to give the "*Wanderer*" a light, airy touch, in the right places; and the heavy spots are never merely heavy, always muscular and full of musical spring. He scores 100 on every count, and there never was a more superbly listenable Schubert recording.

The Schumann *Sonata*, out of his early-ish piano exuberance (Schumann went through phases of composing all in one fashion), is equally well done. Perhaps I note the Schubert more positively because "*Wanderer*" is so often recorded and played, and so often bogs down into pianistic bombast or plain impotence. Not here!

**Wagner: Wesendonk Lieder; Vorspiel/Liebeshod (Love/Death Music) from "Tristan."** Jessye Norman, London Symphony, Davis. **Philips 9500 031, stereo, \$7.98.**

The five songs, originally with piano (here orchestrated), which Wagner wrote for his passion of the moment, Mathilde Wesendonk, to words of her

own writing, were actually studies for the coming opera *Tristan*, as is instantly apparent to anyone who knows the high points of the big opera. In this rather nicely planned recording, the five songs are preceded on side 1 by the familiar love music from the opera, going on in the long-familiar concert fashion directly into Isolde's death music at the opera's end (many hours later); but here there is a new twist; she sings. Most such concert juxtapositions are purely instrumental. So we have Isolde herself as a prelude to the pre-Isolde *Wesendonk* songs. Nice idea.

I could not say what Wagner might think were he to perceive a black Isolde but here we have one and she puts forth in the grand tradition, a moving if maybe not a great Wagnerian performance. She is a bit quavery in her emotion, does not produce that infallible long line that the great Flagstad could control, even into her old age, and yet she does know and understand the musical expression. The songs, on a smaller scale, are perhaps better than the Isolde segment. Colin Davis provides a solid Wagner orchestra though, again, without quite the long line of tension that the great Wagnerian leaders can command.

**American Songs for A Cappella Choir.** The King Chorale, Gordon King. **Orion ORS 75205, stereo, \$6.98.**

Fifteen very pro singers with big, operatic voices make up this typical American virtuoso choral group and their music is all-American here, contemporary, more or less, "classical" in approach. If you enjoy this type of ensemble sound, you will find its best virtues here—good, opera-style diction and "acting" of the music, a vast dynamic range from very soft to impressively loud, an unerring exuberance of the sort that all our trained singers learn first of all, and with it that heightened sense of projection, from stage to audience, that opera in particular requires, minus microphones. (Well, we don't count broad-

casts and recordings; they simulate or are live performances.)

Opera? None of this music is opera and there is no orchestra, no instruments; the Chorale is church-based via its organist-choirmaster conductor. Yet the standard American professional choral sound is opera and that is what you will find here in the choral sonics—the good and the bad of it. The unfocused, unblended sound of each part, an aggregation of audible soloists, and the poorly defined harmonies—the singers hear them OK, but we listeners don't. Too fast, too sprightly, too energetic, to the point of habitual inaccuracy of pitch. Too bad. Because this group has a lot to say in musical terms, if it would just blend better and tune up more accurately.

Not easy to tell you what music is being sung. I won't even try, except to mention Barber, Mennin, Pinkham. (1) Texts, with authors, are on the jacket reverse—with no composers attached. The composers are duly listed, to one side—in alphabetical order. (2) The composers are on the record label, but in such jumbled fashion that it's almost impossible to figure out

who composed what. (3) Not surprisingly, there are outright mistakes—wrong composer—one on each side. A letter came along from the conductor himself (not the record company) noting the corrections.

Since I couldn't tell what was being sung except by stopping the turntable after each piece, every minute or so, and mostly not even then, I just listened anonymously. That'll work fine for you, too. Orion—for goodness' sake, after all these years in the record business...!

**Hermann Goetz—Complete Chamber Works.** A. Veritch, T. King, G. Dicterow, G. Robbins, D. Trembly. **Genesis GS 1037/38**, 2 discs, stereo, \$13.95.

And WHO is Hermann Goetz? Good question; for you won't find him in Music Appreciation. Listen, here, for four whole sides, and you will find that he was a good man, a German composer after Schumann and early Brahms, yet with a distinct French style of melody, very easy to digest; technically he ranks as a conservative merely because, from our distance, he sounds a bit further back

than he actually was. He was around 12 or 13 when Schumann himself wrote his last big works, early 1850s.

Goetz was harried all his short life by TB, which finally got him in his early thirties. That's one reason you haven't heard much about him. He's best known, over there, for a comic opera in German called *Der Widerspenstigen Zähmung*, which is enough of a name to keep it off the Met stage for another 100 years.

A group of five young pro musicians from the West Coast, who remain collectively nameless (and no room, above, to write them all out in detail), plays Goetz with a fine sense of style and intent, full of fire, notably the solo violin and the piano, very clearly expressing a certain intensity that we can ascribe to the dread weight of that ever-threatening TB that first showed up when Goetz was only 17. It is really lovely music, all fresh early Romanticism, even unto a certain Mendelssohnian flavor. I particularly enjoyed the filler items, *Three Easy Pieces* for violin and piano; you might try them first. Nicely recorded, though the strings are a bit too loud and close for the piano.

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# Jazz & Blues

**Eastborne Performance:** Duke Ellington  
RCA APL1-1023, stereo, \$5.95.

Here is the last album recorded by the Duke Ellington orchestra, made in England in October, 1973, six months before Ellington's death. It is, remarkably, as pungent and as bracing a performance as anything the band produced in the past decade.

The full-bodied, full-blooded sound of the Ellington ensemble comes through with richness and clarity thanks to top notch on-the-spot recording and a splendid remix and editing job by RCA producer Mike Lipskin and engineer Bob Simpson. When one realizes that Ellington had



but six months to live, the vigor and animation of his pianistics are astounding. As noted by Stanley Dance on his album liner, Ellington's solo on *The Piano Player* has "an intensity and energy that belied the terminal nature of the illness from which he was suffering."

The only Ellington warhorse appearing in the Eastborne collection is *The Creole Love Song*, which features Russell Procope on clarinet, Harry Carney's bass clarinet, and Money Johnson on muted trumpet. While I've heard the piece hundreds of times, it still comes through as a fresh listening experience. *Don't You Know I Care*, an obscure Ellington gem which languished in the Ellington library since it was written in 1944, is led by alto saxist Harold Minerve, who here has much of the late Johnny Hodges' eloquence and authority. He's backed up by Harry Carney's big, throaty baritone in distinctive background support. There is also an arresting performance of Bunny Berigan's Swing Era standard, *I Can't Get Started* by Harold Ashby on tenor, and trumpeter Johnny Coles sails through the bop anthem, *How High the Moon*, on which the Charlie Parker *Ornithology* variations are crisply translated by the Ellington brass.

The band moves smoothly from bop to New Orleans jazz with a humorous version of the traditional *Tiger Rag* and with Money Johnson's affectionate salute to Louis Armstrong on *Basin St. Blues*, *Pitter Patter Panther*, a *tour de force* for piano and bass originally recorded in 1940 by Ellington and his great bassist Jimmy Blanton, is played by Duke and Joe Benjamin, and, as pointed out by Stanley Dance, their performance is particularly affecting as each had mere months to live when it was made.

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Perhaps the single finest track in the album is *Meditation* appearing on side two. It is the same elegaic, evocative piano solo that Ellington played in his Second Sacred Concert. Stanley Dance asks what was in Duke's mind as he performed *Meditation* that night in Eastborne? Was it thoughts of farewell or remembrances of the warm welcome and brilliant reception he received in England on his first European tour 40 years ago? Whatever, Duke Ellington's **Eastborne**

**Performance**, is, indeed, a fitting farewell from the master. *John Lissner*

Sound: A Performance: A

**Picture of Heath:** Jimmy Heath.

**Musicians:** Heath, tenor and soprano saxes; Barry Harris, piano; Sam Jones, bass; Billy Higgins, drums.

**Songs:** *For Minors Only, Body and Soul, Picture of Heath, Bruh' Slim, All Members, CTA.*

**Xanadu 118**, stereo, \$6.98.

Though he will celebrate his 50th

birthday this year, Jimmy Heath is not nearly as well known as he ought to be. This album, probably his best as a player (he is also a first-rate composer and arranger), might remedy that unfortunate condition.

Brother of bassist Percy (the bedrock of the Modern Jazz Quartet) and drummer Al (known as Tootie), Jimmy has worked with such notables as Dizzy Gillespie, Miles Davis, Gil Evans, J. J. Johnson and Donald Byrd. He is a splendid musician whose work is free from any trace of meretriciousness or vanity. He has never pandered to fads or fancies and has remained true to the jazz spirit.

Supported by a first-rate rhythm section, Heath maintains a high level of inspiration in a program of his own compositions and that classic test piece for tenor saxophonists, *Body and Soul*. On this, he introduces the theme on soprano sax, and then, after Barry Harris' lovely solo, proceeds to build to a moving climax on tenor. Outstanding, too, is his work on the fast *Minors Only*, where he creates an ambiance worthy of Dexter Gordon or Sonny Rollins. His soprano feature, *Members*, shows his attractive tone and lyrical conception on the smaller horn, but it is on tenor that Jimmy Heath stakes out his claim to recognition as a major artist.

Coincidentally, Milestone has recently released **Fast Company** (M-47025), a two-record set culled from Heath's 1959-64 albums on the old Riverside label. It rounds out the picture of Heath nicely, focusing on his talents as an arranger for various interesting combinations of instruments, and features, among others, the Adderley Brothers, Freddie Hubbard, Kenny Burrell, Herbie Hancock, and Percy and Albert Heath.

But first, hear what Jimmy Heath can to today. It is the work of a master.

*Dan Morgenstern*

Sound: A Performance: A

**Lament for Booker Ervin:** Booker Ervin.

**Musicians:** Ervin, tenor sax; Kenny Drew, piano; Niels Henning, Orsted Pedersen, bass; Alan Dawson, drums; Horace Parlan, piano (on *Lament* only).

**Songs:** *Blues for You, Lament for Booker.*

**Enja 2054**, stereo, \$6.98.

Booker Ervin died of a kidney ailment in 1970, at the age of 39. He was one of the most powerful, individualistic musical personalities to emerge in the 1960s, best known for



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his work with Charles Mingus and the brilliant series of albums under his own name for Prestige produced by Don Schlitten.

This stupenduous performance was taped at the Berlin Jazz Festival in October 1965, at a concert featuring tenor saxophonists (the others were Ben Webster, Don Byas, Brew Moore, and the sole survivor, Dexter Gordon). In typical festival style, each player was accorded the barest minimum of playing time, and prior to Ervin's spot, Webster had been publicly abused and hustled off stage by the producer. Ervin, who wore his heart on his sleeve, was brimfull of pent-up emotion. It came out like a torrent in nearly 28 minutes of blues at a blinding tempo.

What makes this outpouring even more astonishing is the way Ervin controls and shapes the music. It is passionate, even violent, but it also has the structure and order and coherence without which there can be no art worthy of the name.

The protagonist gets wonderful support from the rhythm section, particularly from Dawson in *Blues for You*.

As a tribute to his good friend and frequent associate, pianist Horace Parlan offers the moving elegy, *Lament for Booker*. It was recorded almost 10 years after *Blues*.

Speaking of tributes: Fantasy, which owns the rights to the Prestige catalog, should consider an Ervin entry in their excellent reissue series.

Meanwhile, this remarkable record will help keep the music of Booker Ervin alive. *Dan Morgenstern*

Sound: B Performance: A+

**Truckload of Loving:** Albert King  
**Utopia BUL-1-1387**, stereo, \$6.98.

What we have here is a desperate attempt to make a commercial entity out of a decent blues guitarist who has been absent from the recording scene for a year or two. The songs generally range in an up-tempo blues mold with occasional disco strings and one slower number. The lead guitar sounds like King but since he is uncredited, it's hard to tell, and it could be the ubiquitous Wah-Wah Watson imitating him. King's singing is okay, and he sounds like he is having a reasonably good time but nothing ever gets beyond the expected or the average. *Michael Tearson*

Sound: B Performance: C



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**ACOUSTIC RESEARCH AR-3** loudspeaker systems. Any finish, but drivers must be original and electromechanically perfect. State condition and serial numbers. Tyson, 707 Flornham, High Point, NC 27260. (919) 967-2462, 10 to 6.

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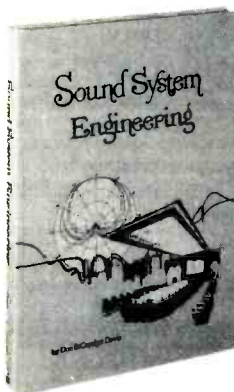
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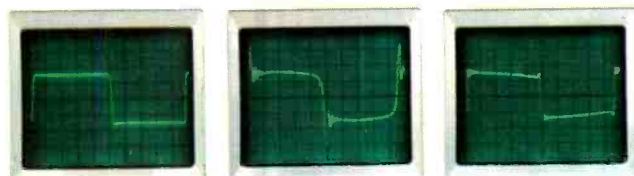
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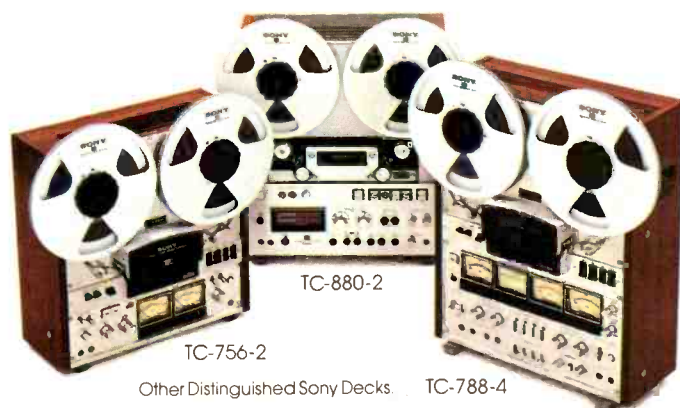
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