

First Test:
ADS 2001

Audio

THE AUTHORITATIVE MAGAZINE ABOUT HIGH FIDELITY • JULY 1975

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Car Stereo Directory

Five Car Radios Tested

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2608 CENTRAL BLVD
EUGENE OR 97403



receivers the world

Pioneer believes that any objective comparison of quality/performance/price between our new SX-1010, SX-939 and SX-838 AM-FM stereo receivers and any other fine receivers will overwhelmingly indicate Pioneer's outstanding superiority and value.

Our most powerful ever.

Pioneer uses the most conservative power rating standard: minimum continuous power output per channel, into 8 ohm loads, across the full audio spectrum from 20 Hz to 20,000 Hz.

Despite this conservatism, the SX-1010 far surpasses any unit that has come before it with an unprecedented 100 watts of power per channel, minimum RMS, at no more than 0.1% total harmonic distortion. Closely following are the SX-939 (70 watts RMS per channel, minimum) and the SX-838 (50 watts RMS per channel, minimum), both with no more than 0.3% total harmonic distortion. Dual power supplies driving direct-coupled circuitry maintain consistent high power output with positive stability. A fail-

safe circuit protects speakers and circuitry against damage from overloading.

Outstanding specifications for flawless reception

FM reception poses no challenge to the exceptionally advanced circuitry of these fine instruments. Their FM tuner sections are designed with MOS FETs, ceramic filters and phase lock loop circuitry. The result is remarkable sensitivity, selectivity and capture ratio that brings in stations effortlessly clearly and with maximum channel separation.

	SX-1010	SX-939	SX-838
FM Sensitivity (IHF) (the lower the better)	1.7uV	1.8uV	1.8uV
Selectivity (the higher the better)	90dB	80dB	80dB
Capture Ratio (the lower the better)	1dB	1dB	1dB
Signal/Noise Ratio (the higher the better)	72dB	70dB	70dB

Total versatility plus innovations

Only your listening interests limit the capabilities of these extraordinary receivers. They have terminals for every conceivable accommodation: records, tape, microphones, headsets — plus Dolby and 4-channel multiplex connectors. Completely unique on the SX-1010 and SX-939 is tape-to-tape duplication while listening simultaneously to another program source. The SX-838 innovates with its Recording



The finest stereo has ever known.





3,025 possible tonal compensations with unique twin stepped tone controls (SX-1010, SX-939)

Selector that permits FM recording while listening to records and vice versa. Up to three pairs of speakers may be connected to each model.

INPUTS	SX-1010	SX-939	SX-838
Tape monitor/4-ch. adaptor	3	2	2
Phono	2	2	2
Microphone	2	2	1
Auxiliary	1	1	1
Noise reduction	1	1	1
OUTPUTS			
Speakers	3	3	3
Tape Rec./4-ch. adaptor	3	2	2
Headsets	2	2	1
Noise reduction	1	1	1
4-channel MPX	1	1	1

Master control system capability

Pioneer's engineers have surpassed themselves with a combination of control features never before found in a single receiver. All three units include: pushbutton function selection with illuminated readouts on the ultra wide tuning dial, FM and audio muting, loudness contour, hi/low filters, dual tuning meters and a dial dimmer.

Never before used on a receiver are the twin stepped bass and treble tone controls found on the SX-1010 and SX-939. They offer over 3,000 tonal variations. A tone defeat switch provides flat response instantly throughout the audio spectrum. The SX-838 features

switched turnover bass and treble controls for more precise tonal compensation for room acoustics and other program source characteristics.

In their respective price ranges, these are unquestionably the finest values in stereo receivers the world has ever known. Audition their uniqueness at your Pioneer dealer. SX-1010 — \$699.95, SX-939 — \$599.95, SX-838 — \$499.95. Prices include walnut cabinets.

Also new and more moderately priced.

Pioneer's most complete and finest line of receivers ever, presents equally outstanding values starting at \$239.95. Shown here are the SX-535 — \$299.95, SX-636 — \$349.95, SX-737 — \$399.95. All with walnut cabinets.

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90248/Midwest: 1500 Greenleaf,
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when you want something better



SX-535



SX-636



SX-737



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Discs Today are Different

There's a greater difference than meets the eye between today's records and older records. Modern technology in high-speed manufacturing can leave crystallized compounds on the surface of new discs. Quite frankly, only our fluid-based record cleaning system is designed to remove this audible problem.

That's because we carefully developed **dii** as a fully integrated system. Only **dii** fluid solubilizes ordinary dirt and debris as well as other contaminants. Then fluid, problems, and particulate matter are removed through capillary action onto our uni-directional brush fiber. The **dii** system is available from your audio specialists for \$15.00. **dii** fluid is \$2.25. (We also have a special formula for old 78's for \$2.00.)

Discwasher, Inc.,
909 University, Columbia, Mo. 65201.

Audio

July, 1975

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

Vol. 59, No. 7

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You could pay \$100 less for a turntable.
You could pay \$100 more.
Here are some reasons you shouldn't.

Pay less and you get less.

If you're serious about your music system and your records, you'll live to regret a compromise.

Pay more and you still won't get all you get in a B.I.C. multiple-play manual.



This new turntable, developed by B.I.C., achieves a new state of the art. It includes a low-speed (300 rpm) 24-pole synchronous motor; belt drive, a superb new tone arm, plus a group of easy-to-decipher-and-use adjustments that let you fine-tune the machine as you can no other.

The real benefit, however, is performance. Playback quality is comparable with turntables in the \$300 and up class. And no other belt-drive turntable can be operated in 3 modes: single-play manual, single-play automatic, and multiple-play (which lets you play up to 6 records in sequence).

There are two models. The 980, at left, has electronic speed and variable pitch control with illuminated strobe. The 960, at right, is virtually identical except for these features.

We think they're more turntable for the money than anything else you'll find. But why not compare them for yourself.

See your audio dealer for more information or write to us, British Industries Co., Westbury, New York 11590.

Stravinsky made us do it.



Stravinsky . . . and every composer who has ever written music with the range, power and majesty of "Rites of Spring" . . . music that demands far more than any stereo can deliver without adequate amplifier power.

The Phase Linear 700B Power Amplifier faithfully reproduces the most difficult passages of the most demanding recorded music. It lets *all* of the music through at realistic volume levels. You never have to reach for your volume or tone controls to prevent clipping.

The 700B has the highest power, widest frequency response and lowest distortion of any stereo amplifier in the world. Take Stravinsky to your dealer and listen to what we mean.



Phase Linear 700-B

THE POWERFUL DIFFERENCE

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LYNNWOOD, WASHINGTON 98036

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Behind The Scenes

Bert Whyte

FOR MANY YEARS, we have been reading the purple prose of copywriters who tell us that their particular brand of loudspeaker has a frequency response of 20 to 20 kHz. Of course, in most cases they conveniently forget to mention how flat this response curve is. As has often been noted, the loudspeaker generally is the weakest link in the chain of hi-fi sound reproduction, and even with today's advanced technology, this still holds true. The attainment of flat response over a frequency spectrum that encompasses human hearing was, and is, one of the most elusive goals of loudspeaker manufacturers.

In the early days of hi-fi, loudspeaker designers placed great emphasis on the reproduction of high frequencies. Thus, we had all sorts of tweeters on the market, which purportedly offered "facsimile" reproduction of the tinkly triangles and sizzling cymbals, etc. Some of these tweeters were so directional they were akin to a laser beam, and they also had such exaggerated high frequency response that listening to them was almost painful. Of course, there were engineers who recognized the need for high-quality reproduction of low-frequency fundamentals below 50 Hz. Perhaps the most famous of the low frequency speaker designs was Paul Klipsch's Klipschorn, a folded corner horn. Following in short order, we had such things as front-loaded horns, back-loaded horns, and the true exponential horn. The most famous example of this last was the 30-ft. concrete horn built outside the home of Al Kahn, former president of Electro-Voice. The mouth of this monster occupied one entire wall of Mr. Kahn's living room! Another approach to low-frequency reproduction was the use of multiple driver units, ranging from 8 to 15 in. mounted in large infinite baffles.

The main problem with all these low-frequency loudspeakers was that they were of heroic dimensions, both in inches and dollars. History shows that as the idea of hi-fi sound spread

to more people, these monsters fell into disfavor, with only the most dedicated purists remaining faithful to them. The advent of the acoustic suspension loudspeaker ushered in the "bookshelf" speaker, which, in a small package, put out a very respectable level at low frequencies. They also carried the penalty of being extremely low in efficiency, requiring commensurately greater amplifier power. The arrival of moderately priced, transistorized amplifiers with high output power solved this problem. This acoustic suspension type of loudspeaker has since proliferated to the extent that there are literally hundreds of different brands available, all variations on the same theme. As with any class of products, there is considerable gradation of quality among these loudspeakers. Although a great many of them are advertised as having that magical 20 Hz to 20 kHz response, the knowledgeable audiophile is aware that this is highly unlikely.

Put plainly and bluntly, *no* loudspeaker that I know of has *flat* response from 20 Hz to 20 kHz. Big, small or middling, horn, reflex, infinite baffle, transmission line, or what have you . . . all fall short of this goal in one respect or another. Admittedly, there has been great progress in the area of mid- and high-frequency drivers, both of the dynamic and electrostatic varieties as well as the more exotic types, which do indeed give quite flat response from around 300 Hz to 20 kHz (at least, as measured in an anechoic chamber). However, where almost all speakers of today are found wanting is in the area of low-frequency reproduction. Yes, the big Klipschorns and transmission lines and 24-in. Hartleys in 100-cu. ft. infinite baffles are still with us and have their bands of loyal adherents. But the myriad of acoustic suspension boxes or reflex types just can't put out much energy below about 45-50 Hz.

Now, don't climb on my back! I know you've seen those reviews of some of these speakers, which state . . . "the Zilch speaker was down 8 dB at 40 Hz, but there was usable re-

Tops all of ours and all of theirs too

the Sansui 881



SANSUI 881 is our finest hour.

The most advanced model in the long line of our already famous AM/FM stereo receivers and it's not only our best, it's the best on the market today.

Specs: 63 watts per channel minimum RMS into 8 Ohm load from 20 Hz to 20 KHz with no more than 0.3% total harmonic distortion. 1.8 microvolts sensitivity.

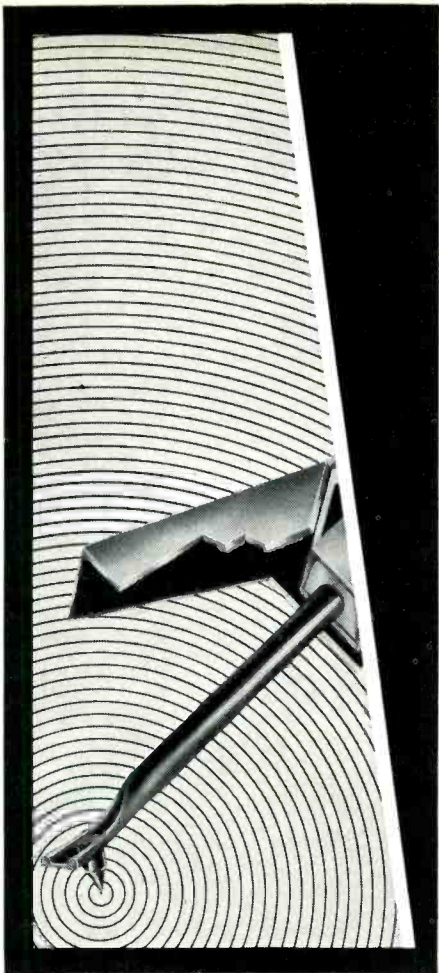
Hear the SANSUI 881 at your nearest SANSUI franchised dealer – and be sure to pick up your free copy of "The Sounds of SANSUI" or write directly to us.

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www.AmericanRadioHistory.com

Sansui



Straight talk about a stylus

You can still hear some audiophiles refer to the record stylus as . . . "the needle." The fact is that the stylus of today bears no more resemblance to a needle than it does to a ten-penny nail. In fact, a Shure stylus is probably the most skillfully assembled, critically important and carefully tested component in any high fidelity system. It must maintain flawless contact with the undulating walls of the record groove—at the whisper-weight tracking forces required to preserve the fidelity of your records. We put everything we know into Shure Stereo Dynetic Stylus Assemblies—and we tell all about it in an informative booklet. For your copy, write:

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



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response to 30 Hz and still some response at 25 Hz." HAH! Who are they kidding with this stuff and nonsense! Of course, there are probably some of these people who sincerely feel that this represents adequate bass response. In my book, when your speaker has this kind of low frequency response, you can just forget about the real bass fundamentals which are the foundation of the modern symphony orchestra, to say nothing of the pipe organ.

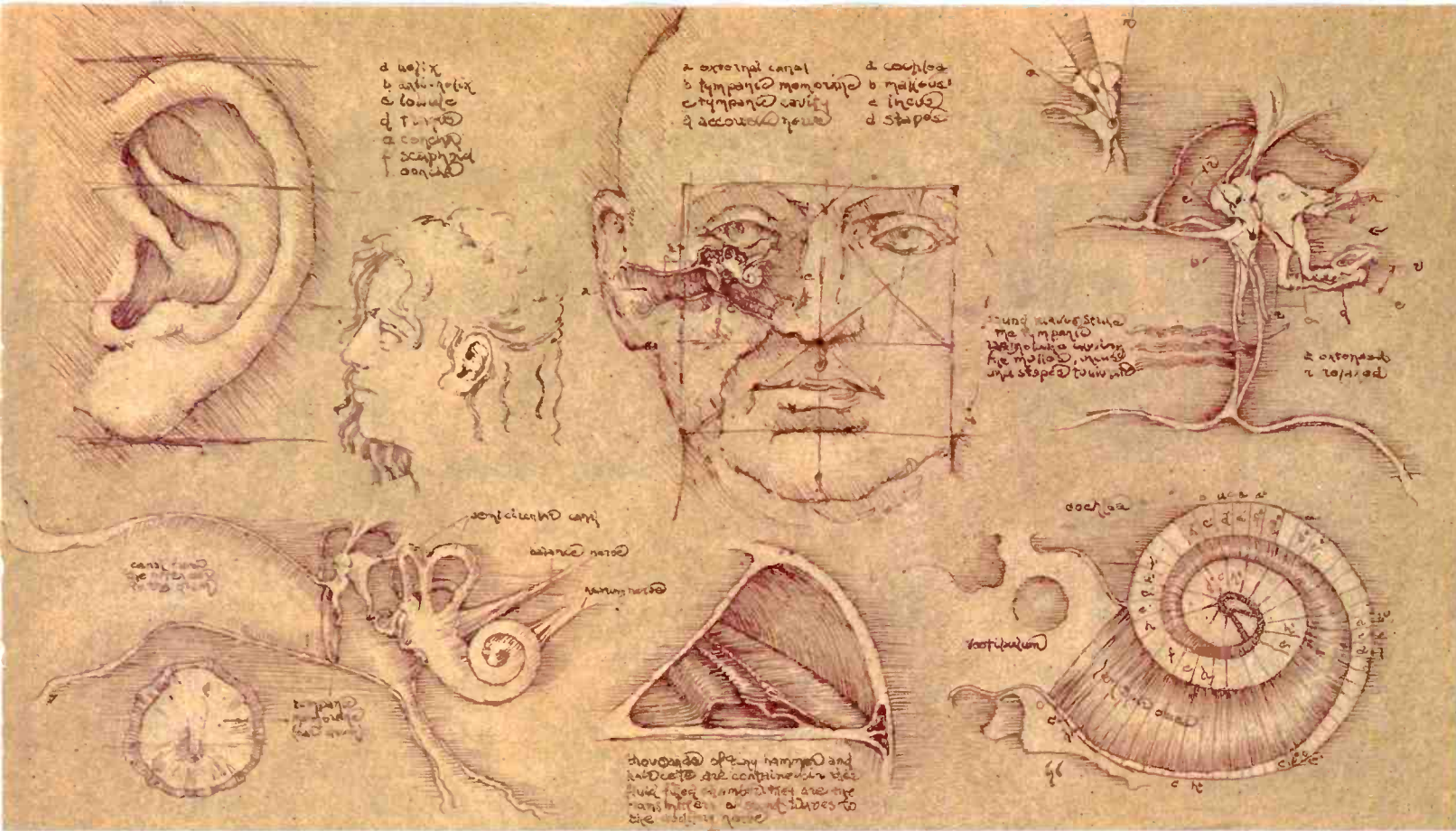
An approach with wide application to many types of loudspeaker systems, most especially to pure electrostatic and electrostatic/dynamic hybrids, is the use of a "sub-woofer." There are a number of these units on the market, and they are found mostly in shops of the high-end "exotic" equipment dealers, many of whom advertise in the classified section of *Audio*. I have heard several of these units which are of excellent quality, but most of them are a bit "outsized." Recently, through the good offices of *Audio's* resident expert on phono cartridges, Barney Pisha, I met a Mr. John Marovskis, who is a graduate physicist from Columbia Univ. and a very keen audiophile. In fact, Mr. Marovskis is president of the New York Audio Society, a group of highly sophisticated audio people who meet monthly and are the frequent recipients of lectures and demonstrations by various audio manufacturers. John has developed a sub-woofer which, in the opinion of this reporter, is a product of outstanding excellence. One of the major virtues of this unit is that, contrary to the dictum of "big bass . . . big box," this sub-

woofer is but 22 in. square by 18 in. in height. After living with this unit for a number of months, it is still hard to believe that this small system has been pouring out some of the deepest, cleanest, most awesomely sonorous bass frequencies I have ever heard.

Among John Marovskis' other accomplishments, he is an expert cabinet maker. As you can see from the accompanying photo of his sub-woofer, it is a very attractive unit. With its inlaid parquet top, it puts the usual "walnut boxes" to shame. In spite of the small size of the sub-woofer, it weighs in just under one hundred pounds. Part of this considerable weight is in the massive 15-in. theatre woofer with 4-in. voice coil that John uses as a driver. The driver faces upwards towards the top of the enclosure. The output of the driver enters a chamber of special configuration and then is slot-loaded. What looks like a decorative frieze near the top of the unit is actually an acoustic resistance. John has patents pending on the system. Slot-loading is, of course, nothing new, but, unlike applications of this principle heretofore, there is absolutely none of the objectionable "over-hang," which muddies the bass response. John has also tailored the response of the system to operate optimally from 100 Hz downward, and he freely admits that although the sub-woofer can be used at a higher crossover point, the distortion will rise rapidly. Needless to say, as with any sub-woofer, it is used in a bi-amplification set-up with a crossover, preferably electronic. By a happy coincidence, Crown Interna-

(Continued on page 50)





It's not your components that are getting worse, it's your ear that's getting better.

By better, we mean it's learned to pick up things in music that it was never able to before.

And that's why that system you bought may have sounded great a couple of months ago but doesn't sound so great today. The human ear, you see, is the most advanced sound receiver system in the world. Your eardrum is sensitive to one billionth of a centimeter. And it has a tiny bone called the incus that can vibrate up to 20,000 times a second.

Enough said about how good your ears are. Now what can you do to improve your system?

A general tip: Whatever you buy, buy up. You might not think it's worth the extra couple of hundred dollars now but you'll be glad you sprung for it later.

A specific tip: Consider Sony separates.

Separates offer you specs you generally can't get in non-separates. And therefore a better quality of sound. Our TAE-8450 pre-amp, for example, has a low distortion rating of THD 0.03%, a wide dynamic range of 60-70dB and accurate phono equalization (RIAA).

In addition, it offers you such features as a step attenuator gain control (volume control) that allows precise gain adjustment readings (our 2dB reading is the minimum loudness change the human ear can detect), extremely accurate tracking in 2 channels, and a quieter, longer lasting performance due to the use of low resistant sterling silver contacts. The unit also has a single peak program meter with a hold position that allows reading at the highest point of the signal wave form, thereby helping to detect overload distortion. And it also serves as a volume unit meter (vu) that allows for easier monitoring by showing the

average value of a signal over a period of time rather than sudden changes within a short period.

We have separates that start at prices a lot lower than you'd expect to pay. And go all the way up to prices you're probably not ready to spend right now. So if your ears ever outgrow the system you buy we have others they can easily grow into. Why not stop into a Sony dealer and ask one of our salesmen for some help. After all, if you really appreciate music, shouldn't you have a system you can really appreciate it on?

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THE GREAT CROWN BARGAIN!

At \$349

The IC150 on the bargain counter? That's right. It's always been there. Only everyone thought you had to spend much more to get CROWN performance.

Not so. Just check what you get with an IC150 control center for just \$349.

- Virtually unmeasurable THD of 0.05% and IMD of 0.01%, both at rated output.
- Hi level hum and noise 90db below rated output. Phono, 80db below 10mv input.
- Wide band frequency response of $\pm .6$ db from 3Hz to 100KHz with hi impedance load.

Now, examine the seven position mode selector switch (two phono, two tape, two auxiliary and one tuner), and a highly sophisticated cascode phono preamp. On top of that, there are push-button controls for scratch and rumble filters, tape-1 and tape-2 monitors, loudness compensation, separate channel tone controls and instant flat! Then CROWN's exclusive panorama control allows continuous mixing of two stereo channels from normal stereo through mono to reverse stereo.

Add it all up and Crown's IC150 is one of the greatest sound values ever offered!

For controlling signal outputs from your power amp, consider CROWN's new OC-150 output control center. See them both at a CROWN dealer. He'll show you what CROWN flexibility can do for your system.

For independent lab test reports, write: CROWN, BOX 1000, Elkhart, IN. 46514.




CROWN
WHEN LISTENING BECOMES AN ART

Check No. 5 on Reader Service Card

Audio ETC

Edward Tatnall Canby

WOW—AM I UPDATED in quadraphony!! I haven't caught up with Bert Whyte, to be sure, but Bert is a bigger man than I am by at least 2:1, and I have more than I need. A roomful of new componentry, including both decode and demod, all interhooked for instant comparisons. I've been wearing out pushbuttons for days.

I am indeed impressed. Also bemused. Is *this* the quadraphonic upon which our industry is going to build its mass acceptance? Incredible. And yet — in a new and curious way, it is indeed.

Once again the stuff is bigger, fatter, more expensive, and more complicated than all past equivalents. Who would have believed it a few years back? Take a look at those first little decoders for four-channel discs. Even the elegant little E-V 44, which bravely included an enhancement circuit over and beyond its basic matrix: my new Sony SQD-2020 decoder (and there's a newer version, the 2010, coming up) is maybe six times as bulky, and it has meters, four of them. The Technics (by you-know-who) SH-400 demodulator for CD-4 discs, too, is decidedly bigger than its earlier equivalent, the (you-know-who) SE-405-H demodulator. Note that Japanese model numbers seem to progress backwards, at least from our numerical viewpoint.

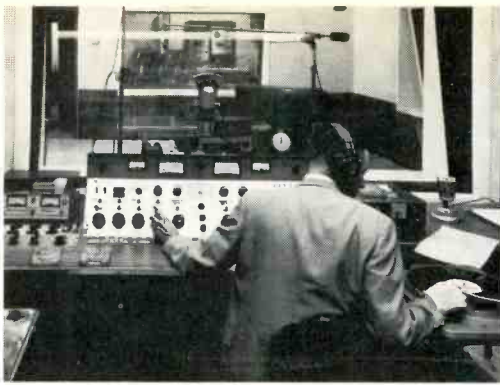
On the other hand — and what a very big hand — things are now so much easier in the operation, as I quickly found out, so much more sure in the listening, that I must hail what amounts to a cybernetic revolution in a year's span, and well worth the added complexity. With this generation of equipment, already into the basic IC configurations for the various systems, we have come to a turning point. And it is a new kind of turning point, too.

If the kind of quadraphonic experience I am receiving from these units can be *extrapolated*, so to speak, into later generations of simpler and cheaper equipment, right on down the line, value for value, for everybody and his uncles and his cousins and his aunts — then quadraphonics will have it made. This, I think, is the intention. Because no industry, and least of all our present home music industry, is going to build a business on these top-flight components alone, however gorgeous they may appear to those who are audio and hi-fi fans and have the required moola (cash to you). Out of the question. *No software*. Well, anyway, not nearly enough.

And so, in a curiously new way, the present expensive lines of componentry, and to an extent the present intermediate receiver-type built-in lines too, are a new kind of breadboard, prototypes for what is still to come. A working, manufactured, completely-finished breadboard, which would seem to be a contradiction, but isn't. For now we have a new stage of designing, which in one sense is wholly complete, a production configuration, and yet in another is very much like the breadboard circuits of old — large, bulky, complex, but embodying the essentials of future equipment.

We can take this year's fancy quadraphonic equipment, then, without reservations as to cost and complexity. The ease of operation is what now matters, as if the sound itself depends on the confidence-inspiring sureness of operation. All this will move on, and will be even better, into the ultimate big-market production to come. It's going to work, I think, this new system! I really do.

So I have been pushing buttons like mad, as I say, with all sorts of equipment tied grotesquely together and



In response to the needs of the recording and broadcast industries, Stanton creates the new calibration standard ...the 681 TRIPLE-E...

A definite need arose.

The recording industry has been cutting discs with higher accuracy to achieve greater definition and sound quality.

Naturally, the engineers turned to Stanton for a cartridge of excellence to serve as a primary calibration standard in recording system check-outs.

The result is a *new* calibration standard, the Stanton 681 TRIPLE-E. Perhaps, with this cartridge, the outer limits of excellence in stereo sound reproduction has been reached.

The Stanton 681 TRIPLE-E offers improved tracking at all frequencies. It achieves perfectly flat frequency response to beyond 20 kHz. It features a dramatically reduced tip mass. Actually, its

new ultra miniaturized stylus assembly represents an important advance in stereo cartridge design and construction, with substantially less mass than its predecessor. And this stylus assembly possesses even greater durability than had been previously thought possible to achieve.

The Stanton 681 TRIPLE-E features a new design of both cartridge body and stylus; it has been created for those for whom the best is none too good.

Each 681 TRIPLE-E is guaranteed to meet its specifications within exacting limits, and each one boasts the most meaningful warranty possible: an individual calibration test result is packed with each unit.

For further information write Stanton Magnetics, Inc., Terminal Drive, Plainview, N.Y. 11803.



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twisting on its own tail, almost, just to see what will happen. The Sony 2020, designed to hook together your stereo receiver and another stereo amp with all controls centered on the Sony — and four meters to read things by — is now feeding my earlier Lafayette 4000 already-quadrasonic receiver, much to its surprise; I thereby have two different SQ-with-logic operations, two "Regular Matrix" (QS) outlets, apparently minus logic (they do not say), a plain SQ matrix, a "2-4" enhancement for stereo, and so on

and s'forth. All this directly comparable — at last! — with Technics' excellent CD-4 and their not-as-spectacular parallel stereo, fronts and backs hooked together. On all of this I have been playing everything, right way, wrong way, any old way. And my very first impression is that *all of it* sounds OK, and for my ear all of it is variously better than plain two-speaker stereo by itself.

(Well, I know. Some people prefer stereo. Some even still fight for mono as the only proper way to reproduce

good music. What can I say?)

In my musical area, CD-4 sound at the moment means mostly Tchaikovsky. And the comparison of importance is Tchaikovsky via CD-4 next to T. via SQ-with-logic (any old logic) — but even then there are overriding factors, such as Ormandy and Philadelphia on CD-4 vs. Somebody Else and maybe London on another system. So we music-minded listeners must avoid technological hair-splitting. We will do best by sticking to larger principles first — the fact of four surround speakers and four channels, first of all, and then the ease with which these units adapt to the music we want, hopefully via whatever system *has the music we want*.

So I am going to unhook my grotesquerie of equipment as not of any real musical interest. I can tell you how Sony SQ sounds versus Lafayette SQ though not easily in words; but it isn't that important — for the home listener, anyhow. Bit more definition here, slightly better separation there (see vector charts and so on . . .). I've tried the two QS-type matrices — one coyly marked "Composer A" and the other (Sony) more revealingly, candidly, as "R-MTX." No stunning difference between them — why should there be? But via both I was surprised to find an excellent body of surround sound, even minus logic, when Vox's new QS recordings were on the table. I also note that non-QS discs, plain stereo records, are not so good by either of these, since the front stereo is closed in and too much sound jumps to the back of the room. Better the SQ position for stereo discs, since there is no diminution of the stereo up front and the ambience in back is thus additive in effect. I confirmed, via the Technics SH-400, that parallel stereo will not do, and is insufficient, compared to virtually any matrix treatment of stereo records. You are boxed in between two stereo channels, sidewise. No good. Might as well have them up front where they belong. . .

Sony's alternative "2-4" position for stereo enhancement is good, too, and I use it alternatively with the SQ position on stereo records. The four Sony meters are fascinating (since I can read meters as of long practice). Do they indicate some sort of delay in the "2-4" back channels, to provide a more realistic big-hall reverb effect? Seems to work.

Over on CD-4 (tactfully separated by a few feet from my SQ-based equipment, but instantly switchable, even so) I found that the newly added

(Continued on page 55)

GOOD CAN BE EVEN BETTER



CROWN DC300A
(the old standard)

SOUND: Good overall performance limited by current limiting circuits.

MUSCLE: 16 rugged 150 watt output transistors.

COOLING: Integral heat sink chassis construction with additional fins.

POWER: 155W/ch 1 Hz—20 KHz @ .05% into 8 ohm loads.

No 4 ohm rating possible as unit will not precondition per FTC ruling.

SPEAKER PROTECTION: Relies solely on single fuse in primary of power supply.

PRICE: \$799.00 \$799.00 (more for your money).

The BGW 500D will drive more speakers in parallel or any kind of load with absolutely no difficulty, unlike amplifiers designed with current limiters.



BGW 500D
(the new standard)

Highest accuracy over the complete audio band. Elimination of current limiters yields unbelievable improvement, especially noticeable in lower impedances at high power levels. No chirps, buzzes, etc. Sounds clean!

20 rugged 150 watt output transistors.

Low noise dual speed fan cooling huge extruded aluminum heat sinks means uninterrupted performance under even the most grueling operation.

150W/ch 10 Hz — 20 KHz or 200W/ch 25 Hz—15 KHz @ .2% into 8 ohm loads.

251W/ch 20 Hz — 15 KHz @ .25% into 4 ohm loads.

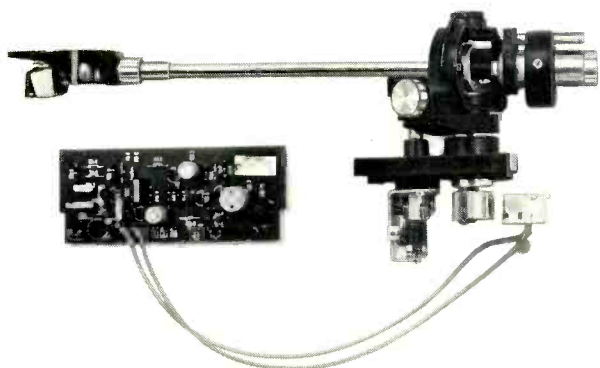
Electronic SCR crowbar with magnetic circuit breaker. Saves your precious speakers in the event of output transistor failure.



BGW Systems, P.O. Box 3742, Beverly Hills, CA 90212
(213) 391-0320

Introducing the Thorens TD-145C

The world's only turntable with electronic sensing for automatic tonearm lift-up and shutoff.



For years turntable manufacturers have been seeking the faultless tonearm system that would eliminate stylus damage and protect records. Thorens, with its long tradition of advanced engineering and state-of-the-art technology, has achieved this breakthrough in the new TD-145C. Its completely unique and innovative electronic sensing system automatically lifts the tonearm and shuts off power to prevent any mishaps.

Totally electronic, rather than mechanical, as are most automatic lift-up/shutoff systems, nothing inhibits the tonearm or comes between it and the trip mechanism. As the tonearm approaches the final lead-out grooves of the record, a control signal activates a viscous damped elevating platform that lifts the tonearm and shuts off the power. Further, the sensing system goes into action instantly should the power be inadvertently cut off or if the tonearm accidentally slides across the record. It's virtually foolproof.

The new sophisticated Thorens TD-145C turntable comes complete with a wide range of advanced features which it has in common with Thorens' top of the line TD-125 Mark II series: magnetic anti-skate control with the highly acclaimed TP-16 gimbal suspension tonearm; a high torque, slow speed, belt-driven 16-pole

synchronous motor; dynamically balanced, seven pound, 12-inch non-magnetic die cast platter; front panel precision cueing control; split-level suspension system that reduces rumble, acoustic feedback and vibrations.

The TD-145C is still another reason why Thorens is the first name in turntables and the last word in precision performance.

At \$299.95, complete with dust cover and base, the TD-145C is the perfect choice for the audiophile seeking the precision of a manual turntable combined with semi-automatic features.

For advance data write to: Elpa Marketing Industries, Inc., East: New Hyde Park, N.Y. 11040; West: 7301 E. Evans Rd., Scottsdale, Ariz. 85260.

THORENS®



Car Stereo Directory

CAR STEREO EQUIPMENT is proliferating, as original equipment installed in new automobiles, and particularly in a wide variety of radio and tape gear which can be installed later. In this issue *Audio* presents a directory of add-on FM and AM radios and cassette and 8-track players in many different configurations. Loudspeakers are listed in their own section.

Note that the data in these listings are as supplied to *Audio* by the makers for this Directory, and are not the results

of *Audio's* laboratory tests. While most of the specifications given are believed to be accurate, the power output ratings should be viewed with care, since the manufacturers of this equipment (generally) appear to be using measurement methods other than those dictated by the recent FTC ruling, or the earlier IHF standards.

Since many of these units are not price-fixed, considerable sales competition often exists. Hence prices may vary, particularly with the higher-priced sets.

Directory of Manufacturers

ADS

Analog & Digital Systems
377 Putnam Ave.,
Cambridge, Mass. 02130

Afco Electronics, Inc.

471 Roland Way
Oakland, CA. 94621

Aiko Corp.

2020 W. 16th St.
Broadview, Ill. 60153

Arrow Trading Co.

1115 Broadway
New York, N.Y. 10010

Astrosonix

Bowman Industries
9300 Hall Road
Downey, CA. 90241

Audiovox Corp.

150 Marcus Blvd.
Hauppauge, N.Y. 11787

Becker Autoradio, USA, Inc.

617 S. 24th St.
Phila., PA. 19146

Big Brute (see Comm. Industries)

Blaupunkt

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

Bon Sonic (See Hanabashiya)

Braun (See ADS)

CTS of Paducah, Inc.

1565 N. 8th St.
Paducah, Ky. 42001

Caltron (Car Tapes, Inc.)

9180 Kelvin Ave.
Chatsworth, CA. 91311

Channelmaster Corp.

Ellenville, N. 12428

Clarion Corp. of America

5500 Rosencrans Ave.
Lawndale, CA. 90260

Comm. Industries, Inc.

One Gateway Center
Newton, Mass. 92158

Craig Corp.

921 W. Artesia Blvd.
Compton, CA. 90220

Electronic Industries Co.

333 Taft Drive
South Holland, Ill. 60473

Far Eastern Research Labs.

8749 Shirley Ave.
Northridge, CA. 91324

Hanabashiya, Ltd.

39 West 28th St.
New York, N.Y. 10001

Inland Dynatronics, Inc.

10 Horizon Blvd.
S. Hackensack, N.J. 07606

J.I.L. Corp. of America

1000 E. Del Amo Blvd.
Carson, CA. 90746

Jensen Sound Laboratories

4310 Transworld Road
Schiller Park, Ill. 60176

Kustom Kreations, Inc.

19316 Londelius St.
Northridge, CA. 91324

Lear Jet Stereo

868 S. Plumer Ave.
Tucson, Ariz. 85706

Medallion Automotive

1137 Saline St.
N. Kansas City, Mo. 64116

Motorola Automotive Sound

9401 W. Grand Ave.
Franklin Park, Ill. 60131

Neosonic Corp. of America

57 Old Country Road
Westbury, N.Y. 11590

Oaktron Industries Inc.

704 30th St.
Monroe, Wisc. 53566

Panasonic

Matsushita Electric
One Panasonic Way
Secaucus, N.J. 07094

Pioneer Electronics of America

1555 E. Del Amo Blvd.
Carson, CA. 90746

Power Mag (See Electronic Industries Co.)

Quam-Nichols Company

Marquette Rd. & Prairie Ave.
Chicago, Ill. 60637

RCA-Parts & Accessories

2000 Clements Bridge Rd.
Deptford, N.J. 08096

Ranger (See Tenna Corp.)

Royal Sound Co., Inc.

409 N. Main St.
Freeport, N.Y. 11520

Sanyo Electric, Inc.

1200 W. Artesia Blvd.
Compton, CA. 90220

Sonosphere (See Neosonic)

Sony-Superscope, Inc.

8150 Vineland Ave.
Sun Valley, CA. 91352

Sparkomatic Corp.

Milford, Pa. 18337

Tenna Corp.

19201 Cranwood Pkwy.
Warrensville Height, O. 44124

Utah Electronics

1124 E. Franklin St.
Huntington, Ind. 46750

XK (See Kustom Creations)

Xtal (See Far Eastern)

Car Radio/Tape Players



Audiovox C980



Blaupunkt 2072



AFCO IDC-600

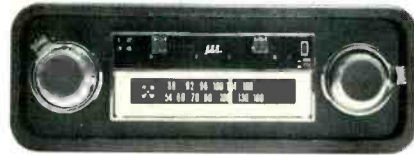
MANUFACTURER	MODEL	PRICE		Stereo(S), Mono(M) or Quad(Q)	8 Tracks ?	Cassette ?	AM ?	FM ?	FM Synthesizer (only for 30 dB Quieting)	AFC ?	Local Distant Switch ?	Watts output (cont.) per chan.	Distortion @ rated watts, %	Treble and Bass Controls ?	Includes speakers ?	In-dash(M) or Under-dash(U)	Control shaft spacing, inches	Dimensions, inches H, W, D
AFCO	TM-55	39.95	S	Yes	No	No	No	—	—	—	5	—	—	Yes	—	U	—	2-3/8x5-1/2x7-1/4
	AFX 810	99.95	S	Yes	No	Yes	Yes	10	Yes	—	4	10	—	Yes	No	I	Adj.	1-7/8x6-7/8x5-7/8
	AG-50	119.95	S	Yes	No	Yes	Yes	10	Yes	—	4	5	—	Yes	No	I	Adj.	2x6-7/8x5-9/10
	ID-300	129.95	S	Yes	No	Yes	Yes	14	Yes	Yes	6	2(1 w)	—	Yes	No	I	Adj.	2-1/2x7-5/16x6-1/4
	ID-400	179.95	S	Yes	No	Yes	Yes	10	Yes	Yes	6	2(1 w)	—	Yes	No	I	Adj.	2-11/16x7-1/2x7-1/2
	IDC-600	139.95	S	No	Yes	Yes	Yes	2	Yes	—	5	3(1 w)	—	Yes	No	I	Adj.	1-31/32x7-3/32x6-1/2
	IC47AS	79.95	S	No	No	Yes	Yes	9	Yes	Yes	6	3(1 w)	—	Yes	No	I	Adj.	2x7-3/8x5-3/4
AIKO	ACS215	59.95	S	No	Yes	No	No	—	—	—	—	—	—	No	No	U	—	2-1/8x5-5/8x6-1/2
	ACS217	129.95	S	No	Yes	Yes	Yes	—	No	No	—	—	—	No	No	U	—	2-3/16x6-3/4x8-5/8
	ACS251	119.95	S	No	Yes	No	Yes	—	No	No	—	—	—	No	No	U	—	3-11/32x6-13/16x9-29/32
	ACS310	139.95	S	No	Yes	Yes	Yes	—	No	No	—	—	—	No	No	I	5.1	2-1/4x7-1/4x8-5/8
	ACS312	149.95	S	No	Yes	Yes	Yes	—	No	Yes	—	—	—	No	No	I	5.1	2-5/32x6-3/32x8-15/32
	ASTROSONIX	BM-595	119.95	S	No	Yes	—	Yes	—	—	—	—	—	—	—	—	—	—
BM-590		53.95	S	No	Yes	—	—	—	—	—	—	—	—	—	—	—	—	—
BM-1125		154.95	S	Yes	—	Yes	Yes	—	—	—	Yes	—	—	—	—	—	—	—
BM-1335		184.95	S	No	Yes	Yes	Yes	—	—	—	—	—	—	—	—	—	—	—
BM-1150		184.95	Q/S	Yes	—	Yes	Yes	—	—	—	—	—	—	—	—	—	—	—
BM-1115		109.95	S	Yes	—	Yes	Yes	—	—	—	—	—	—	—	—	—	—	—
DP-5000		169.95	S	No	—	Yes	Yes	—	Yes	—	—	—	—	—	—	—	—	—
605-MPX		119.95	S	No	—	Yes	Yes	—	Yes	—	—	—	—	—	—	—	—	—
1800-MPX		119.95	S	No	—	Yes	Yes	—	Yes	—	—	—	—	—	—	—	—	—
405-FM		79.95	—	No	—	Yes	Yes	—	Yes	—	—	—	—	—	Yes	I	—	—
1500-FM		79.94	—	—	—	Yes	Yes	—	Yes	—	—	—	—	—	—	—	—	—
305-PB		44.95	—	No	—	Yes	No	—	—	—	—	—	—	—	Yes	I	—	—
1200-PB		44.95	M	No	—	Yes	No	—	—	—	—	—	—	—	Yes	I	—	—
MPX-80		89.95	S	No	—	No	Yes	—	—	—	—	—	—	—	—	U	—	—
150-M		34.95	M	No	No	Yes	No	—	—	—	—	—	—	—	—	I	—	—
A-7000	39.95	M	No	No	No	Yes	—	—	—	—	—	—	—	—	I	—	—	
50/100-M	23.95	M	No	No	Yes	No	—	—	—	—	—	—	—	—	I	—	—	
TR-175M	74.95	M	No	No	Yes	No	—	—	—	—	—	—	—	—	I	—	—	
AUDIOVOX	ID-400	149.50	S	Yes	No	Yes	Yes	5	Yes	Yes	4.5	10	—	Yes	No	I	5.5/8-6.9/32	2-1/2x7x6-1/8
	ID-500	199.95	S	Yes	No	Yes	Yes	5	Yes	Yes	4.5	10	—	Yes	No	I	5.5/8-6.9/32	2-3/4x7-1/8x6
	ID-600	169.95	S	No	Yes	Yes	Yes	5	Yes	Yes	4.5	10	—	Yes	No	I	5.5/8-6.9/32	2-1/4x7x6-1/8
	CP-650	269.95	S	No	Yes	Yes	Yes	3	Yes	Yes	6	10	—	Yes	No	I	5.5/8-6.9/32	3-1/4x7-1/4x6
	C988	79.95	S	No	Yes	No	No	—	No	No	4	10	—	Yes	No	U	—	1-7/8x5-1/8x6-3/8
C980	129.95	S	Yes	No	No	Yes	5	Yes	Yes	4	10	—	Yes	No	U	—	2-1/4x7-3/4x7-3/4	
BECKER	Grand Prix	614.31	S	No	No	Yes	Yes	2.0	Yes	Yes	5	0.8	—	Yes	No	I	5-1/8	1-5/8x7-1/16x5-5/8
	Europa	379.35	S	No	No	Yes	Yes	2.0	Yes	Yes	5	0.8	—	Yes	No	I	5-1/8	1-5/8x7-1/16x5-5/8
	Mexico	844.28	S	No	Yes	Yes	Yes	2.5	Yes	Yes	5	0.8	—	Yes	No	I	5-1/8	2-1/16x7-1/16x5-7/8
BLAUPUNKT	CR4076	149.00	S	Yes	No	Yes	Yes	10	Yes	Yes	5	—	—	Yes	No	I	5.1	2x6-1/2x7
	CR4075	169.00	S	No	Yes	Yes	Yes	10	Yes	Yes	5	—	—	Yes	No	I	5.1	2x6-1/2x7
	CR4074	209.50	S	No	Yes	Yes	Yes	10	Yes	Yes	5	—	—	Yes	No	I	5.1	2x6-1/2x7
	Frankfurt	196.50	S	No	No	Yes	Yes	2.5	Yes	Yes	5	—	—	Yes	No	I	5.1	1-3/4x7-1/16x4-1/2
	2072	89.90	M	No	No	Yes	Yes	10	Yes	No	3	—	—	Yes	No	I	5.1	1-3/4x6-3/4x4-3/4
	1071	35.00	M	No	No	Yes	No	No	No	No	3.5	—	—	Yes	No	I	5.1	1-3/4x6-3/4x3-3/4
Berlin	1,000.00	S	No	Yes	Yes	Yes	—	—	—	—	—	—	Yes	4	—	—	—	
BON SONIC	510	—	S	No	Yes	Yes	Yes	—	Yes	—	4	—	—	—	—	I	Adj.	—
	CC5000	—	S	No	Yes	Yes	Yes	—	Yes	—	4	—	—	—	—	U	—	—
	808D	—	S	No	Yes	No	No	—	No	—	3	—	—	—	—	U	—	—
	AF977	—	S	Yes	No	Yes	Yes	—	Yes	—	4	—	—	—	—	I	Adj.	—
	601F	—	S	Yes	No	No	Yes	—	Yes	—	3	—	—	—	—	U	—	—
	889	—	S	Yes	No	No	No	—	No	—	3	—	—	—	—	U	—	—
	806	—	S	Yes	No	No	No	—	No	—	3	—	—	—	—	U	—	—
650	—	S	No	No	Yes	Yes	—	Yes	Yes	3	—	—	—	—	I	Adj.	—	
CALTRON	522	54.95	M	No	No	Yes	—	—	—	—	3	5	—	Yes	No	I	Adj.	2-5/8x7-1/8x4-1/4
	523	84.95	M	No	No	Yes	Yes	8	No	Yes	4	5	—	Yes	No	I	Adj.	2-5/8x7-1/8x4-1/4
	524	124.95	S	No	No	Yes	Yes	5	Yes	Yes	4	3	—	Yes	No	I	Adj.	2-5/8x7-1/8x4-1/4
	4350	149.95	S	Yes	No	Yes	Yes	5	Yes	No	4	5	—	Yes	No	I	Adj.	2-1/6x7-1/16x6-7/8
	4355	179.95	S	Yes	No	Yes	Yes	5	Yes	Yes	5	3	—	Yes	No	I	Adj.	2-5/8x7-1/8x4-1/4
	9300	179.95	S	No	Yes	Yes	Yes	5	Yes	Yes	5	3	—	Yes	No	I	Adj.	1-15/16x7-1/16x5-1/2
	8340	39.95	S	Yes	No	No	No	—	—	—	3.5	5	—	Yes	No	U	—	2-5/16x5-3/8x7-5/16
	8355	59.95	S	Yes	No	No	No	—	—	—	4	5	—	Yes	No	U	—	2-5/16x5-3/8x7-5/16
	8360	69.95	S	Yes	No	No	No	—	—	—	5	3	—	Yes	No	U	—	2x6-1/4x5-15/16

Car Radio/Tape Players



Channelmaster 6348

J.I.L. 832-Q



Lear Jet A-26

MANUFACTURER	MODEL	PRICE	Stereo(S)	8 Track ?	Cassette ?	AM ?	FM ?	FM Separately Tuning (for 30 dB Queuing)	MTC ?	Local/Distant Switch ?	Watts output (cont.) per chan.	Distortion @ rated watts, %	Treble and Bass Controls ?	Includes speakers ?	In dash(I) or Underdash(U)	Control shaft spacing, inches	Dimensions, inches H.W.D.
CHANNELMASTER	6270	44.95	S	Yes	No	No	No	-	-	-	-	No	No	U	-	-	2-7/8x5-9/16x6-7/32
	6378	69.96	S	Yes	No	No	No	-	-	-	-	No	No	U	-	-	2-1/2x7-1/8x6-5/16
	6379	79.95	S	Yes	No	No	No	-	-	-	-	No	No	U	-	-	2-1/2x7-1/8x6-5/16
	6385	79.95	S	Yes	No	No	Yes	-	-	-	-	No	No	U	-	-	8x8-1/2x9-1/2
	6381	119.95	S	Yes	No	No	Yes	-	Yes	No	-	No	No	U	-	-	2-1/6x7-1/16x7-1/16
	6383	119.95	S	Yes	No	Yes	Yes	-	-	-	-	Yes	No	I	5.1	-	1-7/8x6-7/8x5-7/8
	6348	139.95	S	Yes	No	Yes	Yes	-	-	-	-	Yes	No	I	4.1	-	2-1/6x7-5/32x6-7/32
	6398	59.95	S	No	Yes	No	No	-	-	-	-	No	No	I/U	-	-	2x6-1/2x7
6399	99.95	S	No	Yes	No	No	-	-	-	-	No	No	U	-	-	2-7/8x6-7/8x6-11/16	
CLARION	888	109.95	S	Yes	No	No	-	No	No	14	10	No	No	U	-	-	2-1/2x8x7-1/2
	434	159.95	Q	Yes	No	No	No	-	No	7	5	Yes	No	U	-	-	2-1/4x7-3/4x7
	884	129.95	S	Yes	No	No	Yes	10	No	Yes	12	10	Yes	No	U	-	2-1/4x7-1/4x7
	617	164.95	S	Yes	No	Yes	Yes	10	No	Yes	4	8	Yes	No	I	Adj.	2-1/2x7x6-1/8
	811	119.95	S	No	Yes	No	No	-	No	No	4	10	Yes	No	U	-	2-1/4x5-3/4x7-3/8
	812	154.95	S	No	Yes	No	No	-	No	No	4	10	Yes	No	U	-	2-1/4x5-3/4x7-3/8
	659	199.95	S	No	Yes	Yes	Yes	10	No	Yes	4	8	Yes	No	I	Adj.	2-1/2x7x6-1/8
	388B	159.95	S	No	No	Yes	Yes	10	Yes	No	4	10	Yes	No	I	-	1-7/8x6-1/2x4-3/4
	342A	199.95	S	No	No	Yes	Yes	10	Yes	No	4	10	Yes	No	I	Adj.	2x7-1/2x4-3/4
	CRAIG	3138	109.95	S	Yes	No	No	No	-	No	No	12	-	No	No	U	-
3139		169.95	S	Yes	No	No	Yes	-	No	No	12	-	Yes	No	U	-	2.9x8.2x8.7
3141		109.95	S	Yes	No	No	Yes	-	No	No	12	-	Yes	No	U	-	8x6.3x9.6
3142		169.95	S	Yes	No	No	Yes	-	No	No	12	-	Yes	No	U	-	8x6.3x9.6
3519		119.95	S/M	No	Yes	No	No	-	No	No	12	-	Yes	No	I	-	-
3520		179.95	S	No	Yes	No	Yes	-	No	No	12	-	Yes	No	I	-	-
INLAND	AXT-838	124.95	S	Yes	No	Yes	Yes	2.0	Yes	No	3.8	5	No	No	I/U	Adj.	2-1/4x7-1/2x7
	MPT-801	114.95	S	Yes	No	No	Yes	2.0	Yes	No	3.5	5	No	No	U	-	2-1/32x6-11/16x7-5/16
	S-4001	89.95	S	Yes	No	No	No	-	No	No	3	5	No	No	U	-	2x5-7/8x7-1/16
	S-505	59.95	S	Yes	No	No	No	-	No	No	4	5	No	No	U	-	1-7/8x4-3/4x6-1/4
	S-405	49.95	S	Yes	No	No	No	-	No	No	2.6	5	No	No	U	-	2x5-7/8x7-1/16
	S-105	39.95	S	Yes	No	No	No	-	No	No	1.8	5	No	No	U	-	2-1/4x5-1/2x7-1/2
	C-110	49.95	S	No	Yes	No	No	-	No	No	2	5	No	No	U	-	2x6x6-7/8
	RX-14	69.96	S	No	No	Yes	Yes	2.0	Yes	No	2.8	5	No	No	I	Adj.	2x6-3/16x7-3/8
J.I.L.	515	59.95	S	Yes	No	No	No	-	No	No	3	10	Yes	No	U	-	2x6-3/4x6-3/4
	517	89.95	S	Yes	No	No	Yes	10	Yes	Yes	3	10	Yes	No	U	-	2x6-3/4x6-3/4
	528	49.95	S	Yes	No	No	No	-	No	No	3	10	Yes	No	U	-	2x4-7/8x6-1/2
	604	159.95	S	No	Yes	Yes	Yes	10	Yes	No	3	10	Yes	No	I	Adj.	1-3/4x6-3/4x4-3/4
	605	199.95	S	No	Yes	Yes	Yes	10	Yes	Yes	5	10	Yes	No	I	Adj.	1-3/4x7-1/8x5-1/2
	701-U	99.95	S	No	No	Yes	Yes	10	Yes	No	3	10	Yes	No	I	Adj.	2x7-1/8x4-1/2
	704	99.95	S	No	No	Yes	Yes	10	Yes	No	3	10	Yes	No	I	Adj.	1-3/4x6-3/4x3-1/8
	828-P	39.95	S	Yes	No	No	No	-	No	No	3	10	Yes	No	U	-	1-15/16x4-11/16x6-5/16
	832-Q	199.95	Q	Yes	No	Yes	Yes	10	Yes	No	3	10	Yes	No	I	Adj.	2-1/8x7x7
	841	119.95	S	Yes	No	Yes	Yes	10	Yes	Yes	3	10	Yes	No	I	Adj.	1-3/4x7-1/4x5-1/2
	842	139.95	S	Yes	No	Yes	Yes	10	Yes	Yes	4	10	Yes	No	I	Adj.	1-3/4x7-1/4x5-1/2
	843	169.95	S	Yes	No	Yes	Yes	10	Yes	No	4	10	Yes	No	I	Adj.	2-5/8x7-1/4x5-1/2
	846	179.95	S	Yes	No	Yes	Yes	10	Yes	Yes	5	10	Yes	No	I	Adj.	2-5/8x7-1/4x5-1/2
	848	199.95	S	Yes	No	Yes	Yes	10	Yes	Yes	3	10	Yes	No	I	Adj.	1-3/4x7-1/8x5-1/2
	851	99.95	S	Yes	No	Yes	Yes	10	Yes	No	3	10	Yes	No	I	Adj.	1-3/4x6-3/4x4-3/4
852CB	349.95	S	Yes	No	Yes	Yes	10	Yes	Yes	5	10	Yes	No	I	Adj.	2x7-1/2x7	
LEAR JET	A-10	59.95	S	Yes	No	No	No	-	-	-	8	-	No	No	U	-	1-7/8x5-1/2x7-1/4
	A-46	69.95	S	Yes	No	No	No	-	-	-	8	-	No	No	U	-	-
	A-26	79.95	S	Yes	No	No	No	-	-	-	10	-	No	No	U	-	2-1/2x5-1/4x7
	A-126	119.95	S	Yes	No	No	No	-	-	-	10	-	No	No	U	-	2-1/2x7x7-3/4
	A-146	139.95	S	Yes	No	No	Yes	-	Yes	Yes	10	-	No	No	U	-	2x7x7
	A-226	149.95	S	Yes	No	No	Yes	5	Yes	No	10	-	Yes	No	U	-	2-1/2x8-3/8x8
	A-255	169.95	S	Yes	No	No	No	-	-	No	16	-	No	No	U	-	2-1/2x7x8
	A-275	169.95	S	Yes	No	Yes	Yes	5	No	No	10	-	No	No	U	-	2-1/2x8-3/8x8
A-295	249.95	S	Yes	No	Yes	Yes	5	No	No	16	-	No	No	U	-	2-1/2x8-3/8x8	

Car Radio/Tape Players



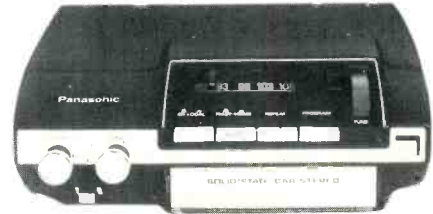
Motorola TM 316S



Pioneer KP-4000

Panasonic CQ-898

Medallion 65-556



MANUFACTURER	MODEL	PRICE	Stereo(S), Mono(M) or Quad(Q)	8 Track ?	Cassette ?	AM ?	FM ?	FM Sensitivity mV (for 30 dB S/N)	AFC ?	Local/Distant Switch ?	Watt output (cont.) per chan.	Distortion @ rated watts, %	Treble and Bass Controls ?	Includes speakers ?	In-dash(I) or Under-dash(U)	Control shaft spacing, inches	Dimensions, inches H.W.D.
LEAR JET (cont.)	A-12	69.95	S	No	Yes	No	No	-	-	No	-	No	No	-	-	-	-
	A-52	149.95	S	No	Yes	No	No	-	-	No	7	No	No	U	-	-	2 1/4x5-1/2x7-1/2
	A-152	199.95	S	No	Yes	No	Yes	6	No	No	8	No	No	U	-	-	2 1/4x7-1/4
	A-71A	169.95	S	Yes	No	Yes	Yes	5	No	Yes	10	Yes	No	I	-	-	1-15/16x7-1/16x5-7/8
	A-90A	224.95	S	Yes	No	Yes	Yes	5	Yes	No	20	-	No	No	I	-	2 1/2x7-3/8x6-1/4
	A-80A	229.95	S	Yes	No	Yes	Yes	5	Yes	Yes	10	-	No	No	I	-	2 5/8x7 3/8x8 5/8
	A-72A	219.95	S	No	Yes	Yes	Yes	5	No	No	10	-	No	No	I	-	2 1/4x7-1/4x6-1/4
MEDALLION	65-556	119.95	S	Yes	No	Yes	Yes	5	Yes	Yes	3.5	10	Yes	No	I	-	-
	65-496	139.95	S	No	Yes	Yes	Yes	10	Yes	Yes	3.5	10	No	No	I	-	-
	65-414	99.95	S	No	No	Yes	Yes	5	Yes	No	4.0	10	No	No	I	Adj.	2x7 3/8x6
	65-589	99.95	S	Yes	No	No	Yes	5	Yes	No	2.5	10	No	No	U	-	2x6-1/8x6 3/4
	65-487	119.95	S	No	Yes	No	No	-	No	-	3.0	10	No	No	U	Adj.	2 3/4x6-3/4x6 3/4
	65-534	159.95	S	Yes	No	Yes	Yes	10	Yes	No	4.0	10	No	No	I	Adj.	2-13/32x7 5/32x6 5/8
	65-412	89.95	M	No	No	Yes	Yes	10	Yes	No	4.0	10	No	No	I	Adj.	2x7 3/8x4-3/4
65-406	69.95	M	No	No	Yes	No	-	-	No	4.0	10	No	No	I	Adj.	2x7 3/8x4-3/4	
MOTOROLA	TM124S	29.95	S	Yes	No	No	No	-	-	-	2.5	10	No	No	U	-	2x5 7/8x2
	TM226S	-	S	Yes	No	No	No	-	-	-	3	10	No	No	U	-	2 7/8x1 1/2
	TM316S	-	S	Yes	No	No	No	-	-	-	3	10	No	No	U	-	2 7/8x1 1/2
	TM416S	-	S	Yes	No	No	No	-	-	-	3	10	No	No	U	-	2 5/8x7 1/4
	TF756S	-	S	Yes	No	No	Yes	3.0	Yes	Yes	3	10	No	No	U	-	2 5/8x7 1/4
	TF875AX	-	S	Yes	No	Yes	Yes	4.0	Yes	Yes	3	10	No	No	I	5.8	2 9/8x7 2x6
	TF874AX	-	S	Yes	No	Yes	Yes	3.0	Yes	Yes	4	10	No	No	I	5.8	2 9/8x7 8x7
	TM912S	99.95	Q	Yes	No	No	DNA	DNA	DNA	3	10	No	No	U	DNA	-	2 5/8x8 1/2x6
	TM85A	-	M	No	No	Yes	No	-	-	-	4	10	No	No	I	Adj.	2x7 8x5
	TM575A	-	M	No	No	Yes	No	-	-	-	3	10	No	No	I	Adj.	2x6 4x3 3/8
	FM216A	-	M	No	No	Yes	Yes	4.0	Yes	Yes	4	10	No	No	I	Adj.	2 5/8x7 8x6 2
	FM675A	-	M	No	No	Yes	Yes	4.0	Yes	Yes	4	10	No	No	I	Adj.	2x6 4x4 6
	FM485AX	-	S	No	No	Yes	Yes	4.0	Yes	Yes	4	10	No	No	I	Adj.	2 5/8x7 8x6 2
	FM775AX	-	S	No	No	Yes	Yes	4.0	Yes	Yes	3	10	No	No	I	Adj.	2x6 4x4 8
	FM273AX	-	S	No	No	Yes	Yes	4.0	Yes	Yes	4	10	No	No	I	Adj.	1 9/8x8 5/2
PANASONIC	CX-375	49.95	S	Yes	No	No	No	-	No	No	3.5	-	No	No	U	-	2 1/4x5-1/2x6 3/8
	CX-475	69.95	S	Yes	No	No	No	-	No	No	3.5	-	No	No	U	-	2 1/4x5-7/8x7-1/4
	CX-675	89.95	S	Yes	No	No	No	-	No	No	3.5	-	No	No	U	-	2 1/4x5-7/8x7-1/4
	CX-567	89.95	S	Yes	No	No	No	-	No	No	3.5	-	No	No	U	-	2 5/8x6-3/8x6 3/8
	CX-601	149.95	Q	Yes	No	No	No	-	No	No	3.5	-	No	No	U	-	3x8-1/2x8 3/8
	CQ-898	139.95	S	Yes	No	No	Yes	-	Yes	Yes	3.5	-	No	No	U	-	3-7/16x8-17/32x7-11/32
	CQ-252	119.95	S	Yes	No	Yes	No	-	No	No	3.5	-	No	No	I	Adj.	2 3/8x7-1/2x7-7/8
	CQ-969	159.95	S	Yes	No	Yes	Yes	-	Yes	Yes	3.5	-	No	No	I	Adj.	2 5/8x7-13/32x7-1/2
	CQ-979	-	S	Yes	No	Yes	Yes	-	Yes	Yes	2	-	No	No	I	Adj.	2 1 1/16x7-1/2x7-11/32
	CQ-999	-	Q	Yes	No	Yes	Yes	-	Yes	Yes	3	-	No	No	I	Adj.	2 3/4x7-1/2x6 3/8
	CX-232	79.95	S	No	Yes	No	No	-	No	No	3.5	-	No	No	U	-	2x4-3/4x6 3/4
	CX-141	119.95	S	No	Yes	No	No	-	No	No	3.5	-	No	No	U	-	2 5/16x6 5/16x6 7/8
	CQ-840	-	S	No	Yes	Yes	Yes	-	No	Yes	3.5	-	No	No	I	Adj.	1-3/4x7 5/5 1/16
	CR-143	44.95	M	No	No	Yes	No	-	No	No	3.5	-	No	No	I	5-1/8	1-3/4x6-3/8x3 4/5
	CR-514	94.95	M	No	No	Yes	Yes	-	Yes	Yes	3.5	-	No	No	I	5-1/8	1-3/4x6-3/8x5 1/4
	CR-714	119.95	S	No	No	Yes	Yes	-	Yes	Yes	3.5	-	No	No	I	5-1/8	1-3/4x6-3/8x6
	CR-501	49.95	M	No	No	Yes	No	-	No	No	-	-	No	No	I	-	-
	CR-656	99.95	M	No	No	Yes	Yes	-	Yes	Yes	3.5	-	No	No	I	Adj.	2x7-3/8x6-1/4
	CR-701	124.95	S	No	No	Yes	Yes	-	Yes	Yes	3.5	-	No	No	I	Adj.	2x7-3/8x6-1/4
	PIONEER	TP-232	49.95	S	Yes	No	No	No	-	No	No	7.6	8	No	No	U	-
TP-200		99.95	S	Yes	No	No	Yes	3	Yes	No	7.6	8	No	No	U	-	2-1/8x7-1/8x7-3/8
TP-828		89.95	S	Yes	No	No	No	-	No	No	8	4.5	No	No	U	-	3-3/4x7-3/4x8-1/2
TP-800		129.95	S	Yes	No	No	Yes	3	Yes	No	8	4.5	No	No	U	-	3-3/4x7-3/4x8-1/2
KP-300		129.95	S	No	Yes	No	Yes	3	Yes	No	7.6	8	No	No	U	-	2x7-1/2x7-1/2
KP-345		89.95	S	No	Yes	No	No	-	No	No	7.6	8	No	No	U	-	2x5-1/8x7-1/4
TP-7000		159.95	S	Yes	No	Yes	Yes	3	Yes	No	7.6	2.5	No	No	I	Adj.	2x7-1/8x6-1/4
KP-4000		159.95	S	No	Yes	Yes	Yes	3	Yes	No	7.6	2.5	No	No	I	Adj.	2x7-1/8x6-1/4

Car Radio/Tape Players

Sony TC-30

RCA 12R150

Sanyo FT403



MANUFACTURER	MODEL	PRICE	Stereo(S)	8 Track ?	Cassette ?	AM ?	FM ?	FM Sensitivity m.V. (for 50dB Quieting)	MFC ?	Local/Distant Switch ?	Watts output (cont.) per chan.	Distortion @ rated watts, %	Treble and Bass Controls ?	Includes speakers ?	In-dash(D) or Under-dash(U)	Control shaft spacing, inches	Dimensions, inches H.W.D.
RCA	12R301	69.95	S	Yes	-	-	-	-	-	4.5	8	No	No	U	DNA	2-3/8x7-1/8x7-5/8	
	12R490	39.95	S	Yes	-	-	-	-	-	4	8	No	No	U	DNA	2-1/8x5-1/2x7-1/4	
	12R500A	54.95	S	Yes	-	-	-	-	-	5.0	8	No	No	U	DNA	2-1/8x5-1/2x7-1/4	
	12R600	129.95	S	Yes	-	-	Yes	10	Yes	4.5	8	No	No	U	DNA	3-5/8x7-5/8x8-3/8	
	12R606	74.95	M	-	-	Yes	Yes	4	Yes	No	4.5	10	No	No	I	Adj.	2x7x4-1/2
	12R607	104.95	S	-	-	Yes	Yes	4	Yes	Yes	4.5	10	No	No	I	Adj.	2x7x4-1/2
	12R703	159.95	S	Yes	-	Yes	Yes	10	Yes	Yes	5	8	No	No	I	Adj.	2-3/16x7-1/16x7-1/16
	12R800	119.95	Q	Yes	-	-	-	-	-	4.5	8	No	No	U	DNA	2-5/8x10-1/8x7-1/2	
	12R150	112.95	S	-	Yes	No	No	-	No	No	5	8	No	No	U	DNA	2-1/8x5-1/2x6-5/8
	ROYAL SOUND	SS 8A	39.90	S	Yes	No	-	-	-	-	-	-	Yes	-	U	-	-
SS 208		99.50	S	Yes	No	-	Yes	2.5	No	Yes	4	1	Yes	No	U	-	
SS 308		99.50	S	Yes	No	Yes	-	2.5	No	Yes	4	1	Yes	No	U	-	
SS 408		119.50	Q	Yes	No	-	-	-	-	4	1	Yes	No	U	-	-	
SS 608		119.50	S	Yes	No	Yes	Yes	2.5	Yes	-	4	1	Yes	No	I	5.1	
CS 131		129.50	S	No	Yes	Yes	Yes	2.5	Yes	-	4	1	Yes	No	I	5.1	
SANYO		FT865	99.95	S	Yes	No	No	Yes	4	-	6	-	Yes	No	U	-	3x4-3/4x7-1/2
	FT863M	99.95	S	Yes	No	No	Yes	4	Yes	6	-	Yes	No	U	-	3x7x8-1/2	
	FT866M	139.95	S	Yes	No	No	Yes	3	-	7	-	Yes	No	U	-	3-1/8x8x8-7/8	
	FT868	159.95	S	Yes	No	Yes	Yes	2.5	-	Yes	6	-	Yes	No	I	Adj.	2x7-1/8x6
	FT433M	139.95	S	No	Yes	Yes	Yes	2.5	-	5	-	Yes	No	U	-	3x9x8-1/2	
	FT867	119.95	S	Yes	No	Yes	Yes	3	Yes	No	6	-	Yes	No	I	Adj.	2x7-1/8x6
	FT403	129.95	S	-	Yes	Yes	Yes	2.5	-	No	6	-	Yes	No	I	Adj.	3x7-1/4x6
	FT816	39.95	S	Yes	No	No	No	-	No	No	5	-	Hi/Lo	No	U	-	2-5/8x5-5/16x7-1/2
	FT401	49.95	S	No	No	No	No	-	No	No	5	-	Yes	No	U	-	1-3/4x6-3/4x5-5/16
	FT819	49.95	S	Yes	No	No	No	-	No	No	6	-	Yes	No	U	-	2-5/8x5-5/16x7-1/2
	FT862	59.95	Q	Yes	No	No	No	-	No	No	5	-	Yes	No	U	-	2x7x7-3/8
	FT864	99.95	Q	Yes	No	No	No	-	No	No	7	-	Yes	No	U	-	4x6x8-1/2
	F8270	34.95	-	-	-	Yes	-	-	-	No	5	-	Yes	No	I	Adj.	2x7-1/8x4-9/16
	F8571	69.95	-	-	-	Yes	Yes	3.0	Yes	-	5	-	Yes	No	I	Adj.	2x7-1/8x4-9/16
	F8572	69.95	-	-	-	Yes	Yes	3.0	Yes	-	5	-	Yes	No	I	Adj.	2x7-1/8x4-9/16
	F8573	99.95	S	-	-	Yes	Yes	3.0	Yes	-	5	-	Yes	No	I	Adj.	2x7-1/8x4-9/16
	F8574	99.95	S	-	-	Yes	Yes	3.0	Yes	-	5	-	Yes	No	I	Adj.	2x7-1/8x4-9/16
SONY SUPERSCOPE	TC 10	129.95	S	No	Yes	No	No	-	No	No	-	No	No	U	-	2-5/8x7-3/16x7-7/8	
	TC 25F	169.95	S	No	Yes	No	Yes	-	No	Yes	-	No	No	U	-	2-9/16x8-1/16x8-1/2	
	TC 30	179.95	S	No	Yes	No	No	-	No	No	-	No	No	U	-	2-7/8x7-1/4x9-3/8	
SPARKOMATIC	FMX-10	59.95	S	No	No	No	Yes	5	Yes	No	3.5	10	Yes	No	U	-	15/16x6-1/8x5-1/4
	AFM-10	59.95	M	No	No	Yes	Yes	5	Yes	No	4	10	Yes	Yes	U	-	15/16x6-1/8x5-1/4
	AM-10	29.95	M	No	No	Yes	No	-	No	No	3.5	10	No	Yes	U	-	1-5/8x4-3/8x5-1/4
	FM-10	29.95	M	No	No	No	Yes	5	Yes	No	3.5	10	No	No	U	-	1-5/8x4-3/8x5-1/4
TENNA	RR 201M	39.95	M	No	No	Yes	No	-	No	No	3	-	No	No	U	-	1-1/8x4-1/8x5-3/4
	RR 202MF	49.95	-	No	No	No	Yes	5	Yes	No	-	-	No	No	U	-	1-1/8x4-1/8x5-3/4
	RR 203MPX	99.95	S	No	No	No	Yes	5	Yes	Yes	5	-	No	No	U	-	2-3/8x4-1/8x6-5/8
	RR 51T	49.95	S	Yes	No	No	No	-	No	No	2	-	No	No	U	-	2x5-5/8x7-1/2
	RR 53T	59.95	S	Yes	No	No	No	-	No	No	3	-	No	No	U	-	2-1/4x5-5/8x6-3/4
	RR 54T	69.95	S	Yes	No	No	No	-	No	No	3-1/2	-	No	No	U	-	2-7/16x5-5/8x7-1/4
	RR 86T	89.95	S	Yes	No	No	No	-	No	No	4	-	No	No	U	-	2-7/16x5-5/8x7-1/4
	RR 93MPX	119.95	S	Yes	No	No	Yes	10	Yes	No	4-1/2	-	No	No	U	-	2-3/16x7-1/2x7-7/16
	RR 2001T	129.95	Q	Yes	No	No	No	-	-	No	3-1/2	-	No	No	U	-	2-1/8x8x6-3/4
	RR 2002CMX	159.95	S	No	Yes	Yes	Yes	10	Yes	No	3-1/2	-	No	No	I	-	2x7x6-1/4
	RR 2003MPX	129.29	S	Yes	No	Yes	Yes	10	Yes	No	3-1/2	-	No	No	I	-	2x7x6-1/4
XTAL	XA 80	39.95	S	Yes	-	-	-	-	-	-	-	-	-	No	U	-	5-9/16x2-11/16x7-1/4
	XA 82	49.95	S	Yes	-	-	-	-	-	-	-	-	-	No	U	-	5-1/16x2-7/16x6-7/8
	XA 84	59.95	S	Yes	-	-	-	-	-	-	-	-	-	No	U	-	5-1/16x2-7/16x6-7/8
	XA 86	79.95	S	Yes	-	-	-	-	-	-	-	-	-	Yes	U	-	7-1/2x7x2
	XA 88	119.95	Q	Yes	-	-	-	-	-	-	-	-	-	Yes	U	-	-

4300.

The non-stop Teac.

Wouldn't it be nice to have a tape recorder that didn't require you to stop whatever you're doing to turn the tape over?

Our 4300 will do that for you. It will play both sides of a tape, one after the other, for as many times as you like — so you can listen non-stop.

And so you can do that for as long as you like, it's a typical TEAC.

We've been building 3 motor tape recorders like the 4300 for over 20 years now.

We make our products work well — for a long time. That's our philosophy.

We can't describe most of the reasons we think you'll like the 4300.

The performance. The solid precise feel. The effortless operation. You really have to experience these for yourself.

You can do that by calling (800) 447-4700, in Illinois call (800) 322-4400 to find your local TEAC dealer. The persons there will provide you with specifications and a demonstration, and be helpful in general. That's why they're a TEAC Retailer.

TEAC

The leader. Always has been.

TEAC Corporation of America, 7733 Telegraph Road, Montebello, California 90640.

Car Speakers

MANUFACTURER	MODEL	Price each	oz per pair	Max. Power Handl. watts	Driver in. (nominal)	ohms Impedance	Freq. Range in Hz. ±dB	Copaxial?	Flush mtg. (F) Surface mtg. (S)	Overall Dimensions (in.)	Notes
ADS	2001	—	475.00	40	1+4	—	50-25K ±5dB	No	S	4 x 4 x 6-2/3	Sep. Tweeter, woofer. Incl. 4 power amps (60 watts/chan.), two electronic crossovers.
AUDIOVOX	69-10	15.50	—	10	6 x 9	8	55-16K	Yes	F	6 x 9 x 4	—
	69-18	19.95	—	15	6 x 9	8	55-17K	Yes	F	6 x 9 x 4	—
	DSW-30	—	22.50	20	5-1/4	8	60-20K	No	S/F	—	—
	ID-36	—	22.95	5	4	4/8	100-13K	No	F	5 x 5 x 2	—
	SC-20	—	31.99	15	5-1/4	4/8	60-14K	No	F	6 x 6	—
	1069-10	—	24.95	15	6 x 9	4/8	50-15K	No	F	6 x 9 x 4	Studded grilles
	1069-18	—	33.95	15	6 x 9	4/8	50-15K	No	F	6 x 9 x 4	Studded grilles
	TAC-10	—	24.95	10	3-1/2	8	100-15K	No	S	—	—
BIG BRUTE	X10	—	47.25	20	5-1/4	4	—	Yes	F	6	10 oz magnets
	X20	—	63.25	30	5-1/4	4	—	Yes	F	6	20 oz magnets
	6910X	24.40	—	40	6 x 9	8	—	Yes	F	6-1/4 x 9-1/4 x 3-3/8	10 oz magnets
	6920X	31.25	—	60	6 x 9	8	—	Yes	F	6-1/4 x 9-1/4 x 3-3/8	20 oz magnets
	710	—	31.25	20	3-1/2	4	—	No	F	4	10 oz magnets
	D-10	24.90	—	40	—	4	—	No	S	9-1/8 x 5-3/4 x 3-1/2	10 oz magnets
	2003	—	12.45	8	5-1/2	8	—	No	S	5-1/2 x 5-1/2 x 3-1/2	3 oz magnets
BON SONIC	CR10	—	—	10	—	8	—	—	S	—	—
	AL35	—	—	5	—	8	—	—	S	—	—
	525P	—	—	5	—	8	—	—	F	—	—
BOMAN	SK-685	—	29.95	20	5-1/4	4	—	—	F	—	—
	SK-680	—	24.95	10	5-1/4	4	—	—	F	—	—
	SK-660	—	17.95	10	5-1/4	4	—	—	F	—	—
	SK-1010	—	21.95	8	5	4	—	—	S	—	—
	SK-75	—	14.95	8	5	4	—	—	S	—	—
	SK-97	—	13.95	6	5-1/4	4	—	—	S	—	—
	SK-72	—	9.95	5	5	8	—	—	S	—	—
	SK-94	—	11.95	5	5-1/2	4	—	—	S	—	—
	SK-62	—	8.95	—	—	—	—	—	S	—	—
	SK-80	—	9.95	5	5-1/4	8	—	—	S	—	—
	SK-600	—	12.95	5	5-1/4	8	—	—	F	—	—
	SK-609	—	12.95	10	6 x 9	8	—	—	F	—	—
C.T.S.	5-1/4 FR14	—	41.50	10	5-1/4	8	70-18K	No	F	5-1/4 x 3-1/2	Also avail w/bk grille
	69STK14	—	43.90	10	6 x 9	8	40-18K	No	F	6 x 9 x 3-1/2	14 oz magnet
	69R SK14	29.68	—	10	6 x 9	8	40-18K	No	F	6 x 9 x 3-1/2	14 oz magnet
	69CA14	25.39	—	10	6 x 9 & 3	8	40-20K	Yes	F	6 x 9 x 3-1/2	14 oz magnet
CALTRON	DS-25	—	12.95	8	5-1/4	8	100-10K ±5	No	F	6-1/4 x 3	—
	DS-224	—	25.95	28	5-1/4	4	50-15K ±3	No	F	6-1/4 x 3-1/2	—
	DS-96	9.95	—	10	6 x 9	8	50-10K ±3	No	F	7-1/2 x 9-1/4 x 3-1/2	—
	DS-964	15.95	—	20	6 x 9	4	50-15K ±3	No	F	7-1/2 x 9-1/4 x 4	—
	DS-60	—	10.95	5	3 x 5	8	100-7.5K ±5	No	S	7 x 6-3/4 x 3-3/4	—
	DSU-10	—	16.95	10	4	8	100-10K ±5	No	F/S	6 x 2-1/4	—
	CTJ-5A	—	19.95	10	4	4	80-12K ±3	No	F/S	6 x 2-1/4	—
CLARION	SK-63	—	25.95	40	5-1/4	4	100-10K ±10	No	F	6.5 x 2-3/4	—
	SK-64	—	34.95	80	5-1/4	4	100-10K ±10	No	F	6.5 x 3	—
	SK-69	—	22.95	40	6 x 9	4	100-10K ±10	No	F	6.5 x 9.5 x 3-1/4	—
	SK-76	—	22.95	20	5	4	100-10K ±10	No	S	6 x 5.5 x 4	—
	SK-77	—	24.95	16	5	4	100-10K ±10	Yes	F/S	8.5 x 7 x 4.5	—
CRAIG	9420	—	29.95	16	—	8	70-10K	No	F	6-1/2 x 6-1/2 x 1-1/4	—
	9421	—	49.95	16	—	4	100-12K	No	S	15-3/4 x 5 x 9	—
	9422	—	29.95	16	6 x 9	8	50-10K	No	F	9-3/8 x 6-3/8 x 3	—
	9425	—	34.95	16	—	8	60-10K	No	S	8-7/8 x 5 x 9-1/4	—
	9430	—	—	16	—	4	—	No	S	—	—
	9432	—	—	16	—	4	—	Yes	F	—	—
INLAND	CSK-20	—	7.95	—	4	8	—	No	F	—	—
	SO-455	—	8.95	—	3 x 5-1/2	8	—	No	S	—	—
	W-36	—	11.50	—	3 x 5-1/2	8	—	No	S	—	—
	CSK-201	—	10.40	—	5	8	—	No	S	—	—
	RM-755	—	14.95	—	6-1/2	8	—	No	F	—	—
	SK-1069	10.95	—	—	6 x 9	8	—	No	F	—	—
	SMA-55V	—	19.95	—	5	8	—	No	S/F	—	—
	SMA-53V	—	14.95	—	5	8	—	No	S/F	—	—

The tuner that restates the state of the art.

Imagine a stereo FM tuner that performs as cleanly and vividly as your favorite records. That has distortion so low it defies laboratory measurement. That automatically rejects all unwanted noise and interference.

You're looking at it. The YAMAHA CT-7000... the new state of the art tuner. Its cost? \$1,200. So listen at your own risk, because you may never be satisfied with any other tuner again.

It's the first tuner with Negative Feedback.

Long used in amplifiers to lower distortion, the application of Negative Feedback to the CT-7000 has all but eliminated MPX distortion. (At 400 Hz, for example, it's an unheard of 0.02%—and that includes distortion caused by the measuring instrument itself.) Also, Negative Feedback eliminates the need for distortion-causing Side Carrier Filters.

For superior separation of the left and right channels, Yamaha designed a unique *Phase Lock Loop MPX Decoder*. Instead of being a single IC chip as in other tuners, our Phase Lock Loop consists of discrete components mounted on their own circuit board, thus allowing precise control in production and hand-tuning adjustment to meet exact specifications.

A 7-Gang Tuning Capacitor? Most tuners get by with 4 or 5 stages. We refused to. By designing the Front End with our unique 7-Gang Tuning Capacitor and utilizing Dual Gate MOS FETs, the CT-7000 can receive the weakest stations and, at the same time, accept an extremely high input (up to 1 volt input signal) without overloading.

Advanced IF Amp Stages. Inside the IF amp stage is the world's finest combination of ceramic and L/C filters. This has resulted in an advanced degree of selectivity (the ability to pick out a desired signal while rejecting neighboring frequencies). And maintains proper phase linearity and minimum distortion (less than 0.08%).

A selectable IF Mode lets you choose the width of the tuner's selectivity... narrow setting for crowded band areas; wide setting for uncrowded areas. The tuner's reception can be optimized for virtually every listening situation.

Some other important differences. An *Auto Blend Logic Circuit* automatically operates in three stages to blend high and middle-high frequencies for maximum stereo separation with minimum noise and distortion on even the weakest stations. And you don't need to get up and switch in the MPX filter when a station turns noisy. The CT-7000 does it for you—silently, automatically.

There's Auto-Touch Tuning that automatically disengages AFC while you tune, for maximum station selection. When you release the tuning knob, AFC reengages and locks onto the station,



electronically fine-tuning it to the one point of maximum stereo separation and minimum distortion.

A unique Variable Muting Control makes it possible to receive music where there used to be just noise. This control lets you select the muting cut-off level to an unbelievably low 10 dB (3 m μ), yet it can be adjusted to accommodate stations up to 30 dB (30 m μ) in level.

Variable Output Level permits adjustment of the tuner's output to match the other input levels. So, when switching from tape, to records, to the CT-7000, you don't have to readjust your volume control.

The end of Multipath Distortion. Reflection of FM signals off their surroundings causes multipath distortion. And that causes muddled, distorted sound. Until now, you could rely on inaccurate signal strength meters to orient the antenna—or you could invest about 800 dollars in an external oscilloscope.

The CT-7000 neatly solved that problem with a unique signal minus multipath circuit which when activated by the S-M front panel relay, allows the signal strength meter to accurately display the multipath content of the incoming signal. Without guesswork, you now can zero-in the antenna incoming signal to reduce to a minimum multipath interference and distortion. In

fact, tests show the S-M meter of the CT-7000 to be three times more accurate for this purpose than an oscilloscope.

Some things we didn't have to do. We could have settled for just having the best performing tuner in the world. But we also wanted it to be the most reliable and durable.

That's why all the push buttons are silky-smooth, precision reed relays instead of switches. Why the flywheel is solid brass. And why, beneath the walnut wood case, each circuit board is protected by a stainless steel cover to guard against stray noises and interference.

Or as Stereo Review summed it up in its January 1975 issue: "Judged by its overall measured performance, the Yamaha CT-7000 is clearly one of the finest FM Tuners ever made. In no respect was it less than superb, and in a few areas—notably distortion, image rejection, AM rejection, and pilot-carrier suppression—it was either far better than anything we had previously measured or simply beyond the measurement abilities of the best laboratory instruments."

Your Yamaha Audio Dealer will be pleased to demonstrate the incomparable CT-7000. Plus other state of the art Yamaha components that make up the system—designed to make you unhappy with what you're listening to now. Because, like life, the best is always yet to come.



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Car Speakers

MANUFACTURER	MODEL	Price each	or per pair	Max. Power Handl. watts	Driver in. (nominal)	ohms (impedance)	Freq. Range in Hz±dB	Coaxial?	Flush mfg. (F) Surface mfg. (S)	Overall Dimensions (in.)	Notes
JENSEN	C9740	—	87.95	25	6 x 9, & 3	8	40-16K	Yes	F	10-1/4 x 6-1/2 x 3-1/2	20 oz magnet
	C9730	—	56.95	25	5-1/4	8	60-12K	No	F	6-3/4 x 7-1/2 x 6-3/4	20 oz magnet
	C9703	—	44.95	25	5-1/4	8	60-12K	No	F	6-3/4 x 7-1/2 x 6-3/4	10 oz magnet
	C9702	—	34.95	20	5-1/4	8	90-10K	No	F	6-3/4 x 7-1/2 x 6-3/4	4.8 oz magnet
	C9729	—	58.95	25	6 x 9	8	40-16K	No	F	10-1/4 x 6-1/2 x 3-1/2	20 oz magnet
	C9728	—	48.95	25	6 x 9	8	40-16K	No	F	10-1/4 x 6-1/2 x 3-1/2	10 oz magnet
	C9809	—	66.95	25	5-1/4	8	60-12K	No	F	13-1/4 x 7-1/2 x 7-1/4	20 oz magnet
	C9814	—	38.95	20	5	8	90-10K	No	F	12-3/4 x 7-1/2 x 2-3/4	5.4 oz magnet
LEAR JET	S-7000	—	15.95	—	5	—	—	—	F	5	—
	S-7100	—	17.95	—	5-1/4	—	—	—	F	5-1/4	—
	S-7110	—	19.95	—	5-1/4	—	—	—	F	5-1/4	—
	S-7120	—	18.95	—	3 x 5-1/2	—	—	—	S	3 x 5-1/2	—
	S-7130	—	20.95	—	5	—	—	—	S	5	—
	S-7140	—	21.95	—	5	—	—	—	F	5	—
	S-7160	—	26.95	—	5	—	—	—	S	5	—
	S-7170	—	26.95	—	5-1/4	—	—	—	F	5-1/4	—
	S-7175	—	29.95	—	5-1/4	—	—	—	F	5-1/4	—
	S-7180	—	28.95	—	5	—	—	—	—	5	—
S-7190	18.95	—	—	6 x 9	—	—	—	F	6 x 9	—	
MEDALLION	60-070	19.95	—	20	6 x 9	4	—	Yes	F	—	10 oz magnet
	60-071	29.95	—	25	6 x 9	4	—	Yes	F	—	20 oz magnet
	60-073	—	49.95	25	5-1/4	4	—	Yes	F	—	20 oz magnet
	60-074	—	34.95	20	5-1/4	4	—	Yes	F	—	10 oz magnet
	60-175A	—	15.95	5	5	4	—	No	F	—	2 oz magnet
	60-189	—	29.95	15	5	4	—	No	F/S	—	10 oz magnet
	60-177	—	19.95	5	3 x 5	4	—	No	S	—	3 oz magnet
	60-173	—	39.95	20	5-1/4	4	—	No	F	—	20 oz magnet
PANASONIC	EAB-310	—	12.95	10	—	8	—	—	F	—	—
	EAB-101	—	12.95	10	3 x 5	8	—	—	S	—	—
	EAB-201	—	19.95	10	5	8	—	—	S	—	—
	EAB-202	—	24.95	12	5	4	—	—	S	—	—
	EAB-203	—	24.95	12	5	8	—	—	S	—	—
	EAB-301	—	14.95	12	5-1/4	4	—	—	F	—	—
	EAB-302	—	14.95	12	5-1/4	8	—	—	F	—	—
	EAB-501	—	14.95	10	5	8	—	—	S	—	—
	EAB-701	—	29.95	15	5-1/4	8	—	—	F	—	10 oz magnet
	EAB-702	—	29.95	15	6 x 9	8	—	—	F	—	10 oz magnet
PIONEER	TS-163	—	12.95	8	6-1/2	4	70-10K	No	F	7 x 7 x 2	—
	TS-160	—	27.95	20	6-1/2	4	40-16K	No	F	7 x 7 x 2-1/4	—
	TS-161	—	32.95	20	6-1/2	4	40-16K	No	F	7 x 7 x 2-1/4	—
	TS-691	19.95	—	20	6 x 9	4	40-16K	No	F	6-1/2 x 9-1/2 x 3-1/2	—
	TS-692	24.95	—	25	6 x 9	4	35-16K	No	F	6-1/2 x 9-1/2 x 3-1/2	—
	TS-5	—	19.95	8	5-1/4	4	70-10K	No	S	8 x 4-1/2 x 7-1/2	—
	TS-40	—	39.95	8	4 x 1-5/8	4	100-12K	No	S	8-1/2 x 7-1/4 x 4	—
	TS-22	—	36.95	8	4 x 2-5/8	4	100-15K	No	S	10 x 5 x 4	—
QUAM-NICHOLS	69C10FEX	15.20	—	15	6 x 9	8	100-16K ±4	No	F	4-5/8 x 9-1/4 x 3-1/4	Foam surround
	52C10FEX	13.60	—	15	5-1/4	8	90-12K ±7	No	F	5-5/16 x 5-5/16 x 2-1/4	Foam surround
	5C328	7.30	—	4	5	8	90-13K ±10	No	F	4-5/8 x 4-5/8 x 2-1/8	—
RCA	12R400	—	15.75	7	5-3/4	3.2	50-10K	No	F/S	5-11/16 x 5-11/16	—
	12R401D	—	14.85	7	5-3/4	3.2	50-10K	No	F	5-7/8 x 5-7/8	—
	12R403	—	7.50	10	5	8	90-13K	No	F	5-1/4 x 5-1/4	—
	12R404	—	19.95	16	6-1/4	8	80-11K	No	F	6-1/2 x 6-1/2	—
	12R405	—	22.95	10	6 x 9	8	50-15K	No	F	6-3/4 x 10 x 3-1/4	—
	12R406	—	29.75	10	6 x 9	8	50-15K	No	F	6-3/4 x 10 x 3-1/4	—
ROYAL SOUND	ASK-10	—	19.95	5	5-1/4	8	100-10K ±10	No	S	—	—
	ASK-20	—	24.95	10	5-1/4	8	100-10K ±10	No	S	—	—
	ASK-30	—	19.95	10	5-1/4	8	100-10K ±10	No	F	—	—
	ASK-40	—	39.95	10	5-1/4	8	50-12K ±10	No	F	—	—
SONOSPHERE	SP-12	24.95	—	15	4	8	100-16K	No	S	4-1/2 (Sphere)	Magnetic base; opt. chrome finish \$5 add.
	SPR-12	24.95	—	15	4	4	100-16K	No	S	4-1/2 (Sphere)	Screw down base; opt. chrome finish \$5 add.
SONY-SUPERSCOPE	SS-10	—	24.95	8	4-3/4	3.2	50-10K	No	S	2-1/2 x 6-3/8	—
	SS-11	—	24.95	8	4-3/4	3.2	50-10K	No	S	3-9/16 x 7-5/8 x 8-1/8	—
SPARKOMATIC	SK-355	—	10.95	5	3.5	8	100-16kHz ±10	No	F	3-7/8 x 3-7/8 x 1-1/4	5 oz magnet, hi compliance
	SK-510	—	22.95	8	5	8	70-15kHz	No	S/F	4-5/8 x 4-5/8 x 2	10 oz magnet
	SK-5206	—	34.95	8	5	8	50-16kHz	Yes	S/F	4-3/4 x 4-3/4 x 2-1/2	20 oz magnet, hi compliance
	SK-610	—	19.95	8	5-1/4	8	40-15kHz	No	F	6-1/4 x 6-1/4 x 2-1/4	10 oz magnet
	SK-620C	—	29.95	12	5-1/4	8	40-17kHz	Yes	F	6-1/4 x 6-1/4 x 2-1/2	20 oz magnet, hi compliance
	SK-690	—	24.95	8	6 x 9	8	50-16kHz	No	F	6-3/8 x 9-3/8 x 2-7/8	10 oz magnet
	SK-6920C	—	39.95	16	6 x 9	8	50-17kHz	Yes	F	6-3/8 x 9-3/8 x 3-1/2	20 oz magnet, hi compliance
	SK-203	—	11.95	4	3 x 5.5	8	80-16kHz	No	S	2-7/8 x 5-1/2 x 1-1/2	5 oz magnet

MANUFACTURER	MODEL	Price each	0/1 per pair	Max. Power Handl. watts	Driver in. (nominal)	ohms Impedance	Freq. Range in Hz-dB	Coaxial?	Flush mfg. (F) Surface mfg. (S)	Overall Dimensions (in.)	Notes
UTAH	C35EC	8.25	-	8	3-1/2	8	-	No	-	-	Front/rear control RFK-20 \$2.95—for all 4-10 ohm spkrs.
	CS5JVC-W	19.45	-	12	5	8	-	No	-	-	"
	C57JC-WCR	17.30	-	10	5 x 7	8	-	No	-	-	"
	C69JC-WR-48	17.85	-	15	6 x 9	4	-	No	-	-	Grilles avail. \$2.30-\$5.35
	C69JVC-WCR	21.70	-	18	6 x 9	8	-	No	-	-	As above
	C69-LXC-FR3	35.15	-	30	6 x 9	8	-	Yes	-	-	As above
	C410-JC-WCR	17.85	-	15	4 x 10	8	-	No	-	-	As above
	SP-410-CPS-8	12.00	-	10	4 x 10	8	-	No	-	-	As above
	SA5-10P	-	40.20	10	5	8	-	No	F	-	Kit, incl. grilles
	SA52-10P	-	44.25	10	5-1/4	8	-	No	F	-	As above
	SA52-16-P	-	49.65	12	5-1/4	8	-	No	F	-	As above
	SA6-10-P	-	44.25	10	6	8	-	No	F	-	As above
	SA69-10-N/T	-	60.60	12	6 x 9	8	-	Yes	F	-	As above
	SA69-20-N/T	-	87.90	30	6 x 9	8	-	Yes	F	-	As above
XK	840	24.95	-	30	6-1/2	8	40-19.5K ±8	Yes	S	9 x 9 x 9	Removable grilles—omni directional

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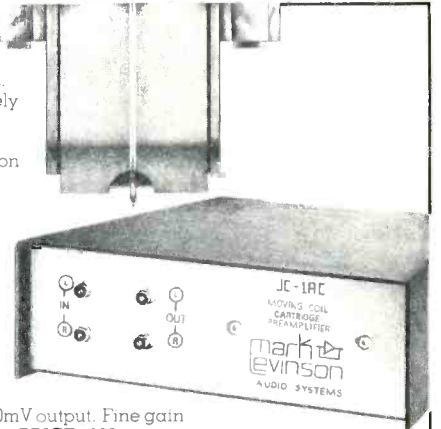
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The JC-1AC is optimized for absolutely highest performance with the FR-1MK2. Cartridge and preamplifier were both developed using the most advanced measurement techniques as well as the ultimate reference: the human ear. The combination offers extreme clarity and openness without "edge"; extended, powerful bass; extra-fine detail and focus; wide dynamic range; and ultra-low hum and noise. By special arrangement the JC-1AC and FR-1MK2 are available as a package. **PRICE \$310.**

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Five Car



JUST HOW GOOD are those add-on FM and FM/AM car radios which also play cassettes or cartridges? For all their compactness, the better units are just not inexpensive. And if you're interested in obtaining a unit with reasonably high fidelity radio reception and tape playback, trying to choose one by reading most advertising brochures discloses that even the very minimum specifications we have come to expect from makers of home high fidelity components are missing.

We tested five units for this comparison report. All of them had one thing in common: FM and stereo-FM reception. Some had AM as well, and all played either cassettes or 8-track cartridges. Our primary concern in testing these sets was with the FM tuner sections and the amplifiers, rather than with the tape performance. We did, however, audition each for its tape playing and handling with prerecorded tapes, though we didn't measure distortion, S/N ratio, etc., since none of these units had recording circuitry.

General

All five units tested operate from a 12 to 15 volt power source, with ground or chassis returned to the negative ter-

minal of the car battery. All of the units employ unbalanced antenna inputs and use coaxial lines and connectors of the type which normally feed car antennas to built-in, factory-supplied car radios. The two units tested that do not include AM sections are supplied with an antenna lead-in adaptor (a T-cable) which connects to a previously-installed AM radio as well as to the antenna input of the new set. Suitable mounting brackets and hardware are supplied with each, and all are equipped either with attractive front panels ready for in-dash mounting or have separate bezel plates to provide a finished appearance after installation.

Becker Mexico

This compact unit from the German firm of Becker Auto-radio handles tape cassettes and receives AM and FM broadcasts, as well as stereo FM. A sparsely-calibrated AM/FM dial scale occupies the center of the front panel, above which are two pushbuttons which select AM or FM. Below the illuminated dial scale area are the fast-forward and fast-rewind buttons for the cassette transport, an ejector bar, and the hinged door which swings inward to accept cassettes. At the left of the panel is a rotary knob for power

Radios Tested

Leonard Feldman



on/off and volume, flanked by a concentric lever knob which adjusts tone. The tone-control action is treble cut only, with flat response at the most-clockwise position of the lever. Between the AM and FM pushbuttons above the dial scale, there is an automatic tuning bar which may be depressed to move the tuner and associated dial pointer slowly up the spectrum until a station of adequate signal strength is encountered, at which point the dial stops automatically. Depressing the bar once more causes the set to seek the next station up the dial. When the set reaches the high frequency end of the dial spectrum, it quickly returns to the low frequency end, to begin the station-seeking process all over again. Sensitivity of the radio can be set at three differ-



ent levels, labelled *Country*, the most sensitive; *Suburban*, and *City*, by means of a lever mounted concentrically with the manual tuning knob at the right of the panel.

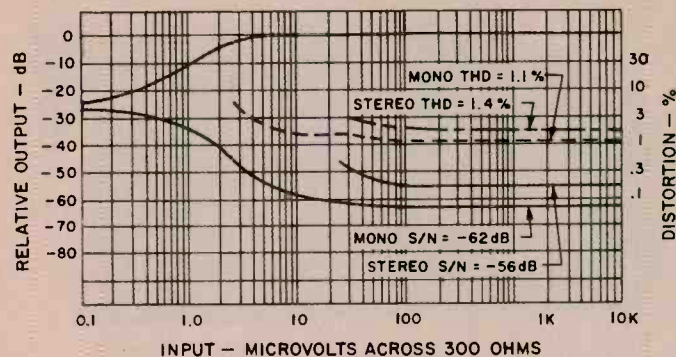


Fig. 1 — FM quieting and distortion — Becker Mexico.

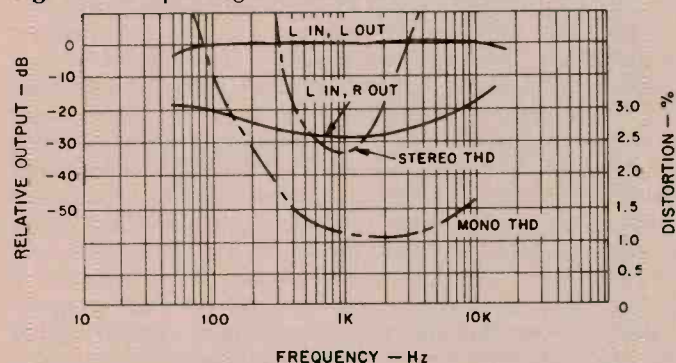


Fig. 2 — Separation and distortion versus frequency — Becker Mexico.

The circuitry of the Becker Mexico employs 32 bipolar transistors and two integrated circuits (both in the cassette section). Audio output is fed to 4-ohm speakers (not supplied) through a 1000 μ F capacitor in each channel's output. Conventional tuned circuits are used throughout the AM and FM sections, and front-end tuning is accomplished by variable inductors.

FM quieting and distortion of the Mexico are shown in Fig. 1, and the results are also tabulated in the comparison table. Figure 2 shows stereo FM separation, which reached 28 dB at the mid-frequencies, along with mono and stereo distortion at various audio frequencies. As with of the units tested, there is a distortion rise at low audio frequencies in both mono and stereo modes. The apparent steep rise in distortion at various audio frequencies. As with most units a result of high-order beats and residual carrier products than actual harmonic distortion. Unlike tuners and receivers built for home high fidelity use, car radio outputs are seldom used to feed tape recorders; thus little effort need be made to filter out the residual 19 kHz and 38 kHz multiplex products which might degrade tape recordings (through creating beats with the recorder's high frequency bias current). Even with the treble controls set to minimum in our tests, the presence of high amounts of these products was apparent in our distortion meter readings.

Maximum output-per-channel measured 1.75 watts continuous power before clipping started and distortion became visible on the oscilloscope. The Becker Mexico is priced at \$844.28.

Craig 3139

The service manual for the Craig lists a few brief specs, such as IHF sensitivity, power output, and stereo separation, though more specs are given for the tape section. After

reading the power output specification, 12 watts per channel, we were surprised to find that this set delivered 0.85 watts with 4-ohm loads before distortion set in. Since Craig



calls this a "Powerplay" unit, we wonder if perhaps their advertising department forgot to check with engineering.

The Craig 3139, an FM-only set, has five station-select pushbuttons. Its 8-track tape programs are indicated by program indicator lights. A manual tuning knob is located at the left, alongside the narrow dial scale. Below the tuning knob is a combination on/off control and tape program-advance pushbutton. Alongside are slide controls for balance and tone control, and a hinged door for insertion of 8-track cartridges. Four pushbuttons above the tape slot select Radio operation, Stereo or Mono mode, Repeat button (for continuous play of a selected pair of tracks of the cartridge) and a Fast Forward button which advances the tape at about three times normal rate. Above these buttons and alongside the track indicator lamps, is a red window which bears the legend "Craig." When the volume control is turned up (as it says in the manual "beyond the loudness of most other players"), this lights up to indicate that the "Powerplay" feature is working. In our tests, this occurred when power output reached about 1 watt per channel into 4-ohm loads. At that point, harmonic distortion measured over 10%.

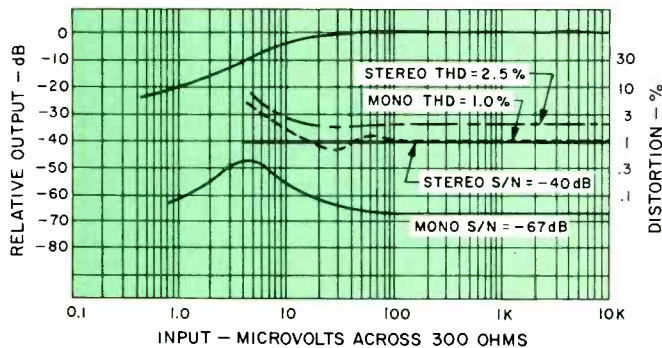


Fig. 3 — FM quieting and distortion — Craig 3139.

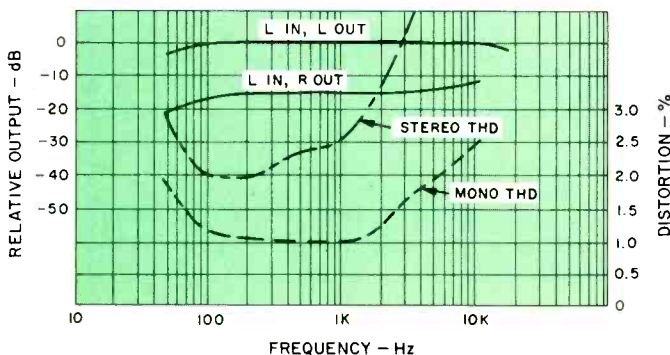
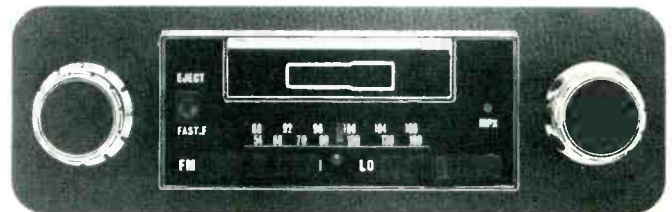


Fig. 4 — Separation and distortion versus frequency — Craig 3139.

The FM front-end of the Craig Model 3139 contains three bipolar transistors and is inductively tuned. The i.f. section uses a single multi-purpose IC and a pair of dual-element ceramic filters feeding a conventional ratio detector. A single IC is also used in the multiplex section; it has two separate tuned circuits for 19 kHz and 38 kHz adjustment. Pre-amplifiers for the tape playback section are also ICs, while the power amplifier section contains 14 transistors per channel. Each output stage is coupled to its speaker by a 1000 μ F capacitor. In operating this unit, tape takes precedence over radio; that is, inserting a tape cartridge automatically switches the audio system over to tape play and keeps it there until the cartridge is extracted (at least partially), before it reactivates the radio.

FM quieting and distortion characteristics of the Craig 3139 are graphed in Fig. 3. While ultimate quieting in mono was an excellent 67 dB, the residual 38 kHz multiplex carrier products in the stereo output limited quieting readings to 40 dB in that mode. To the listener, however, noise would appear much closer to -68 dB since the 38 kHz signal is not audible. The non-carrier harmonic distortion products observed in stereo, at 2.5%, predominated over the carrier product level at midfrequencies (-40 dB would be equivalent to only 1.0% THD if carrier products constituted the sole form of residual distortion). In mono, THD was an acceptable low 1.0% for mid-frequencies, increasing to 2.0% at the low-frequency end of the spectrum and to 2.5% at high audio frequencies, as plotted in Fig. 4. Stereo-FM separation measured only 14 dB at mid-frequencies, improving slightly at low frequencies and decreasing to about 12 dB at 10 kHz. The Craig Model 3139 carries a suggested list price of \$169.95.

J.I.L. 605



The second-most expensive unit we measured was the J.I.L. Model 605, an in-dash cassette stereo player with AM/FM and stereo FM radio. This unit is supplied with a separate escutcheon plate. The cassette compartment is located above the illuminated radio dial scales at the center of the panel. Below the tuning dial are a two-position switch for selecting AM or FM reception and a switch for Local or Distant reception. In the case of FM, the Local position attenuates signal strength by about 20 dB to prevent overload of the front-end. A dual-purpose button at the left of the compartment triggers eject of the cassette or, when depressed half way, provides fast-forward transport of the tape. However, there is no fast rewind control.

The stereo indicator lamp and a "tune lock" lamp (about which more in a moment) are located at the right of the cassette compartment. Concentric knobs at the right of the panel take care of manual station tuning and channel balance, while matching knobs at the left control tone, and power On/Off and Volume. Depressing the volume control actuates the automatic tuning (station-seeking) feature. When the tuning mechanism zeroes in on a usable signal, station seeking stops for 10 seconds to give you time to decide if you like the station the receiver has found. If so, you

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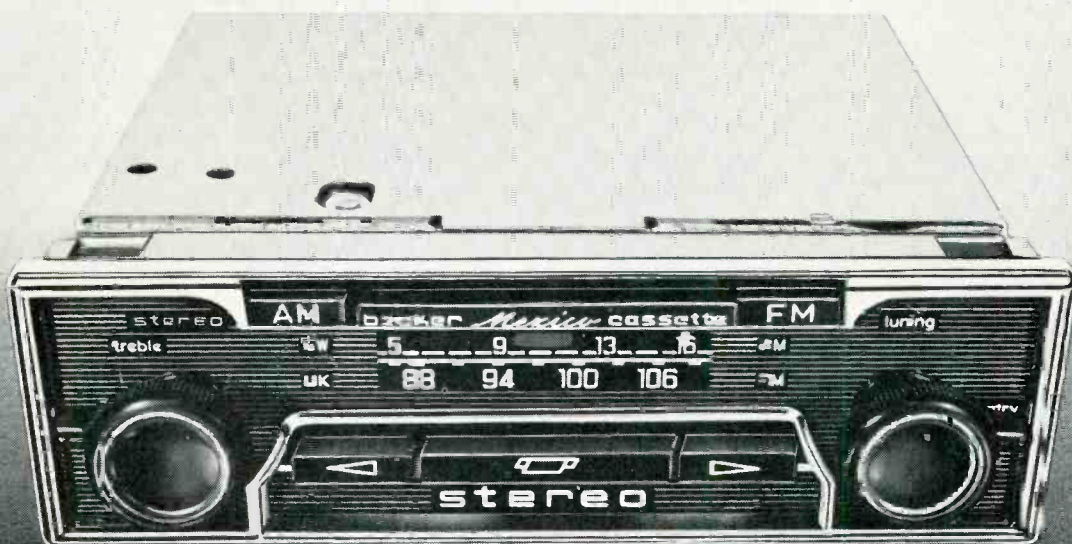
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are used in this set. AFC is used in the FM mode, and it cannot be disabled.

IHF sensitivity of this unit measured $4.0 \mu\text{V}$ in mono and $7 \mu\text{V}$ in stereo. Maximum undistorted power output per channel (four channels driven) was 2.0 watts. S/N ratio in FM mono was 66 dB, while stereo was 55 dB, measured relative to 100% modulation. Harmonic distortion at mid-frequencies in mono was 1%, while THD in stereo measured a bit lower, 0.85%. These are unusual distortion readings since most tuners and receivers have stereo THD higher than mono. The difference in readings is slight, and it is possible that the stereo distortion figure may be the result of two forms of distortion partly cancelling each other. Figure 7 shows limiting, noise, and distortion at 1000 Hz modulation. Note that full limiting in this receiver, as well as in the others measured, tends to occur more gradually than is the case with homehigh fidelity components. The audible effect of this is that variations in audio output will be heard when weak FM signals — at a few microvolts level — are being received.

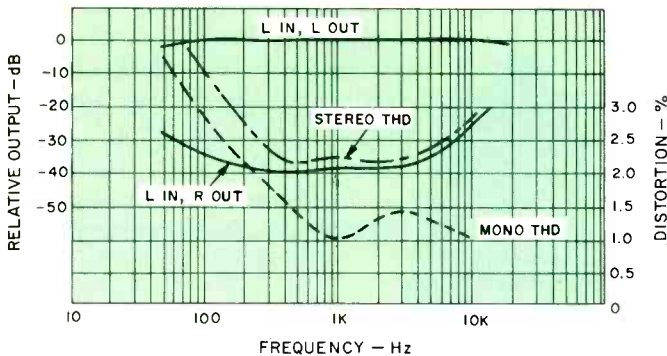


Fig. 8 — Separation and distortion versus frequency — Panasonic CQ-999.

The Panasonic exhibited the best stereo FM separation of the five sets tested, with 38 dB of channel separation at mid-frequencies and nearly 30 dB at the extremes. As for distortion at low audio frequencies, the unit behaved much like the others tested and produced nearly 3% THD at 100 Hz. A continuous plot of separation and distortion versus frequency is shown in Fig. 8. The Panasonic CQ-999EU costs approximately \$200.

Pioneer KP-301



Pioneer of Japan is a large organization which designs and produces both home high fidelity components and car stereo products. The former are handled by U.S. Pioneer Electronics, located on the East Coast, while the car units are distributed in this country by the West Coast firm called Pioneer of America. The last set we tested is the Pioneer KP-301.

This is the first automobile receiver/tape player we've seen which includes Dolby noise reduction. This circuitry is used not only for playing back Dolbyized cassette tapes, but may be employed in listening to Dolbyized FM and FM-ster-

eo broadcasts as well. Unfortunately, switching in the Dolby circuitry while listening to a Dolbyized broadcast does not alter the FM de-emphasis from 75 microseconds to 25, as required by the new Dolby standards. Thus, though the signal-to-noise ratio of Dolbyized broadcasts being received is improved, the treble response is somewhat impaired. If some treble boost were available (via the tone control), this could be compensated for, but the treble control in this set (as in the others tested) is instead a treble cut control which delivers flat response in its maximum-clockwise position.

The front panel layout is a bit different from most. The unit receives FM only, and the dial scale is positioned at the left of the panel, in the form of a meter-movement face with a rotating instead of sliding pointer. Numerals are printed around a semi-circle, somewhat like a clock face or a speedometer. Below the dial area, at the left, is the On/FM/Off switch. For cassette play, this switch need not be used since inserting a cassette also turns on the power. A Dolby In/Out switch is located to the right. Below the cassette compartment (upper right of the panel) are the FM tuning knob, small Balance and Tone controls knobs, a cassette Eject bar, and a Volume control. Pushing the Volume control actuates a switch which reverses tape-play direction. This is another first for us — a cassette car player that can play cassettes in both directions without having to remove and invert the cassette itself. Illuminated arrows indicate the direction of tape travel. A stereo indicator light is located under the dial scale area and, on the under surface of the chassis there is a mono/stereo switch which one finds by feel while driving since it is not visible from the front panel. In installing this unit, one would do well to keep that switch accessible, which dictates under-dash instead of in-dash installation.

The front-end of the Pioneer KP-301 employs an FET r.f. amplifier followed by an IC oscillator-mixer. A single IC serves as a 4-stage i.f. amplifier, with a pair of dual-element ceramic filters between stages. The FM detector is a ratio detector circuit followed by an IC multiplex-decoder circuit.

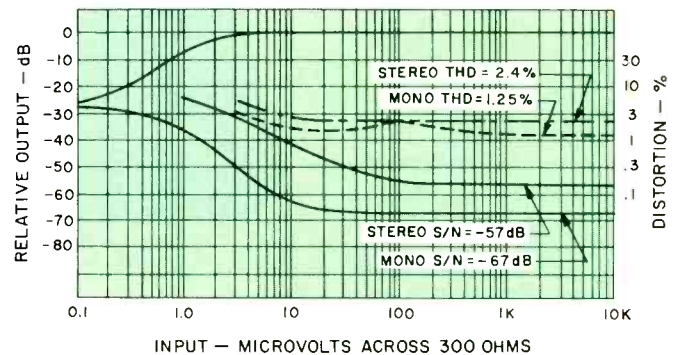


Fig. 9 — FM quieting and distortion — Pioneer KP-301.

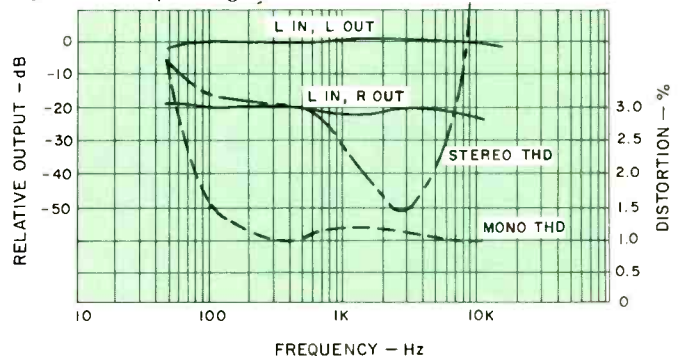


Fig. 10 — Separation and distortion versus frequency — Pioneer KP-301.

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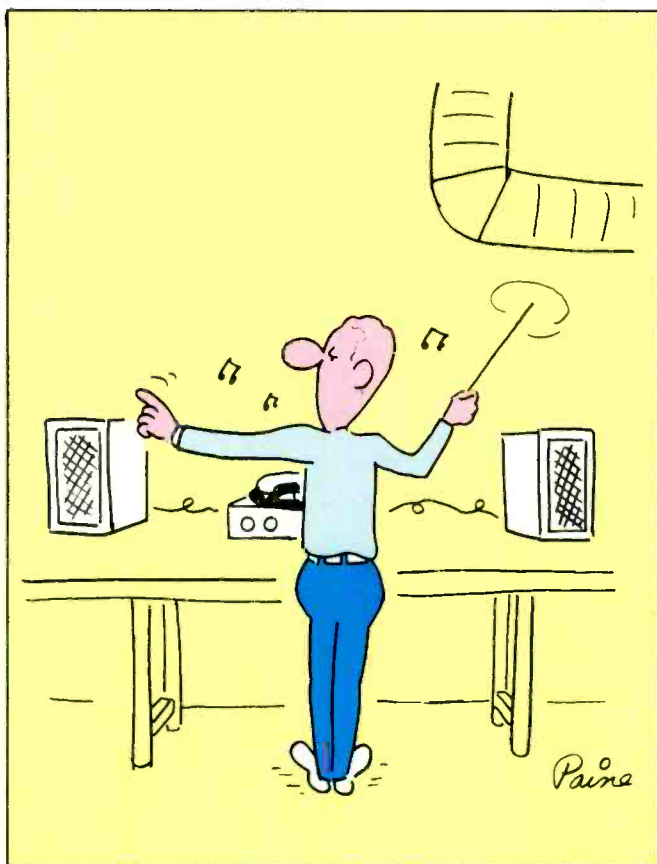
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Tape preamp circuits employ a pair of ICs. The Dolby noise reduction circuitry is all on one separate printed circuit board. Each of the power amplifier stages is a single IC. There is a transistorized drive circuit for the cassette transport motor, including a magnetic reed switch which handles automatic tape slack takeup when a cassette is inserted. The Pioneer KP-301 employs a total of 7 ICs, 3 FETs (two in the Dolby circuitry), 20 transistors, and 33 diodes. Retail price of the set is \$199.95.

The Pioneer KP-301 proved to be the most sensitive of the five units tested, both in stereo and in mono FM reception. IHF sensitivity measured 3 μV both for mono and for stereo, and this is the first time we've ever seen a receiver whose mono and stereo IHF sensitivity figures were the same. It probably is due to some minor misalignment of circuitry which causes the mono figure to be a little worse than it need be. Some 50 dB of quieting was obtained for signals of as little as 3 μV in mono and 30 μV in stereo. Distortion in mono measured 1.25%, while in stereo the figure increased to 2.4% for mid-frequencies. Stereo separation at mid-frequencies was 22 dB and, as plotted in Fig. 10, hovered around the 20 dB mark for all other audio frequencies. Distortion in mono rose rapidly at the low-frequency end of the audio spectrum, exceeding 3.0% at 100 Hz. Similar THD readings for low frequencies were observed in stereo, though at other frequencies, stereo THD was significantly higher than mono. The power output reached before noticeable clipping was 1.0 watt per channel.

Conclusions

It was not possible for us to listen to these units under actual driving conditions, because of the time involved for installation. A few conclusions can be drawn from our lab measurements as well as from the bench listening tests



which were conducted using suitable (and typical) properly baffled 4-ohm speakers. In general, sensitivity is no real problem with any of these units. With the exception of the Becker, stereo reception was adequate, too, despite the limited separation observed on some units. The Becker required a full 50 μV of signal strength to reach the separation figures reported. Unlike most other sets, when a lower signal strength is received, the Becker's stereo mode doesn't switch off — it rather fades away, separation decreasing gradually until reception is monophonic. Thus, the Becker, with signal strengths in the 10 to 50 microvolt range (not atypical under various driving conditions) is likely to supply varying degrees of separation as signals fade and get stronger, rather than a distinct switching from mono to stereo. Perhaps this is desirable to some listeners — with our experience with home components, we found it unusual.

What most of the units share in common is relatively low power output. It can be argued that the small listening "room" inside of an automobile doesn't require high power, but that depends upon how loud you like your music played and how much acoustic energy is needed to really mask those road noises. Also relative to home units, they also have fairly high distortion in the tuner outputs, well before amplifier overload becomes a factor. Our FM measurements, though made at the output of the associated amplifiers, were conducted at a power output level of 0.25 watts — well below the amplifier overload point of any of the models tested.

Brand & Model		Becker Mexico	Craig 3139	J.I.L. 605	Panasonic CQ-999	Pioneer KP-301
IHF Sensitivity, μV	mono	4	6	4	4	3
	stereo	50	8	10	7	3
50 dB Quieting, μV	mono	3	7	3	5	3
	stereo	50	*	35	30	30
Mono S/N ratio @ 1000 μV , dB		62	67	61	66	67
Stereo S/N ratio @ 1000 μV , dB		56	*	56	55	57
Mono THD, %		1.1	1.0	0.65	1.0	1.25
Stereo THD, %		1.4	2.5	1.4	0.85	2.4
Max Power/Ch., watts		1.75	0.85	2.0	2.0	1.0
Separation @ 1 kHz, dB		28	14	22	38	22
Tape transport		Cass.	8-tr.	Cass.	8-tr.	Cass.
AM Incl. ?		Yes	No	Yes	Yes	No
Automatic tuning?		Yes	No	Yes	No	No
Preset pushbuttons?		No	Yes	No	Yes	No
Price (\$)		844.28	169.95	249.95	200 approx.	199.95

*See text

Clearly, no single unit was superior in every respect, as you can see by checking the comparison table. Best sensitivity belongs to the Pioneer KP-301, while honors for best S/N ratio in mono belong to the Pioneer KP-301 and the Craig 3139. Lowest mono FM distortion was found in the J.I.L. 605, while the low stereo THD award went to the Panasonic CQ-999, which also took the prize for best stereo separation in FM.

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 high fidelity 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.

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And what you don't hear sounds good, too. Harmonic and intermodulation distortion are under 0.1% at any power level from 0.25 watts to full power. We think that makes them absolutely inaudible. Hum and noise are also inaudible — 100 dB below full output. And you can enjoy all that quiet because the AA-1640 requires no fan. Even as a PA amplifier, its massive heat sinks need only normal ventilation.

The optional backlighted meters are unusually useful. They monitor the power output directly in watts from 0.2 to 200 watts into 8 ohms and in decibels from -30 to +3 dB. Special ballast circuitry allows the meters to respond to peaks as short as a record click, making them extremely effective overload indicators. The meters can be added to the basic AA-1640 during or after construction.

It almost takes an engineer to appreciate the AA-1640's conservative, reliable design — direct-coupled, differential input amplifier, 16 output transistors (8 per channel) in parallel,

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quasi-complementary configuration, 12 pounds of diecast heat-sinking, a 25-pound power supply transformer, dissipation limiting, automatic thermal shutdown, and output compensation to make the AA-1640 unconditionally stable with any load. A special relay circuit prevents power on/off thumps from reaching your speakers and protects them from DC and extremely low frequency AC. In an exclusive Heath design, speaker fuses are located in the primary feedback loop where they don't degrade bass clarity by lowering its greater than 50 damping factor. And its 1.5V input sensitivity is compatible with most stereo preamplifiers.

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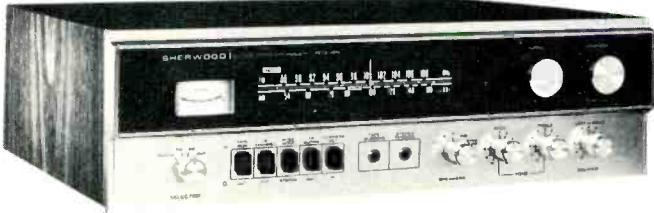


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Equipment Profiles

Sherwood S-7210 Stereo Receiver



MANUFACTURER'S SPECIFICATIONS

FM Tuner Section

IHF Sensitivity: 1.9 μV . **Selectivity:** 65 dB. **Capture Ratio:** 1.4 dB. **Signal-to-Noise Ratio:** 68 dB. **AM Suppression:** 60 dB. **THD:** Mono, 0.3%; Stereo, 0.6%. **Image Rejection:** 70 dB. **IF Rejection:** 85 dB. **Spurious Rejection:** 90 dB. **Stereo Threshold:** 5 μV . **Stereo Separation:** 1 kHz, 40 dB.

AM Tuner Section

IHF Sensitivity: 20 μV . **Selectivity:** 30 dB. **Image Rejection:** 40 dB. **IF Rejection:** 40 dB.

Amplifier Section

Power Output: 28 watts/channel, 8 ohm loads, 40 Hz to 20,000 Hz. **Rated Harmonic Distortion:** 0.7%. **IM Distortion:** 0.8% at rated output. **Frequency Response:** *Phono*, RIAA ± 1.5 dB; *AUX*, 20 Hz to 20 kHz ± 0.5 dB. **Damping Factor:** 30. **Input Sensitivity:** *Phono*, 2.0 mV; *AUX*, 220 mV. **Phono Overload:** 100 mV. **Bass Control:** ± 12 dB at 50 Hz. **Treble Control:** ± 12 dB at 15 kHz.

General Specifications

Power Requirements: 115/125 V, 50/60 Hz, 180 watts maximum. **Dimensions:** 17 1/2 in. W. x 5 1/4 in. H. x 13 1/4 D. **Weight:** 27 lbs. **Price:** \$299.95.

Sherwood Laboratories has, over the years, offered a consistently good line of products at reasonable prices, and in these days of rising costs, it's nice to find in the just-under-\$300 price range a high quality receiver that omits a few of the extra frills and still offers good basic performance and doesn't skimp on power output capability. One can almost see Sherwood's management and engineering people getting together to set the price target, then proceeding to design everything into this receiver which could possibly be included at that price without losing money.

The wood enclosure and three-dimensional, extruded front panel certainly suggest more expensive components. A full-width, blacked-out dial illuminates when power is applied disclosing a linear FM dial scale, a well-calibrated AM scale, and a 0-100 reference (logging) scale. A peak-reading signal-strength meter, which works for both FM and AM, is



Fig. 1 — Rear view.

at the left, while at the right are a flywheel-coupled tuning knob and the master volume control (calibrated in dB), which also serves as a power on/off switch. Rotary controls along the lower section of the panel include a *Program* selector switch, *Speaker* selector switch, *Bass* and *Treble* tone controls, and a *Balance* control. Black, rectangular, push-button switches handle *Tape* monitoring, *Mono/Stereo* selection, *FM Muting*, and *Loudness* control activation. There are actually two tape monitor circuits, with the second identified as 4-channel *Adaptor*, since the addition of such an adaptor requires a circuit interruption point which is identical to the usual *Tape Out* and *Tape in* jacks associated with tape monitoring. Tape dubbing and stereo headphone jacks are located at the center of the panel's lower section. The tape dubbing jack permits connection of a second tape deck for copying tapes with the first deck connected via the rear panel tape jacks.

The rear panel, pictured in Fig. 1, contains screw terminals for connection of main and remote speaker pairs. Alternatively, all four speaker systems can be set up in the same listening room and the speaker switch set to the *Dynaquad* position, which causes out-of-phase, ambient information (often contained in stereo or matrix 4-channel discs) to be fed to the rear speakers in a simulation 4-channel sound. The standard 300-ohm, 75-ohm, and AM antenna lines can be connected to screw terminals located just under the pivotable AM ferrite bar antenna. Standard phono-tip jacks are provided for *Phono*, *AUX* and *Tape Inputs* (including the second 4-channel adaptor pair) and *Tape* (or adaptor) *Outputs*. There is also a single FM 4-channel output jack, which delivers the composite detected FM signal for future use with suitable FM 4-channel adaptors.

A pair of speaker fuses are housed under a plastic cover held in place by a single screw. The see-through cover permits inspection of the fuses to see whether one is blown before removing the cover. A power line fuse, mounted in a standard fuseholder, and a single switched a.c. receptacle

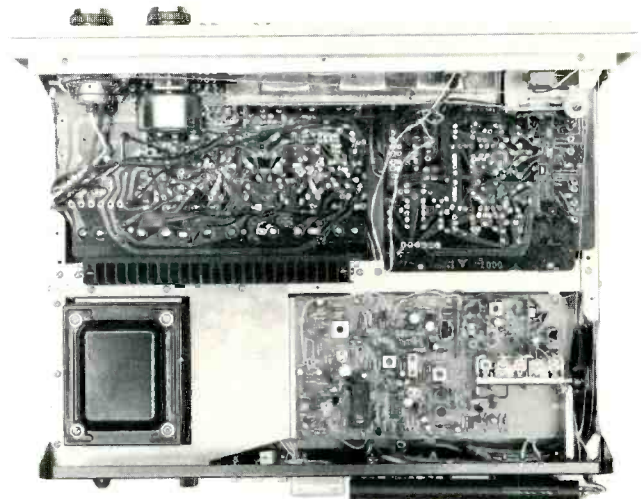


Fig. 2 — Inside view of receiver.

complete the rear panel layout. No separate ground terminal for record changers is provided and users are instructed to use the ground terminal of the 75-ohm antenna pair for this purpose.

We examined the internal construction and layout of the receiver (See Fig. 2) and found it to be cleanly laid out and ruggedly assembled. Power transformer and heat sinks seemed thoroughly adequate judging from the power output range of this model.

FM Tuner Measurements

IHF sensitivity in mono FM was a low $1.7 \mu\text{V}$, measurably better than the $1.9 \mu\text{V}$ claimed by the manufacturer. Only $2.5 \mu\text{V}$ of signal was required to produce 50 dB of quieting — an impressive figure for such a low-priced receiver. Ultimate signal-to-noise ratio (measured at a signal input of $1000 \mu\text{V}$) was exactly 68 dB, as claimed, for mono reception. In the stereo mode, best S/N ratio was 60 dB, and switching from mono to stereo occurred at $18 \mu\text{V}$ of signal input, by which time the signal-to-noise ratio had already reached 43 dB. A bit more than $30 \mu\text{V}$ of signal was required to achieve a 50 dB S/N ratio in stereo.

Distortion in mono was a low 0.25% at 1 kHz, and measured even lower, 0.19%, at 400 Hz. In stereo, 0.3% THD was observed for mid-frequencies. These results are shown graphically in Fig. 3. Capture ratio measured 1.4 dB, as specified, at a signal input strength of $100 \mu\text{V}$, improving somewhat with higher signal strengths. Selectivity measured 67 dB, while spurious and i.f. rejection were both about 90 dB. Frequency response of FM was flat from 50 Hz to 15 kHz within 1.0 dB.

Measured sensitivity of the AM section was $18 \mu\text{V}$, while image and i.f. rejection both measured 40 dB as claimed. Distortion in AM (for 30% modulation) measured 1.3%, and frequency response was down 6 dB at 3.5 kHz.

Figure 4 is a plot of stereo FM separation and distortion at various audio frequencies. Separation at mid-frequencies was 40 dB as claimed, decreasing to 25 dB at 100 Hz and 26 dB at 10 kHz. Mono THD was 0.5% or lower from 100 Hz to 14 kHz. In stereo, low frequency THD remained well under 1.0%, increasing at high frequencies due to the appearance of non-harmonically related beats between audio signals and residual carrier products.

Amplifier Measurements

Several power output ratings are listed in the owner's manual for the Sherwood S-7210. The one which complies most closely with FTC regulations specifies 28 watts per channel over the frequency range from 40 Hz to 20 kHz at maximum rated distortion of 0.7%, when driving 8-ohm loads. (If one wishes to rate the unit from 20 Hz to 20 kHz, Sherwood offers a 26 watt per channel rating.) Whichever you choose, the sample tested did better, delivering 33 watts at mid-frequencies for rated distortion, and 27.5 watts at 20 Hz into 8-ohm loads. At mid-frequencies and power levels below maximum output, THD drops quickly to just under 0.1%, measuring 0.08% at 28 watts per channel output. IM distortion is also under 0.1% for power levels from maximum down to about 3 watts, below which IM rises slightly

Erratum

In our June Profile of the Yamaha YP-701 turntable, we printed an erroneous (high) figure for the test unit's flutter. Actual measured flutter was only 0.04%, which is (as was stated in the review) excellent. Our apologies to Yamaha, and to those of our readers who may have been momentarily confused by the typographical error.—Ed.

to a maximum of 0.2%. These measured results are shown in Fig. 5.

Distortion at rated output for all frequencies is plotted in Fig. 6. At 20 kHz, the receiver delivered 28 watts per channel at 0.15% distortion; 0.2% THD was observed for this output level at 50 Hz.

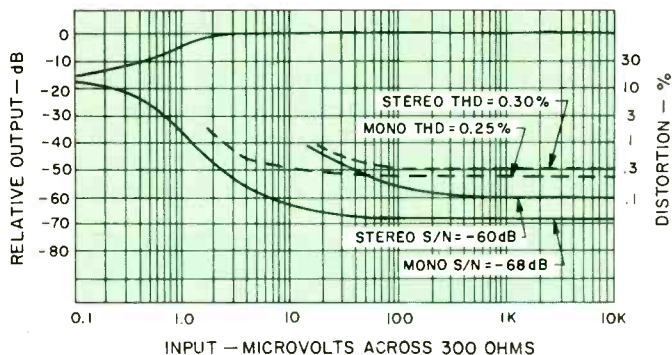


Fig. 3 — FM quieting and distortion characteristics.

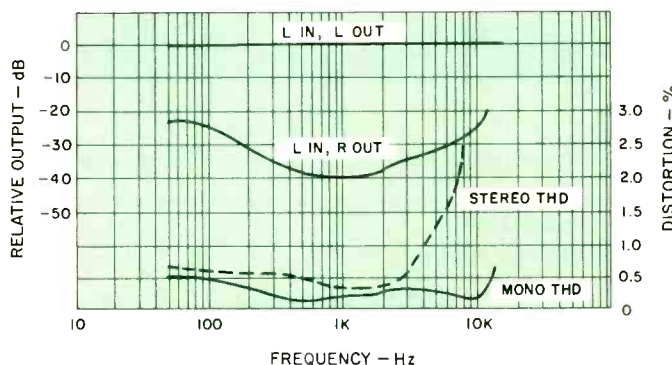


Fig. 4 — Separation and distortion vs. frequency.

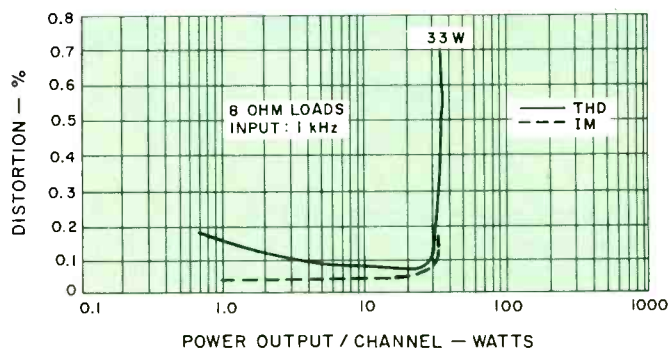


Fig. 5 — Harmonic and intermodulation distortion.

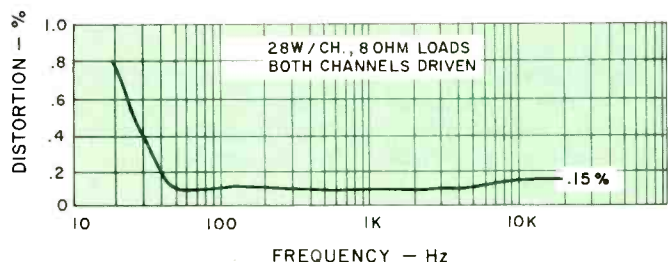


Fig. 6 — Distortion versus frequency.

Preamplifier Section Measurements

Frequency response measured from the AUX inputs through the entire preamp/amplifier circuitry was flat from 6 Hz to 30 kHz within ± 1 dB, while the -3 dB roll-off points occurred at 4 Hz and 60 kHz. Tone control and loudness compensation characteristics are shown in Fig. 7. Phono in/out sensitivity measured 2.2 mV. Overload margin was far better than claimed, with an input of 135 mV required to produce first-stage distortion.

Hum and noise measured through the phono inputs was as low as we have ever measured, -71 dB unweighted, referencing full output and rated input sensitivity. Even though this is an unweighted figure, it exceeds the claimed -65 dB published by the manufacturer. High level inputs have sig-

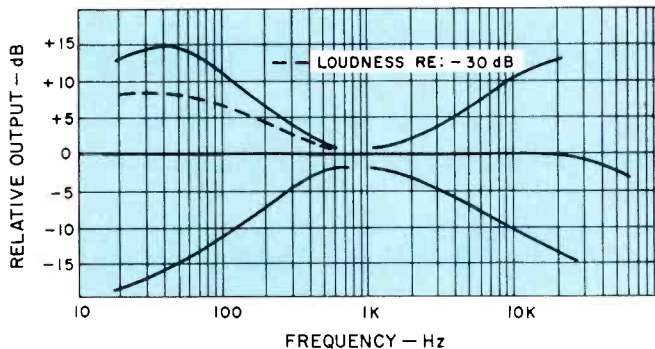
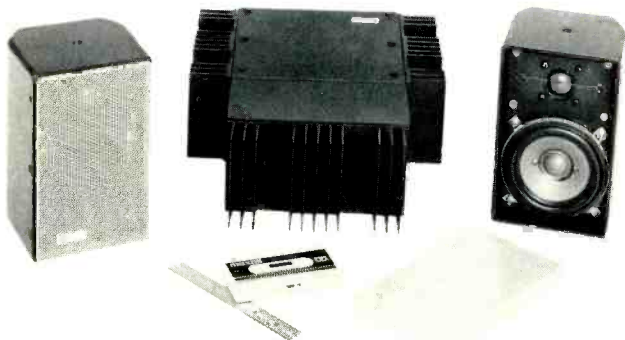


Fig. 7 — Tone control range and loudness compensation.

ADS Model 2001 Car Speaker System



MANUFACTURER'S SPECIFICATIONS

System Type: Bi-amplified, acoustic suspension stereo speaker system. **Frequency Response:** 50 to 25,000 Hz, @ DIN 45-500. **Woofer:** 4-in. long excursion cone. **Tweeter:** 1-in. low-mass soft dome. **Speaker Dimensions:** 6-7/8 in. H. x 4 1/4 in. W. x 4 in. D. **Speaker Weight:** 4 lbs.

Power Amplifiers

Woofer Amplifiers: 2 x 60 W at 500 Hz. **Tweeter Amplifiers:** 2 x 20 W at 10 kHz. **Dimensions:** 3-5/8 in. H x 9-3/8 in. W. x 6 1/2 in. D.

Signal Processor

Input Sensitivity: Low level, 0.5 V into 43k ohms; high level, 5 V into 350k ohms; active filter electronic crossover; equalization for extended bass, and built-in opto-electronic LED limiter for high amplitudes at low frequencies.

Power Supply

Input Voltage: 11 to 16 V d.c. D.c. to d.c. switching converter. **Standby Current at 12 V:** 0.75 A. **Maximum Current:** 26 A. **Dimensions:** 3-5/8 in. H. x 6 1/2 in. W. x 3 1/2 in. D.

System Price: \$475.00

nal-to-hum ratio of 85 dB, also better than the 80 dB claimed, though no further reduction in residual hum level is observed when decreasing the volume control to its minimum setting.

Listening Tests

Sherwood has done a good job of balancing power output and price in this receiver. We were impressed with the unit's ability to drive medium-low efficiency speakers to room-filling loudness levels and suspect that the absence of frills such as filters and more switching were traded off to let dealers sell this unit at the popular "under \$300.00" price.

When we played Columbia's new release of *Carmina Burana*, which is loaded with strong percussive transients and wide swings of dynamic range, the set exhibited none of the input overload characteristics which too often show up in low-cost receivers.

Checking out the FM section, we would have preferred a lower threshold for stereo switching and suspect that Sherwood may have misadjusted this particular sample. Printed specifications claim a stereo switching threshold of 5 μ V, which would have been quite acceptable. Muting also seemed set a bit too high, having an input signal threshold of 18 microvolts. Tuning weak stations without using the muting circuitry gave generally acceptable program sources.

If ever proof were needed that high fidelity components offer more value-per-dollar today than they did even five years ago, inflation notwithstanding, Sherwood proves the point convincingly with its S-7210.

Leonard Feldman.

Check No. 82 on Reader Service Card

Have you ever wished you could turn on your car radio and really hear good, high quality sound? Not the sound of a six-in. whizzer cone special speaker that buzzes like an angry hornet on those inaudible bass notes it is vainly trying to reproduce. Nor the equally anemic high frequency response that seems to lose all of the strings in the orchestra. But a real, honest-to-goodness, high quality sound?

Well, the new mobile speaker system made by ADS in Cambridge, Mass., may well be the answer to your dream of not being forced to leave good music reproduction behind in your living room when you go on a trip. The ADS 2001 is a new miniature, bi-amplified stereo speaker system designed to be powered from 12 volts d.c. and intended for use in cars, boats, vans, campers, etc.

This system comes complete with a combined power amplifier and power supply module, and two deceptively small speaker enclosures. The power supply and amplifier are in a single squat package measuring 12 x 9 1/2 x 4 in. (30.5 x 24 x 10 cm). With the heat sink fins protruding from three sides and a flat black color, the amplifier probably won't win any beauty contests. But it doesn't have to look pretty. It is intended to be tucked away in a trunk space or any compartment where it can go about its job with a minimal amount of free-air passage. There is a treble trim pot inside the module, which requires removal of the cover for adjustment. A labelled hole would have made this easier and perhaps safer.

The speakers are housed in even smaller enclosures measuring about 7 x 4 1/2 x 4 in. (18 x 11.5 x 10 cm). Protected by metal on all sides, including the perforated grille, the speakers are supplied with 9 ft. (2.7 meters) of cable for connection to the amplifier output.

The amplifier unit actually contains four power amplifiers and their associated preamplifiers plus a d.c.-to-d.c. switching converter for changing the 12 V battery voltage to the higher voltage needed by the power amplifiers. The units

(Continued on page 43)

Put a record on and walk away. The Philips 209 will automatically sense the disc size, select the speed, spin the platter and cue the tone arm electronically, all by itself.

Then, when the record is over, it will return the tone arm, and turn itself off. It's the only turntable that does it all.

But most important, there's virtually no detectable wow, flutter, drift or rumble. A well equipped research lab would have a tough time finding an echo of electronic noise.

The 209 is the only turntable with three DC motors. One cues the tone arm. The second transports the arm. The third, a DC servo, spins the platter. Separating the functions simplifies

the operation of the turntable and eliminates noisemaking possibilities.

The DC servo motor's tachogenerator registers and corrects any speed variation. Power fluctuations can't distract from your pleasure.

We eliminated virtually all detectable acoustic feedback and rumble by freely suspending the sub-chassis.

Our precision ground drive-belt also filters out any conceivable noise that could be traced to the drive motor.

We minimized the 209's aluminum tone arm size to cut down mass related resonance. Tracking error is less than $0^{\circ} 10'$ /cm. That means tracking error, for your ears, does not exist. Friction, both vertically and horizontally, is less than 10mg. The tone arm assembly in its rest position provides a continuous read-out stylus force gauge.

Now we're working on automating the dust cover. Any ideas?

GA 209 Quality Specs

Speeds: 33 $\frac{1}{3}$ & 45 rpm—
electronic/automatic selection
Speed calibration range: $\pm 3\%$
Wow and flutter: less than 0.08%—
(Typically 0.03%)
Rumble: —65 dB DIN B (ARLL)
Hydraulic Cueing: motor driven;
touch control actuated
Anti-skating Compensation:
For elliptical and spherical styli.
Drive system: Electronic,
tacho control DC servo motor and
precision stabilized belt drive.
Low capacity cables for CD-4.
Manual override on all automatic
operations.
Includes base, removable dust cover.

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Everything's automated but the dust cover.

Introducing the fully automated electronic Philips GA209.

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(Continued from page 36)

are bi-amped with a 60-watt woofer amplifier and a 20-watt tweeter amplifier for each speaker system. That's 160 watts of power!

The woofer and tweeter power amplifiers have their gain and frequency response controlled by electronic crossover network. Signal input for each amplifier is through conventional phono plugs with a low level input of 0.5 volts into 43 K and a high level input of 5 volts into 350 K. Opto-electronic LED limiters are built in to protect the woofer from high amplitude, low frequency signals.

The real surprise comes in the loudspeakers themselves. A 4-in. long-excursion woofer and a 1-in. tweeter are housed in a metal enclosure occupying less space than many conventional car speakers, but there is absolutely no comparison when it comes to the quality of reproduction.

The d.c. power for the ADS 2001 comes from the 12 volt battery, and I feel a great deal of caution should be exercised during installation. The 2001 does not have an on-off switch so that the amplifier is energized the moment battery voltage is applied. While the standby current at 12 volts is reasonably low, about $\frac{3}{4}$ amps, the turn-on surge and high sound-power peak currents can get quite high. This means that any switch used with the 2001 should be capable of momentary peak currents as high as 26 amps and continuous average currents of about 6 amps if you like loud music. The line switch on some car tuners or cassette machines may not safely carry this current.

A fused direct connection to the accessory position of the ignition switch is a good place to get power. But treat the battery voltage with respect when the connection is made. The common supply line of the ADS 2001 (ground) should be firmly tied to the vehicle ground. Do not, under any circumstances, let the ground current come back through the phono plug connection.

Placing the loudspeaker enclosures for the best sound and mounting them will require some user ingenuity since every car, van, or boat will present different requirements. I recommend that you purchase some heavy duct tape and use it to hold the enclosures firmly in various positions while you "dry run" the sound. Then, when you are satisfied with the location, use the mounting hardware ADS supplies with each unit to provide a permanent mount. This will pay off if you want to get the best sound these units are capable of delivering in your own special case.

Technical Measurements

The ADS 2001 is intended to be powered from the nominal 12 volt d.c. systems used in autos, boats, and campers. The actual voltage available from such a battery system may range from below 12 volts during long standby situations to above 15 volts at high charge rates. In order to provide a valid laboratory test of this portable system under all reasonable battery conditions, it was necessary to use a variable 10 to 17 volt regulated supply capable of delivering over 20 amp peak currents.

The 2001 is a self-contained system with the amplifiers and loudspeakers designed as complementary components. Signal voltages for testing the units were applied to the high level input which is rated at 5 volts rms for maximum level.

The one-meter, anechoic sound-pressure-level frequency response is shown in Fig. 1. The response is very uniform from 100 Hz to 20 kHz with a slight rise in the level of the higher frequencies. The 100-Hz low frequency limit is quite impressive considering the diminutive size of the enclosure and the fact that this is a 4-in. woofer. The frequencies from the octave below middle C up through the highest musical fundamentals are handled very smoothly and are impaired

by only a few absorption notches caused by the protective metal grille. Because this is a self-contained system, it was not possible to use our conventional one-watt basis for sound pressure calibration.

During the course of this measurement, two minor technical points were noted. First, the frequency response above 2 kHz shows a minor tendency to "fatigue" at high sound pressure levels, which shows up as a drop in high frequency response for power levels above about 2 V rms when applied for longer than about 5 seconds. This problem is common in many tweeters under excessive drive and is apparently due to thermal effects in the tweeter, rather than amplifier difficulties. Since the ADS 2001 can really put out a lot of sound power with its self-contained amplifier, it appears the tweeter could be damaged if driven for long periods at clipping level.

The second point noted was that the gain of the 2001 is somewhat dependent upon supply voltage. Figure 2 is a measurement of the relative voltage gain across the woofer and tweeter for supply voltages from 11.5 to 14.5 volts. The small decibel change in gain is not at all important, however, some of the low-supply gain variation is indicative of amplifier problems in the particular unit tested by *Audio*.

Figure 3 shows the phase response corrected separately for the air path delay of the woofer and tweeter. The acoustic crossover occurs at around 2 kHz. The acoustic position of the tweeter is approximately 3.25 in. (8.3 cm) in front of the woofer. The phase transition is smooth throughout the crossover and constitutes the only major nonminimum phase feature in the frequency response, due, of course, to the fact that the tweeter sound arrives before the woofer sound.

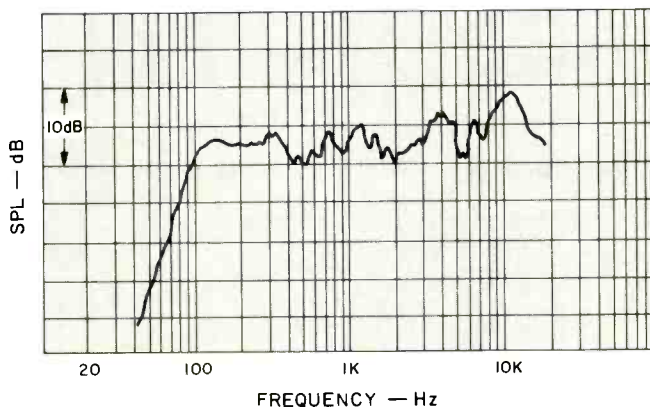


Fig. 1—One-meter anechoic sound pressure level.

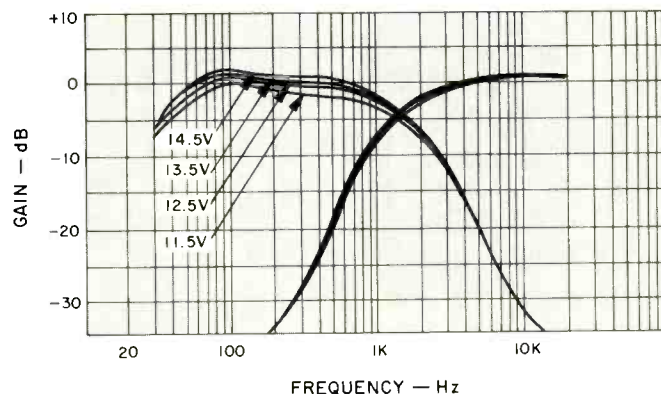


Fig. 2—Frequency response of woofer and tweeter amplifiers for different battery voltages.

Harmonic distortion was measured at two battery voltages, 12 V and 14.5 V. The 12-volt readings will correspond to the conditions frequently encountered when the vehicle has been stationary for some time and the battery is not being charged. The 14.5 volt readings, on the other hand, correspond to moderately heavy charging conditions. Harmonic distortion for the musical tones A2 (110 Hz) and A4 (440 Hz) is shown in Figs. 4 and 5 for the two supply conditions. We did not measure E1 (41.2 Hz) simply because that frequency is far below the cutoff of this system. Maximum drive level of 5 volts rms is chosen as the reference of 0 dB for this measurement.

There is some amplifier distortion as shown by the behavior of 440 Hz, principally with the tweeter amp. The explanation of the appearance of these curves is straightforward. For a battery voltage below about 13.5 volts, the tweeter amplifier loses some stability and a high frequency "ringing" signal appears on one half of the output sine wave as a "chirp." This chirp is well above the audible frequency range but is always locked to some multiple of the applied test signal. The result is that even-harmonics of high frequency signals are enhanced by the presence of this

spurious signal. The audible manifestation of this is a tendency to emphasize certain higher frequency partials in a way that some people might describe as "edgy."

(Editor's Note: This unit tested for this review was a pre production sample. ADS says that they believe they have cured the above mentioned problem by using a new circuit board layout and shielded wire in the actual production models.)

Remember, I am evaluating the ADS 2001 as though it were a high quality, walnut-finished unit you might place in your living room, and so I put it through the standard wringer. But the ADS 2001 was not designed for such a purpose. It is designed for reproducing sound in a limited space on a mobile system and at a level of quality several cuts above the average for those applications—a job the ADS 2001 does handily.

Intermodulation distortion was measured for 41 Hz and 440 Hz mixed 1 : 1 and with a 12-volt supply condition. Although the speaker puts out virtually no useful 41-Hz acoustic power, it was decided to check whether crossmodulation could still exist because the amplifier response test indicates the speakers are being driven at that low frequency. Figure 6 is the measured IM distortion. The IM is about the lowest we have seen for any speaker system. As might be expected from the use of such a small woofer, the IM is principally phase modulation. At the maximum level before amplifier clipping, the IM on 440 Hz consists of 15 degrees peak-to-peak phase modulation and 5 percent amplitude modulation by 41 Hz.

The incremental gain of the 2001 is such that a one decibel increase in signal voltage produces slightly more than one decibel increase in sound pressure. This trend continues up to within 6 dB of maximum level then reverses to produce less than a dB of sound per dB of signal increase. This is due to the internal amplifier and not the speakers. The effect should be a punchy sound at moderate to high levels with a softening of extreme peaks.

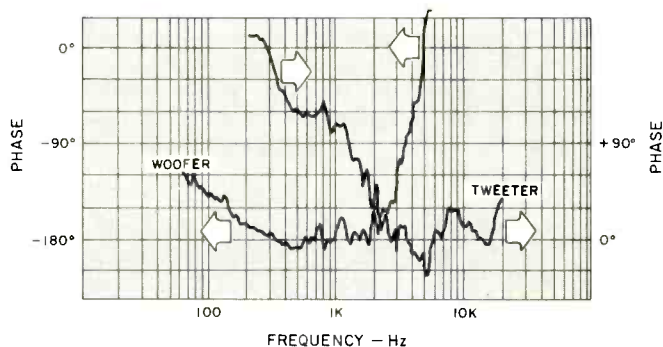


Fig. 3—One-meter phase response for woofer and tweeter.

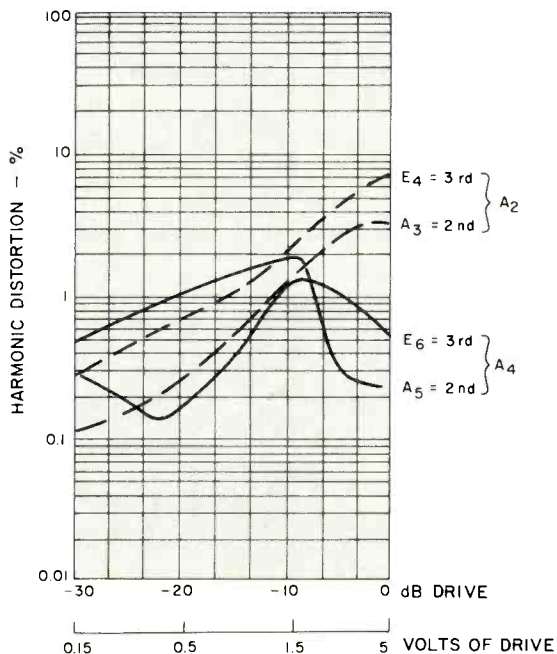


Fig. 4—Harmonic distortion for the musical tones A2, 110 Hz, and A4, 440 Hz, measured at a 12-volt battery potential.

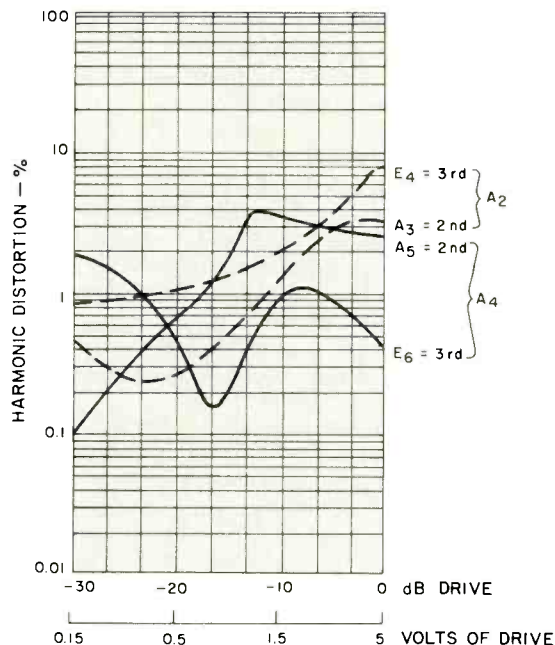


Fig. 5—Harmonic distortion for the musical tones A2, 110 Hz, and A4, 440 Hz, measured at a 14.5 volt battery potential.

The difference between the Dokorder 7100 and Teac's 2300S is about two miles of tape.



The DOKORDER 7100 costs almost \$100 less than the TEAC 2300S. That's about ten reels of the finest tape you can buy, which will give you 12 hours of recording time, which is equivalent to some 24 albums.

That's an important advantage because, like anything else you drive these days, a tape recorder takes a lot of expensive fuel to get you where

you're going and it's no fun to start out empty.

Just as important, you won't have to give up anything important to get that tape. When you compare functions, features, specs and performance you'll see our tape recorder is as good as theirs.

But when you compare price you'll find us miles apart.

After you look at Teac listen to

DOKORDER



	TEAC 2300S	DOKORDER 7100
Motors	3	3
Heads	3	3
Frequency Response at 7½ ips	±3 dB, 40-24,000 Hz	±3 dB, 30-23,000 Hz
S/N	58 dB	58 dB
Wow and Flutter at 7½ ips	0.08%	0.08%
Manufacturer's suggested retail price	\$499.50	\$399.95

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

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The energy-time response measurement is shown in Fig. 7. The soft dome tweeter provides the bulk of the energy for an impulse signal and the peak sound from the tweeter occurs at 3.0 milliseconds for a one-meter impulse measurement. The woofer signal arrives in the 3.3 to 3.6 millisecond time frame and is a bit more spread out than the tweeter. The subsequent peaks are due primarily to reverberation between the speakers and the metal grille as well as from enclosure edge diffraction.

Ninety-five percent of the total sound energy due to an impulse occurs within 3.2 milliseconds. The peak signal component at 3.0 milliseconds has most of its spectral energy at 12.5 kHz. Percussive sounds may therefore be expected to have a sharp bite in their acoustic attack.

Listening Test

The listening test for the ADS 2001 demanded considerably more than the normal amount of preparation. First, since this system is designed for mobile use, it was necessary to perform a legitimate "road test." A Datsun 260Z seemed admirably suited as a rolling test bed since it might demand a bit more of the 2001 than many other cars. The first problem was to get good clean program material that would put the 2001 to the test under highway conditions. Although the 260Z has an FM radio, its quality falls sadly below that of the ADS system. Fine for the manufacturer's type of cheapie car speakers, but not good enough for a critical listening test.

This problem was neatly solved by the loan of a new Nakamichi 550 portable cassette recorder, made available through the generosity of the Santa Monica office of Nakamichi.

The first task was to check out the Nakamichi 550 for quality on record/playback. The curse of the technologist is that he must not assume that all parts of a system are as advertised—he must check it out for himself as it wouldn't do to base a review on a faulty program source. So a complete spectrum analysis, pulse response, frequency response, and distortion measurement was made on the 550 in the record/playback mode using Dolby B and Chromium dioxide tape. This fantastic little tape machine met every specification.

Then I hauled out all my carefully protected test records and taped excerpts from each of them, being careful not to exceed the peak recording level used to check cassette distortion. The *Peace Train* cut from Sheffield Records Volume II was tucked away alongside the Volume III *America* and a Stevie Wonder selection. Some of Mark Levinson's beautiful piano music from his Reference Recording Series, Volume 2, was included, as was the first movement from the RCA recording of Shostakovich's *Symphony Number 15*. Bach's thunderous *Tocatta in D Minor* excerpt, some brilliant Flamenco guitar, and a bit of Stravinsky were excerpted from the Acoustic Research Demonstration Record. And on it went, a yummy selection of demonstration material that, like expensive chocolates, is far too rich to be devoured in one sitting.

During the taping of this material, the ADS 2001 was used as a monitor in the living room environment. The entire system, regulated power supply and all, was set up and auditioned. This gave a "listening test" under controlled non-mobile conditions in a good acoustical environment.

Following the recording session and a subsequent living room listening session with the taped material, the ADS 2001 and Nakamichi 550 were installed in the 260Z. The fuse supplied with the 2001 is a 20-amp quick blow. To protect against any chance of damage (hearing as well as speaker) due to accidental overdriving of the unit, the fuse was replaced with a 10-amp quick blow. As it turned out, the quality of the recorded material was high enough that even at peak clipping levels this 10-amp fuse has more than enough margin. For some material it is possible to get a higher average current on loud passages, which would require 20-amp protection.

The headphone jack on the Nakamichi 550 served as the source for the 2001 since this output is controlled by a volume control. The headphone output of the 550 is a perfect match for the low level input on the 2001. At maximum volume setting the 2001 is just brought to clipping level.

Several different mounting positions were tried for the stereo speakers. For physical reasons, no attempt was made to put them under the dash, but a good location was found in the rear, adjacent to the existing mounting holes for stereo speakers in the "Z." For other automobiles or vans, you will probably want to experiment with different placement.

Don't be afraid of not having enough sound level if placed in the rear—even if you have a Porsche. The ADS 2001 will give you all you need. With the windows down at legal highway speed, the music could readily suppress the sound of a full-song third-gear down shift on a mountain grade, and that's not exactly silent in this particular car.

As with all new toys, this beautiful combination of tape deck and sound system had to pass through a cycle of "playing" before this reviewer could get down to the business of serious listening. It was impossible to suppress the satanic

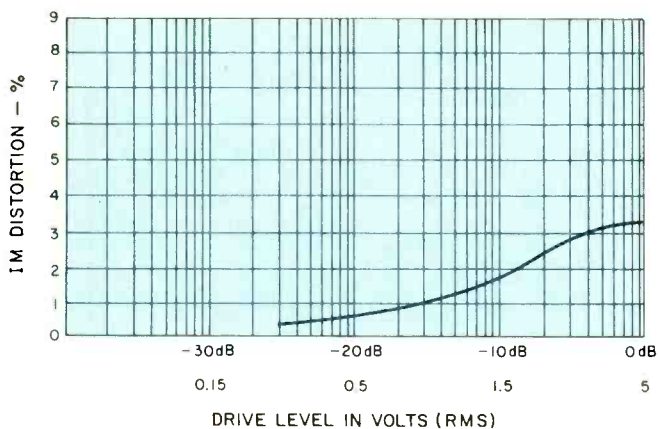


Fig. 6—IM distortion on A4, 440 Hz, caused by E1, 41 Hz, mixed one to one.

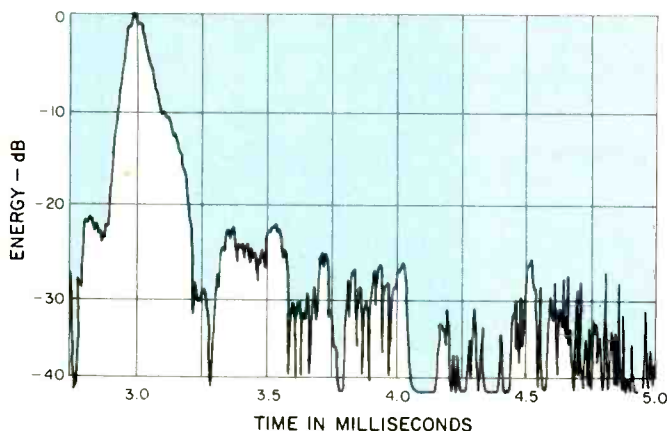


Fig. 7—Energy-time response.

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glee of pulling up next to a gaily bedecked van and calmly unleash 160 watts of clean high fidelity sound. Then just as calmly driving off as though totally unaware of the heads popping out of the van's windows.

The sound of the ADS 2001 in an automobile is clean, and it can be raised to awesome levels. I was particularly interested to note that a *clean* audio system does not suffer as much from limited dynamic range when road noise is present as music systems of more conventional limitations. The Z's regular FM receiver and speaker is almost useless for symphonic music at highway speeds unless the windows are rolled up. Quiet passages just disappear. Not so with the 2001. I know every part of the material I taped for auditioning, and quiet passages were down but not out. Perhaps the fact that the overall level could be raised to overcome the masking of road noise has something to do with this, but I could "stay with" complex music dynamics better with the 2001 than with the conventional audio system.

The 2001 has a good bass punch which makes it sound as though it goes farther down than it really does. Kickdrum will rattle the windows, but pipe organ low bass disappears. It's not a Klipschorn, but it is clean as far down as it goes, which is plenty low.

I was bothered by an upper bass peakiness which seemed to be caused by car body resonance. Also the 2001 is very bright for such a confined space. On some of the extended range passages I found that a tone control would be a decided help. Certain types of strident program distortion might be unpleasant unless a means were found to cut down the response above 5 or 10 kHz. On "cheapie" speakers this is seldom a problem, but a good system is another matter.

I liked the sound of the ADS 2001 for high quality reproduction in the confined volume of an automobile, though I was not as strongly impressed with what I heard during the living room audition. The bottom end and midrange is clean, but the top end seems mildly strident to my ears.

One of the peculiarities I noticed in a quiet listening environment was that the amplifier was emitting a very high frequency whistle at low level, and the whistle was a function of supply voltage. A check with spectrum analyzer and condenser microphone revealed that the static inverter, which changes the low voltage d.c. to a higher voltage d.c. for the amplifiers, was putting out a subharmonic acoustic signal in the 16 to 17 kHz range as well as a fundamental. The acoustic output is lower than the sweep acoustic output from many TV sets and is completely suppressed in normal usage, but some listeners may find it troublesome unless the amplifier is tucked away.

The bass speaker in these units is protected against overload by a limiter. As you might expect, this limiter only becomes audible at high sound levels and serves as a warning that the units are being driven too hard. It is, however, a program limiter that only affects the lowest frequencies and does not cause knocking or severe audible distortion in its operation.

Even with the mild high frequency stridency and lack of low bass the ADS 2001 actually puts out a more accurate sound than some of the present crop of speaker systems with walnut finish and a substantial price tag. I can highly recommend this system for those who want high quality sound in a mobile environment. And if you really have a taste for portable high quality sound, whether for field recording and playback or just plain good cassette listening, I recommend you consider the Nakamichi 550 and ADS 2001 combination. They appear made for each other.

Richard C. Heyser

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Classical Reviews

Edward Tatnall Canby

Mozart: Complete Church Sonatas for Organ and Orch. Daniel Chor-zempa; German Bach Soloists. Philips 6700 061, 2 discs, stereo, \$15.96.

Mozart: The 17 Festival Sonatas for Organ and Orch. Haydn: The Three Organ Concertos. E. Power Biggs, Columbia Symphony, Rozsnyai. Columbia MG 32985, 2 discs, stereo, \$13.96.

Here's a classic confrontation! The seventeen little organ sonatas (for small orchestra and organ, in spite of the name) appear in both recordings, all of them. Columbia adds three complete organ concertos by Haydn, in much the same general musical style. That's a lot of extra music, and the Columbia discs are a dollar cheaper than the Philips. But we don't buy records on length alone. Have to balance the various factors.

The Columbias are reissues (MS 6682 and 6857). The Philips is presumably a newer recording. It is definitely cleaner—and the wider spacing makes for better sound, which is on better surfaces too. You can't dodge this. Moreover, every one of the Sonatas has a repeat sign in the score for the two halves. Philips' performers play all the repeats. Columbia skips them. That makes the Philips versions much longer—it adds up. Which accounts for some of the seeming space difference. And all this without even considering the most important factor, the performance.

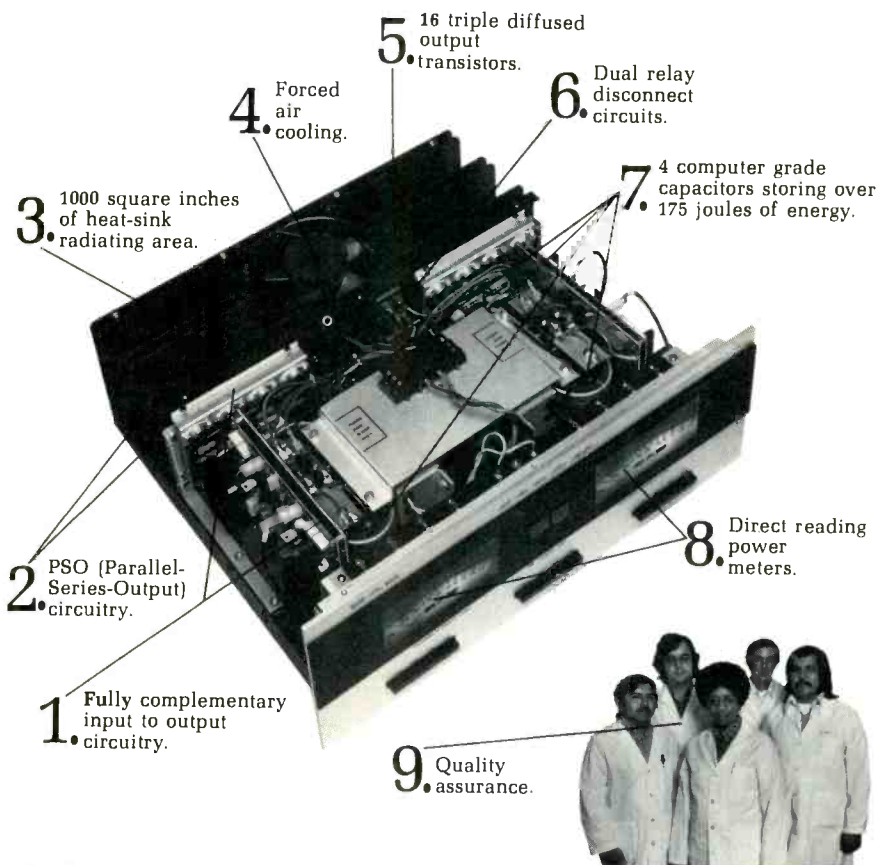
OK—no help for the confused. Daniel Chor-zempa plays a better sounding organ and he is less bump-tuously erratic than good old E. Power. BUT, in these works the organ really is almost nothing. It just fritters along in the background with nice little tunes here and there. Not important. The orchestra is what counts. (I'm telling you. Try for yourself if you don't believe me.) So forget the organ! Either version will do. As for the basic string orchestra, no question. Philips plays nicely but with a certain turning-of-the-crank quality. OK, but remarkably enough, the Columbia Symphony strings do a livelier and better shaped job, projecting more of the music, making for greater variety and generally superior listening. No doubt about it, this Zoltan Rozsnyai knew what to tell his players. It's his

music, too, that you hear in the Haydn concertos.

Good notes in both albums, Columbia's from H.C. Robbins Landon, who is the Nth in note-writing. Philips' more lush outlay includes a love-

ly picture of the featured 1746 organ, surrounded with precariously hanging *putzi*, naked cherubs, each with a scarf around the midparts. Are the scarves a recent addition or part of the original plaster? Can't tell.

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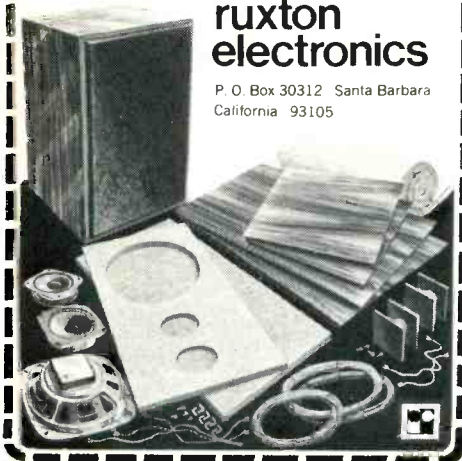
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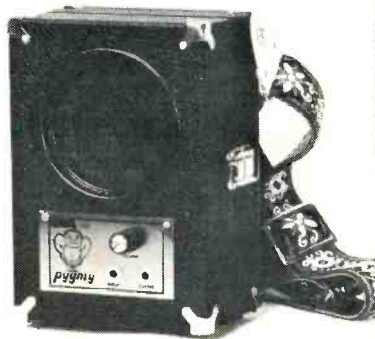
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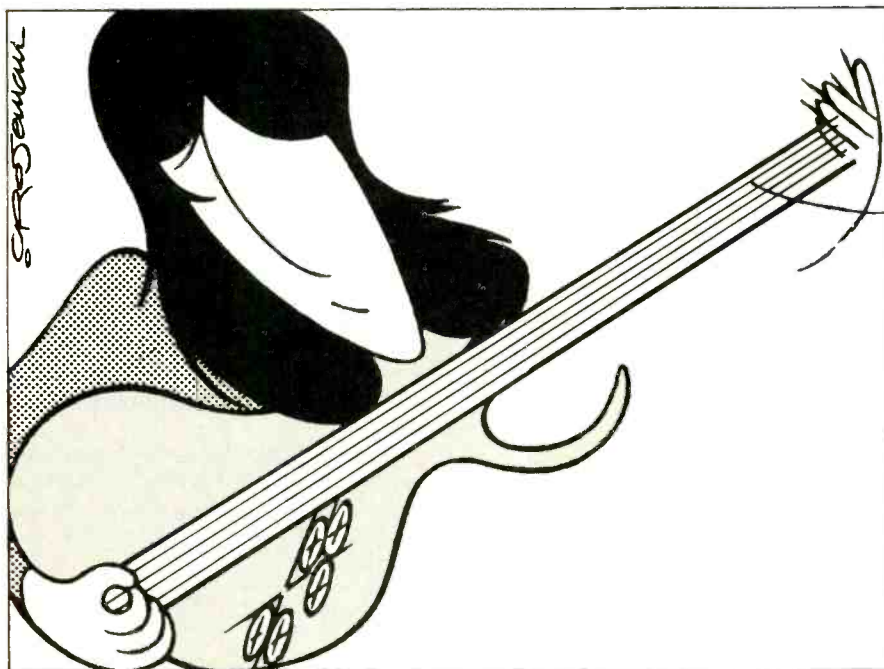
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some months ago were simply awesome in their sheer sonic weight and clean delineation. On a new organ recording I have recently acquired, *Michael Murray plays the organ at Grace Cathedral, San Francisco*, the sound of this organ's 32-ft. contrabombarde pipes was simply stupendous. To give you an idea ... the GR analyzer reads frequencies directly, and we noted 23 Hz at 106 dB SPL at 8 feet! Needless to say, the house was shaking, but fortunately the listening room has a concrete floor (overlaid with carpeting), so the resonances were minimized. Incidentally, as an index of the sub-woofer's efficiency, at this great output, the meters on the McIntosh just peaked at plus 3, which is 105 watts. This new organ recording features works by Vierne, Dupre, Widor and others and is Advent Records #5009 (no connection with the Advent speaker people). Their address is 23366 Commerce Park Road, Cleveland, Ohio 44122. The impact and solidity of 31 to 33 Hz bass drums in many of my master tape recordings was astonishing, reproduced absolutely cleanly with no boominess. On the new Columbia recording of Orff's *Carmina Burana*, there are some really huge bass drum sounds, but there are also sections in which a bass drum is very softly struck with a soft mallet. Unless you have something on the order of these John Marovskis' sub-woofer, you won't even be aware that it is on the record. The bass drums in the new Vanguard recording of *Peter and the Wolf* are reproduced with room-shaking power. The really low contra-bass string sounds, as for example in the new Vox recording of Strauss' *Also Sprach Zarathustra*, are absolutely visceral in their power. To give you an idea how clean the bass is from these sub-woofers, we measured 30 Hz at plus 0.3 dB, re 110 DB SPL @ 100 Hz directly in front of the speaker, with a second harmonic distortion of 0.6%!

As you can gather, I really think very highly of these sub-woofers. In combination with the Crown ES224 speakers, the sound is just magnificent, with the electrostatic section just loafing along, utterly unstrained and non-arcng, even at the high level output. John Marovskis operates as Janis Audio Associates, 2889 Roebling Ave., Bronx, New York 10461. His Janis W1 sub-woofers are priced at \$399.95 for the standard model and \$349.95 for a unit with plain walnut top. An individual calibration curve comes with each unit. At the moment he has no dealer set-up, so if you are interested, write to him directly.

The Column

Fred DeVan



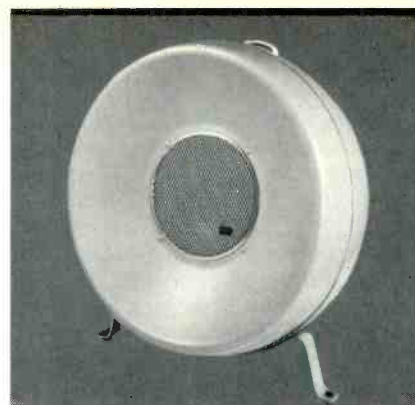
Blow By Blow: Jeff Beck
Epic PEQ 33409, SQ quadrasonic,
\$7.98

Spectacularly great records often come from the most unexpected sources, just as do real recorded bombs. In this day and age nothing should surprise those of us who survey the state of the musical arts. Presto, chango, whizbang. Crossover music, fusion music, blue-eyed soul. Country funk, rock-a-billy, jazz-rock, Electronic classics—and acid Fiedler! Many musical forms that are well represented in your record store today didn't even exist five years ago! Furthermore, today you are not sure what kind of music you're going to get on an album by an established name. Donald Byrd gets a monster hit single, Herbie Hancock a gold record, jazz pianist Les McCann and drummer Grady Tate are AM radio hit makers with vocal tunes. Tabla and oboe are familiar sounds on progressive-rock radio, thanks to exploring groups like Oregon. Stevie Wonder tunes are played and sung by everyone, and synthesizers, as creators of sounds

never heard before, are the dominant sound of our media. Just turn on a TV set to any action show or kids' program today.

It's amazing! The whole thing, the freshness and spontaneity, and the fine quality. Sure, there's trash, but the ratio of junk to quality is lower than ever before in popular music. This phenomenon is as inexplicable as it is unprecedented.

This album by Jeff Beck is a total and pleasant surprise. When Ira Sherman (of Epic) played a piece of this in my ear over the telephone, I could not guess who it was and he would not tell me. And later, when I put this album on the turntable I did not expect that this was the record I had heard. I could not expect that the work that Jeff Beck has been doing with Stevie Wonder had become so much Beck's own music. Jeff hasn't made an imitation Stevie Wonder record here, although two cuts (*Thelonious* and *'Cause We've Ended As Lovers*) are Stevie Wonder tunes. This is definitely a Jeff Beck album, albeit a new and refreshing Jeff Beck. It also is fine music.



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Before you even consider buying any other outdoor speaker, you should listen to the BARD at your Bozak dealer's showroom. We'll gladly send you his name and descriptive literature on the BARD.



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It's just one of those albums where everything works so well you can feel it. It does not sound like it took a long time to make; the spontaneity and energy levels are very high. It sounds like nobody really labored over it, as though everybody was engrossed. Nothing seems to be an accident, but nothing is strained or pretentious. Not even an oddly-John McLaughlinish cut called *Diamond Dust* (as opposed to *Lotus Pollen*, I suppose). At first it seems a bit of a copy, but that impression disappears quickly. It's too unpretentious to have more than a

titular association with Mahavishnu's John McLaughlin (Stevie Wonder has no copyright on the Hohner Clavinet, nor does M. Tilson Thomas have orchestral strings locked up).

Beck's guitar is an education in how tastefully the mega-amped-electric guitar can be played. **Blow By Blow** elevates him instantly into the stratosphere of stellar performers on the instrument. It also shows off his genius in choosing his musicians. Max Middleton on keyboards, Phil Chenn on bass, and Richard Bailey on drums and percussion are very much up to the

energy and musical splendor of Jeff Beck's guitars—as fast as they are dynamic, as precise as they are inventive. All the solos are impeccable interweavings between these four and the magnificent string orchestra. The strings are used for depth, detail, and warmth, yet they cook as heartily as does the quartet.

The producer, George Martin, wrote the orchestral arrangements and it shows. The music is exemplary, stunning, unique. The 4-channel mix is great! It is surround-SQ. No ping-pongs, but it does contain some splendid location emphasis. Especially a touch of intentional sound movement when a phaser is flipped by Beck, just like what happens in live concerts. This mix does not shoot spears at you from its four quadrants. The stereo mix is excellent when played back over SQ. It's fine in two-speaker stereo, but the detail in the quadraphonic mix is just short of incredible. There is so much to hear in the 40-odd minutes of playing time that the album seems uncommonly short.

Blow By Blow makes your ears hungry for more, and when it ends you won't want it to stop. There is a way out of this: play it again—it's well worth it.

Sound: A Performance: A+

Put It Where You Want It: The Average White Band
MCA 475, stereo, \$6.98

MCA records has finally decided that the public likes a band that MCA doesn't believe in. Atlantic released the AWB album that they made, and the rest is a Cinderella story, mixed with a horrible tragedy that is making unfortunate headlines.

Average White Band made their first album for MCA a year before their first Atlantic album (a second was made by Atlantic in March, 1975). MCA didn't have much confidence in the band, and all 50 copies of the record that anyone knew existed sat in a corner to be used as a chair for tired Roadies, or so it seemed. It was as though MCA wanted to keep their good records a secret.

Anyway, AWB is back again and it's no secret this time around. This is a good record; just as good as the terrific Atlantic **Average White Band**, AT-7308. Though this one lacks the magic of Arif Mardin's production, AWB is a group that has what it takes to make good music on their own.

Sound: A Performance: A+

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(Continued from page 10)

CCC — crosstalk compensation circuit — does a memorable job in straightening out the problems we are still having with the cartridge's super-sonic response. It's one of those feedback cancellation things, and it definitely adds a new security to the CD-4 demodulation, which is inherently close to margin and ever so easily thrown off tolerance. Also an excellent *Hi Blend* option, which allows you to derive most of the CD-4 signal and separation from otherwise noisy and distorted CD-4 discs, especially old and used ones.

But what I liked best of all in Mr. Dorren's SH-400 is the new and complex cartridge adjustment procedure — via six pushbutton level sets and a built-in meter. To tell the truth, those horrible warble tones you had to listen to, via the mandatory 7-in. 45-rpm test set-up disc, almost drove me out of my mind; I still can't hear a second's worth of warble without incipient migraine. So—the meter, and God save the meter. I never could get proper results with those first demodulator test set-ups. With Dorren's

SH-400 I can do the whole process via *sight*, meter level, and it takes seconds, literally. I re-do it, just to be sure, every few days.

I quickly add that this Technics model, unlike its predecessor, has an instant *Direct* switch, a cartridge feed-through which turns you over to the matrix side of things in a quarter of a second, and no reconnections. That's the spirit, gents!

In sum, if I have smoothed quickly over a million details in this new equipment, it is because you can find them easily enough elsewhere, in

more technical exposition. I just have to say once more that, though this year's decode-demod units are more complicated than ever before, they work so much more easily and surely, in their respective (and interconnected) systems, we have indeed come to our turning point. From here on, in many big ways, it is going to be downhill. So buy up these components, quick, and keep your eye peeled for the inevitable cheap stuff that is going to follow soon; because it will sound basically the same, and work even more easily.

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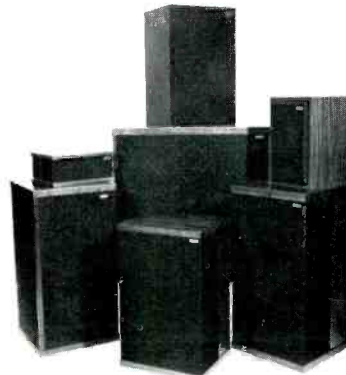
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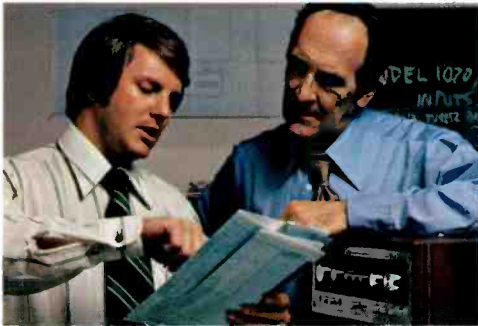
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