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10th ANNUAL CAR STEREO DIRECTORY

REVIEWS: SOUTHER SLA-3 TONEARM TEAC Z-7000 CASSETTE DECK



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Back panel connectors ready for digital cassettes or compact disc players.

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Selects cassette mode and changes display.

Selects tuner mode and tuner command display shown.

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Pioneer's new Centrate offers you more sophisticated functions and features than you'll find in any other auto stereo in the world. (One Centrate Graphic Equalizer, for instance, even features a sensor that adjusts the volume when you roll the window down. Or up.)

So it's also one of the most expensive auto stereos in the world.

What you see here — just the Centrate AM/FM Stereo Cassette unit and Graphic Equalizer — cost \$850.00 and \$240.00 respectively.

The complete Centrate System — including amplifier, sub-woofer, remote control, four speakers and installation — could

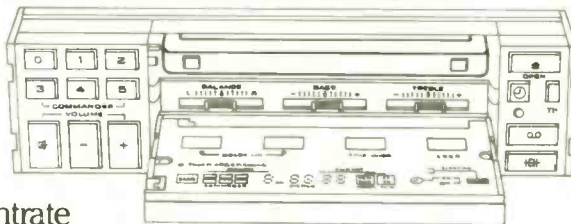
cost \$2,000 to \$3,000.

But even though Centrate may not be on everybody's shopping list, we present it all the same to impart a bit of data you might actually use:

Even after we told our engineers to go-for-broke, damn-the-cost, build-the-best-of-everything into Centrate, the tuner component they chose was the very same Supertuner™ III available in a whole line of eminently affordable Pioneer models.

Which is another way of saying you can't buy a better car stereo. Even if you spend more for the stereo than you spent for the car.

The control panel flips down to reveal a microprocessor-controlled 3-motor direct drive auto reverse cassette deck with Dolby® B and C.



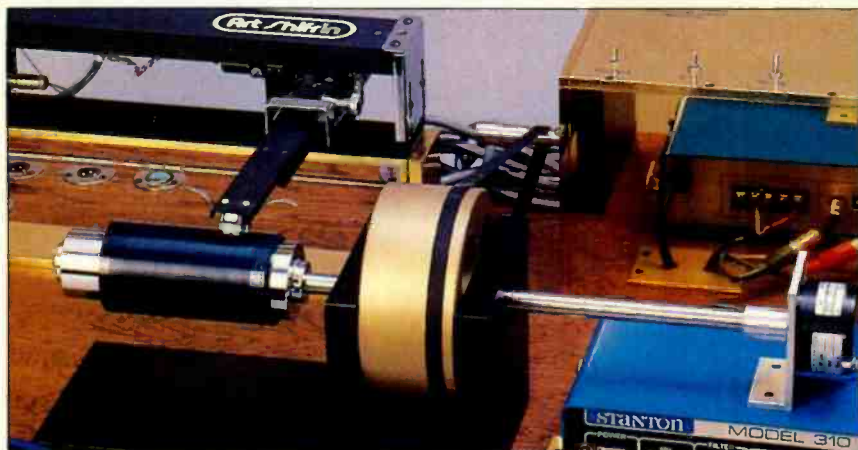
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Audio

MAY 1984

VOL. 68, NO. 5



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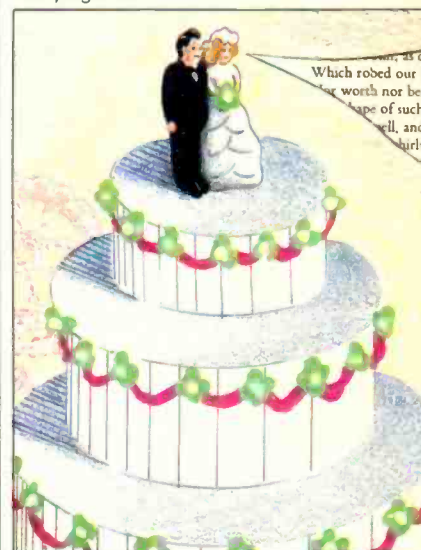
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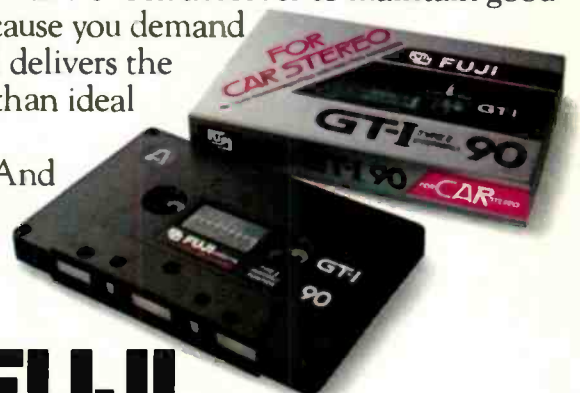
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AUDIOCLINIC

JOSEPH GIOVANELLI

Loudness Control

Q. What, specifically, is a loudness control?—William Kay, Yonkers, N.Y.

A. The loudness control is designed to compensate for human hearing deficiencies. As the sound level decreases, the ear loses sensitivity to low frequencies. (This is why listening at low volume produces a subjectively "thin" sound, and is probably part of the reason that we like to listen to our music at high sound levels.)

There are occasions when it is impossible to listen at high volume levels. The loudness control is intended for use at such times. It acts mainly by boosting the low frequencies as the volume control setting is reduced. Conversely, the bass is restored to normal balance when the volume control is advanced.

The ear also tends to lose some treble sensitivity. The better loudness-control circuits take this into account by boosting treble as volume is lowered, and restoring to normal as volume is raised—just as was done for low-frequency loudness compensation.

Thumps and Record Rotation

Q. My turntable has developed a noise that sounds like a heart murmur, with rhythmical, low-frequency bursts which are in step with the rotation of the platter at 33 1/3 rpm. It is not audible at 45 rpm. These bursts are heard

through the speakers, especially when listening to quiet passages of music. Also, the sound becomes more audible as the tonearm moves further and further towards the center of the record. When the arm is placed in its rest, there is no audible sound. The turntable is a direct-drive unit.—Patrick Carrington, Shreveport, La.

A. What immediately comes to mind is that you may be tracking at too great a force. Under the right conditions—including even slightly warped discs—the warp will push the arm upward. The underside of the cartridge body may strike the disc, thereby causing the sound you hear; it would certainly account for the once-around nature of the sound you have described.

Similar results may be noticed if you play seriously warped discs, even where tracking force has been correctly set.

This does not, in itself, explain the lack of sound when playing 45-rpm discs. The geometry of the arm may be such that it will not come into contact with the disc when only 7-inch discs are played, regardless of rotation speed. If you use 12-inch, 45-rpm discs, however, and if the sound is not heard with their use, I can only think of one possibility. Perhaps the bearings on which your table rotates are "sloppy." At slow rotating speed, the table may move to and fro, causing the table

to rise and fall. At higher speeds, the platter may exhibit better flywheel action. It might then run truer, being less dependent on its bearings for guidance.

Vocal Clarity

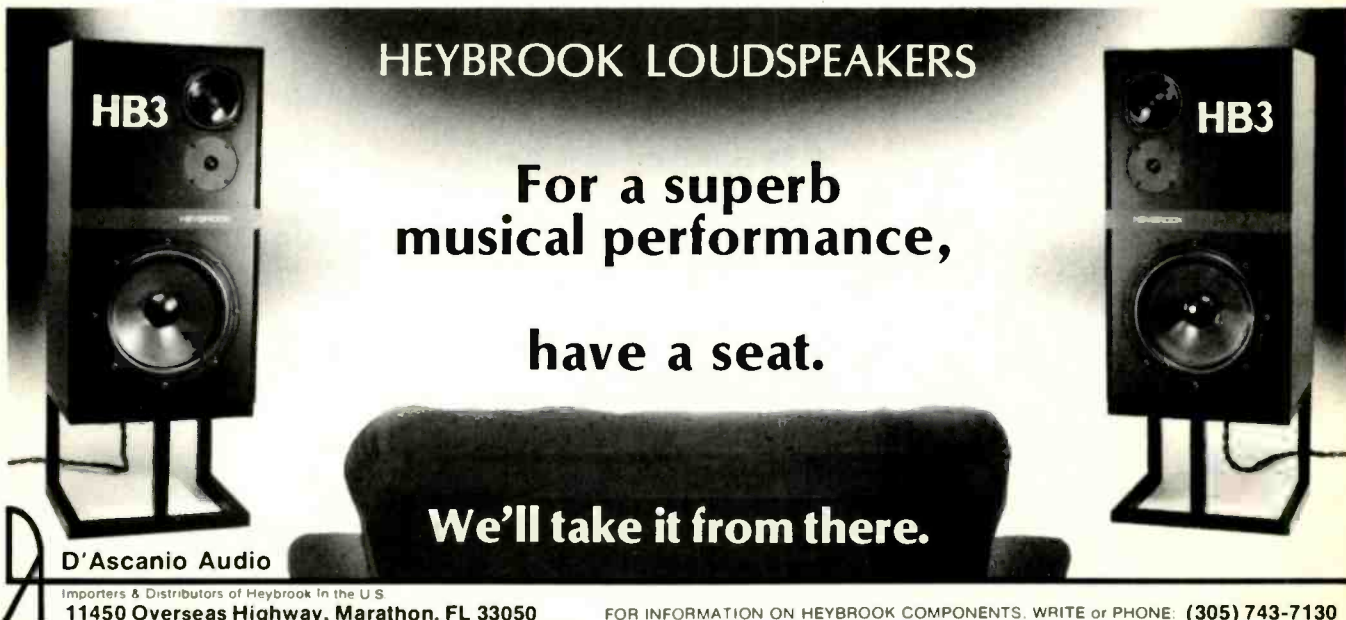
Q. When I listen to my FM receiver, I notice a vocal clarity that I do not experience when playing records on my turntable. Do I need some kind of signal processor?—Rod Stankey, Canoga Park, Cal.

A. FM stations often employ a number of signal processors. Chances are that this accounts for the difference in sound quality when listening to discs from your turntable as opposed to listening to discs broadcast on an FM station.

Are you listening to the same discs in each instance? If not, it well could be that the disc played over FM was intrinsically better than that which was playing on your turntable.

Much of the vocal "clarity" or "presence" is achieved by boosting frequencies in the region of 2.5 to 5 kHz by just a few dB. If this is the effect you desire, it can be produced by an equalizer.

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.



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Static Build-Up on Records

Q. Is there a way I can eliminate the static charge which builds up during record play? By the time a 12-inch disc has played through, a significant charge has been transferred to it. When I lift the disc from the turntable, I can feel the charge 1/2 inch away. The cartridge/arm combination is also charged, which I determine by lifting the arm. As I do this, I hear crackling static in the loudspeakers. Both the arm and turntable are grounded.—Bob Bianconi, Baltimore, Md.

A. The crackling you hear may not have anything to do with your static problem. I have encountered a number of tonearms which depend on their pivots to carry the ground from the arm proper to its mounting base. Lifting and moving the arm will produce intermittent grounding and ungrounding. This results in sounds similar to what you have described.

To cure this condition, you must either clean the bearings with an appropriate contact cleaner or perhaps run a flexible wire from the arm proper to its base, where it will pick up a solid ground.

This solution may result in the body of the cartridge being better grounded and may help to discharge static before it attains the proportions you have described.

I recall one instance in which the headshell was plastic, as was the cartridge body. Static build-up was a very serious problem indeed. I cured it by wrapping the cartridge in aluminum foil (except, of course, for the front) and grounded the foil to one of the ground terminals.

Broadcast Tape Cartridges

Q. What type of recorders do broadcasters use? I have heard they use machines which record onto a cartridge similar to the 8-track system. I gather that the broadcast version has just three tracks (left, right and one which automatically stops the tape when it has finished playing). What makes this system so spectacular? Also, if it is so great, why isn't it available to the public?—Jay Sanders, Whittier, Cal.

A. You are correct as to the operation of the recording systems often used by broadcast stations. Cartridges

are used, not because they are so spectacular in their sonic qualities, but because of the convenience of using them. They are easily loaded into a player; the stop-cue tone from one player can be arranged to start the next one. This rapidity of control is what is required by many stations; the rule appears to be that silence is never golden.

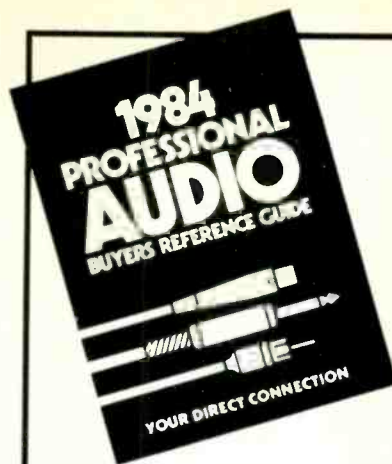
The equipment needed to produce and to play these cartridges is available to anyone who wishes to purchase it. In order to take advantage of this system, care must be taken when introducing the stop tone. It must not be at the end of the selection or program, but recorded just prior to the start of the selection. This is because the cartridge is an endless loop. If the selection is to start immediately after the start button has been pressed, means must be provided so that the tape stops at the correct place—which is not at the end of the selection, unless the cartridge has been loaded with just enough tape for it. Unless you are prepared to spend a considerable amount of time producing cartridges, you will be better served by other recording systems.

Volume vs. Channel Balance

Q. I have a receiver which is four years old. It has a problem, however. When the volume control is adjusted between 0 and 2, there is a slight channel imbalance, favoring the left channel. With settings between 2 and 4, channel balance is even—as it should be. With any setting above 4, the unbalanced condition returns. What could be causing the problem? What is its solution?—Carl A. McGhee, Bethesda, Md.

A. If the problem you have described was not present when you obtained your receiver, I suspect that the volume control needs to be cleaned or replaced.

If this condition was present when you purchased the receiver, the volume control was defective. The part should be replaced. Hopefully, the new control will track better than the original potentiometer does. By "tracking" I refer to the two sections of the control (one for each channel) exhibiting similar changes in resistance versus shaft rotation.



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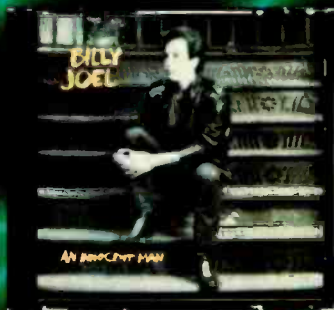
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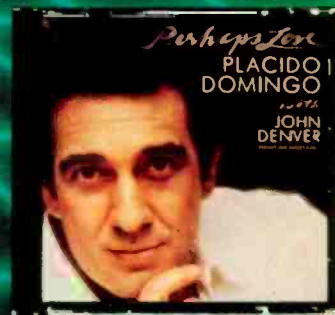
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two 8-inch drivers. The enclosures are available unfinished, finished and upholstered to match a car, or finished and upholstered with drivers. Prices (finished, with drivers): 614-U, \$300.00; 628-SW, \$400.00.

For literature, circle No. 100



Audia dbx Module

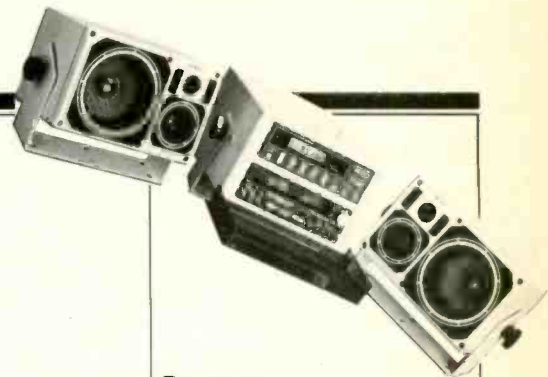
The Audia NRX-50, a dbx-II noise-reduction module, is the first in a projected series of modules to be used with Audia car-stereo receivers or tuners. Its one control is an on/off switch, which illuminates the dbx logo when on. Price: \$85.00.

For literature, circle No. 101

Technics Frequency Analyzer

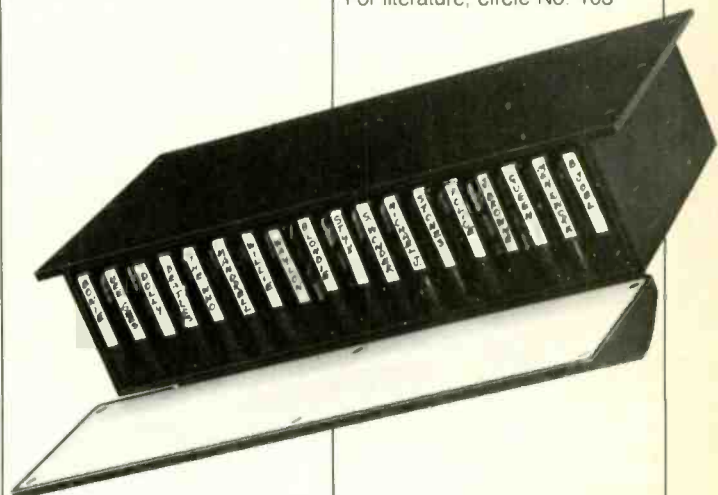
The Technics SH-8000 is a battery-powered, 1/3-octave spectrum analyzer of unusual design. Instead of generating pink noise and

displaying all 31 frequency bands at once, the unit produces warble tones in one band at a time, while output in that band is read from a meter. Price: \$150.00. For literature, circle No. 102



Regency Marine Stereo System

The MS 5000 system, from Regency Electronics, includes an FM/AM tuner and a combination cassette player/equalizer/amplifier in a tilting case with flip-down weather shield, plus two optional three-way speaker systems. The tuner has a 15-station memory, manual and seek tuning, and a backlit liquid-crystal display with digital clock. The cassette/amp unit includes a five-band equalizer and auto-reverse tape deck with Dolby NR, and delivers 13 watts per channel at 5% THD. Price: \$499.00; SP 50 speakers, \$129.00 per pair. For literature, circle No. 103

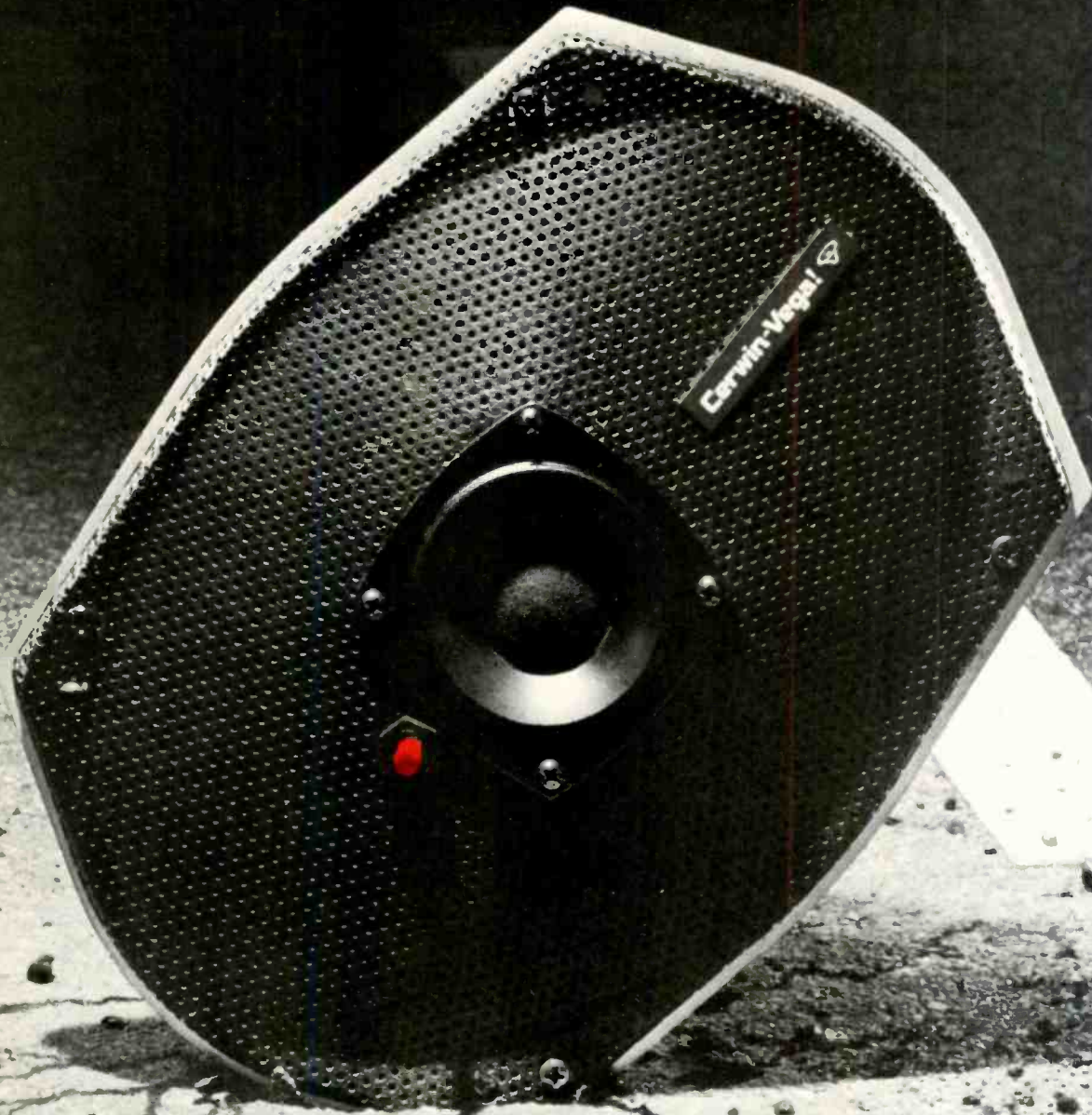


Pompano Cassette Holder

Flip down the door of the Pompano Cassetter, and a light within the door glows to illuminate your choice of 18 cassettes. The tapes are stored without cases, simplifying their insertion into a player; labels are

provided for the cassette's ends, and additional labels are available. The Cassetter operates on 12-V d.c., is supplied with mounting hardware, and is available in four colors. Price: \$49.95. For literature, circle No. 104

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We've also been able to eliminate inferior materials like plastic from the design of these speakers; the all-metal grilles are completely impervious to heat, direct sun, and ultraviolet light.

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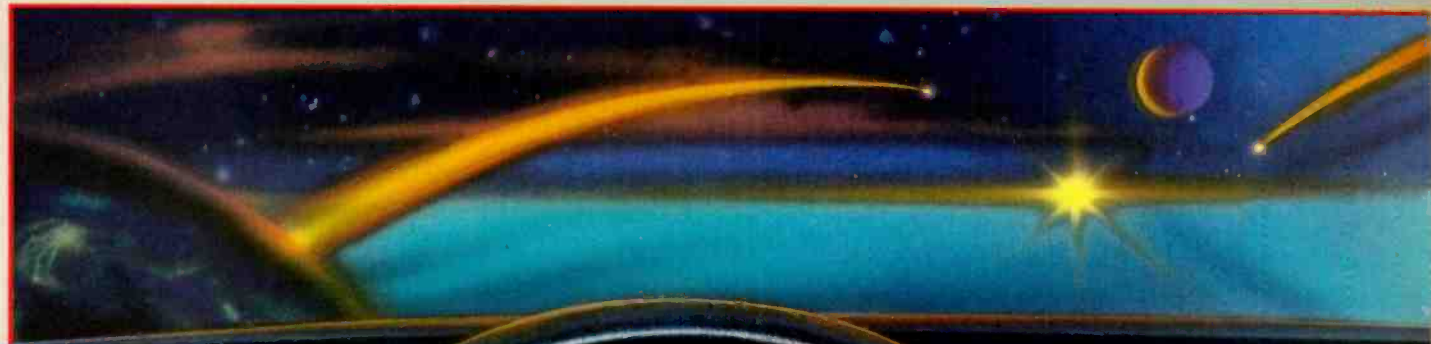
Camaro Berlinetta Climb in. Buckle up. Adjust the retractable, touch-sensitive instrument pods so your hands never have to leave the wheel to control vital functions. Turn the key and watch the system monitor perform seven preflight tests as the engine sparks to life. Blip the throttle and watch the vacuum-fluorescent tach dance to the rhythm of your right foot.

To orchestrate your voyage, dial up a symphony on the pivoting, pod-style Delco AM/FM stereo with vacuum-fluorescent display and optional graphic equalizer. (Radio may be deleted for credit.)

Now, put it in gear, give it some gas and watch the digital speedometer numbers multiply. Your journey has begun.



Let's get it together...buckle up.



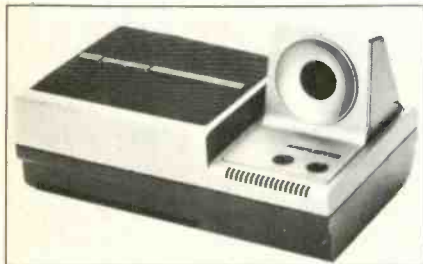
CHEVROLET
taking charge

SELF-POWERED PROGRESS

Usually, I start my CES car-sound wrap-ups with the in-dash units. Since they're more complex than the other parts of the system, with more knobs and circuits, the biggest news is likely to be there. But the most patent trend this year was in another area: Speakers—or, more specifically, self-amplified speaker systems. Audiovox, Philips, Pioneer and Sparkomatic all had interesting variations on the theme.

The Philips EN-8900 (apparently first in a powered series) is an amplified version of the EN-8895, adding three 17-watt amps to its complement of two square woofers and a tilt-up tweeter/midrange module; price, \$600 per pair.

Audiovox and Sparkomatic had similar ideas: Speaker systems with matched amplifiers attached—bi-amplified, full-range models and self-amplified subwoofers. Audiovox's Constant Velocity series includes biamped models (18 and 12 watts) in two sizes, a single-driver/single-amp 4-inch speaker, and a 6 × 9 subwoofer (44 watts), all flush-mounting. The biamped models have high-frequency level controls on their grilles, while the subwoofer has a low-frequency control. The amplifiers have level-dependent equalization, apparently (the company's explanations are glowingly self-contradictory) adding loudness compensation at low levels and preventing over-excitation and distortion at high ones.



Sparkomatic's Amplidyne ASK 4020

Sparkomatic's Amplidyne series includes three bi-amplified systems (at prices from \$200 to \$300) plus a self-amplified subwoofer (\$200), all self-enclosed, for surface mounting. The full-range models have stand-up tweeters (another rapidly growing trend). The speakers have 2-ohm impedances to obtain maximum power from the available voltage swings—permissible, once it's known they'll be used with

amps built for that impedance. The amps' proximity to the drivers saves the need for lengths of heavy cable to handle the high current that results.

The Pioneer entry was a \$400 subwoofer, the GTS-X80, part of their new Centrate component system. This, too, is a surface-mount box but with a separate control module. The controls include crossover frequency (60, 75 or 90 Hz), gain, and phase reversal. The flat 6½-inch driver is powered by a 44-watt amp. More important, this is the first car-stereo speaker I can recall to use motion feedback for better control of resonance and frequency response.



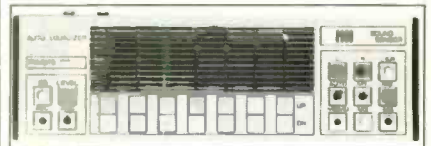
Concord HPST-60

Concord, Ohm, and ESS had other firsts: Concord had two two-way speakers with electrostatic, independently positionable tweeters. (No great surprise, as Concord last year bought Soundmates, which had been making JansZen electrostatics—one possible reason why Concord itself has just been purchased by EPI.) ESS's introduction was a 6 × 9 coaxial with a Heil tweeter. Ohm also showed prototypes of mobile Walsh speakers.

Stand-up tweeters are becoming common in coaxial and two-way "plate" speakers, although Boston Acoustics introduced the first one I've seen in separates. Sony and AR ventured into separates, too, but with conventionally mounted tweeters. AR also had an impressive 8-inch subwoofer, as did AFS Kriket.

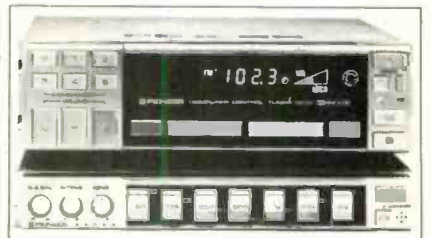
In amps without speakers, the biggest news was probably Harman/Kardon's first entry, the CA260. It delivers 60 watts per channel into 4 ohms, 90 watts/channel into 2 ohms, and 180 watts bridged mono into 4 ohms. Like H/K's home amps, it's a high-current design. Rockford Fosgate showed more powerful Punch models (37.5 and 75 watts per channel), plus a Power 650 at 4 × 125 watts. HiFonics had

a new series, named after ancient gods, ranging from the Mercury (16 watts/channel) to Zeus (200 watts/channel). Linear Power had a series of amps so new that spec sheets weren't ready; more on them next show, I guess.



Panasonic's prototype EQ

Panasonic showed the most interesting equalizer, a prototype automatic unit. Unlike earlier automatic units, its microphone can be remotely mounted so that sound will be equalized for a specific listening position, rather than for the equalizer's own location in the dash. Their literature doesn't mention it, but it would appear from the controls that the same mike can sense ambient noise and adjust overall level as well.



Pioneer Centrate components

That's definitely the case with Pioneer's Centrate EQ-003, an otherwise non-automatic seven-band equalizer of extreme compactness (just 1 inch high). With Yamaha and Alpine already offering auto-levelling equalizers, it looks like there's a definite trend afoot—and a welcome one.

The Centrate centerpiece, though, is the FEX-95 tuner/cassette unit, shown in prototype last year. The tuner section is a Supertuner III with presets for 12 FM and 6 AM stations, plus two-way scanning and a radio program timer with two settings (and a built-in clock, of course). Even the AM section is improved, with auto-variable i.f. bandwidth. The tape section has auto reverse, music search and scan (forward and back), Dolby B and C NR, and automatic pinch-roller release at power-off. There's also an AUX input—for CD, perhaps? A knobless DIN mount,



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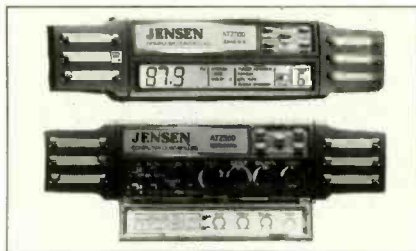
CRUTCHFIELD

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Jensen's ATZ series flip open once for installation, a second time to give you access to controls.

the FEX-95 has a dial that flips down to reveal the tape slot and subsidiary controls. The unit is \$700, plus \$100 for its optional remote control, in case you want the back-seat passengers to share access.

Both the flip-down dial and the remote were found on other company's offerings, too. Jensen's new ATZ line has only controls beneath its flip-down dial; the tape slot is always accessible. But the ATZ line has a more interesting "flip" feature: In order to get the now-fashionable knobless look in a radio designed to fit conventional, two-knob installation spots, Jensen has mounted the volume and tuning buttons on little ears which fold down over the nose-piece during installation, then swing out and lock to the "control" shafts (which actually serve here only for bracing and positioning). That knobless look is more conventionally obtained by many other units designed to fit the new, square DIN panel slots, including Sherwood's CRD-350, Sparkomatic's SR325, and the futuristic-looking Blaupunkt New York.



Jensen ATZ500

As to remote control, another multi-function wireless unit is found in Blaupunkt's new Houston, while Philips' not-so-new AC825 has a two-part wired remote system, consisting of a remote display and a remote tuner search button. This simplified system seems better suited to a driver's purposes, less to a back-seat passenger's, than the full-control Blaupunkt and Centrate systems. The swing toward simplicity is less evident in the tuning display, however—it has an extra digit tacked onto the station frequency, a slight distraction when you're trying to read the station quickly.

An even more specialized wired remote comes with Nakamichi's new TD-800. This provides manual tape azimuth control in place of the earlier TD-1200's NAAC automatic azimuth sys-

tem. That, and the absence of automatic reverse, lower the TD-800's price to \$890; meanwhile, a more compact version of the TD-1200, the TD-1200II, sells for \$1,260.

The Centrate and several other new Pioneer Supertuner III units share a system called 2-Way High Power, consisting of four 6.5-watt amplifier channels which can be strapped together into two channels of 20 watts apiece, plus a unique fader system that lets you use the strapped amplifiers to power one pair of speakers while using preamp outputs to feed an external amp that powers a second pair. This is somewhat similar to Jensen's Flex-Fader system, which also lets you use both the built-in and external amps under fader control; the difference is that Jensen's system fades the front pair of speaker outputs against the rear-speaker and preamp outputs, allowing the use of three pairs of speakers instead of the usual two.

Both the new Pioneers and the Jensen ATZ units exemplify the growing trend towards full night illumination. Pioneer, in fact, is so proud of theirs that the brochure shows all their new models glowing softly green in the dark.

The anti-theft trend is joined by Kenwood's KRC-626, an under-\$500 unit which can be removed from the car and carried off to safety with a special handle (a \$19 option). The unit has Dolby B and C NR and a lithium battery to preserve the contents of its 12-station memory when it's not plugged into the car. This did not, however, prevent a thief from making off with Kenwood's entire show car before they could get it to Las Vegas.

The only new AM-stereo unit I spotted was Sherwood's CRD-150, which espouses the Motorola C-QUAM system, as do Delco and Chrysler. Jensen has announced a preference for the Harris system, but no models receiving it, while Sansui has models which receive all systems. Also new in reception technology were the Sony XR-100 and the Audia DTX-1000 (a new line from Clarion), which use "diversity reception," switching automatically to get the better signal at any instant from two separate antennas. Previously announced, these units are now finally available.

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EDIT AND WED IT

This is the story of a small sound-editing job. It is not exactly of world-shaking importance, yet for a few individuals, including myself, the finished result is not far from a human miracle. As is any good tape editing.

I made the original nearly a half-century ago—43 $\frac{2}{3}$ years, to be exact. Now, at last I have edited it on tape into a final form. How's that? For the first time, thus, this recording is now playable as I surely intended it, ideally speaking, though there was no editing then except, maybe, in Hollywood talkies. Somehow I sensed the future possibilities, if nothing could be done in the old disc medium—for in its tape transfer, this was the most fruitfully editable recording I have worked with for a long time. Wonderfully susceptible to improvement! Shaping the salient material, rearranging, re-pacing and—most important—removing the appalling quantities of sonic junk that are a permanent part of the disc original. Dozens of false starts, abrupt endings, blank stretches, squawks, sputters, growls, dropouts, pops, roars, and, most of all, insane 78-rpm repeats of a syllable or two, over and over, where faulty grooves lock up. What could I do? I was an amateur in a professional field. I couldn't help myself. But I knew instinctively how to get down the gist of what I wanted, for future reference. The editing had to wait. Until editing was invented.

I have come to realize that sound editing is one of the great and primary innovations in our field, on a par with the basic innovation of sound recording itself some 75 years earlier. Is it any wonder that digital editing, still enormously costly, is a major factor in the upheavals of our recent digital sound revolution?

I made my little record in August of 1940. It is not music (though music of a sort appears now and then), but voices. A wedding! The biggest wedding we'd ever seen in our corner of Connecticut. That was the year I bought my first recording equipment, a radical move for any consumer in those days. No tape then. No cassettes. Nothing that one could casually tote around to social gatherings, lectures, concerts, ball games and the rest, as we do now. The only portable



Illustration: Philip Anderson

recorders were those unwieldy electric jobs at 78 rpm, good for three or four minutes at a time, by means of which the early folk collectors—such as Alan Lomax and his father John, the people at the Library of Congress—took down Leadbelly, the Carter Family and other folk music greats. The sound was abysmal. Noisy, grating, dull, no highs above maybe 3 kHz. That was it, outside of the studio. The best commercial 78s reached a level of 6 or 7 kHz (though we are now aware that much more could be, and was, done inside the big labs, including Bell), but almost nobody had home equipment to play that sort of high end. We were accustomed to a muffled sound, both on radio and records, minus overtones and without sibilants. "Super Soft Suds" became, as a matter of course, "Fooper Folt Fuds." We weren't bothered; we got the gist of both speech and music.

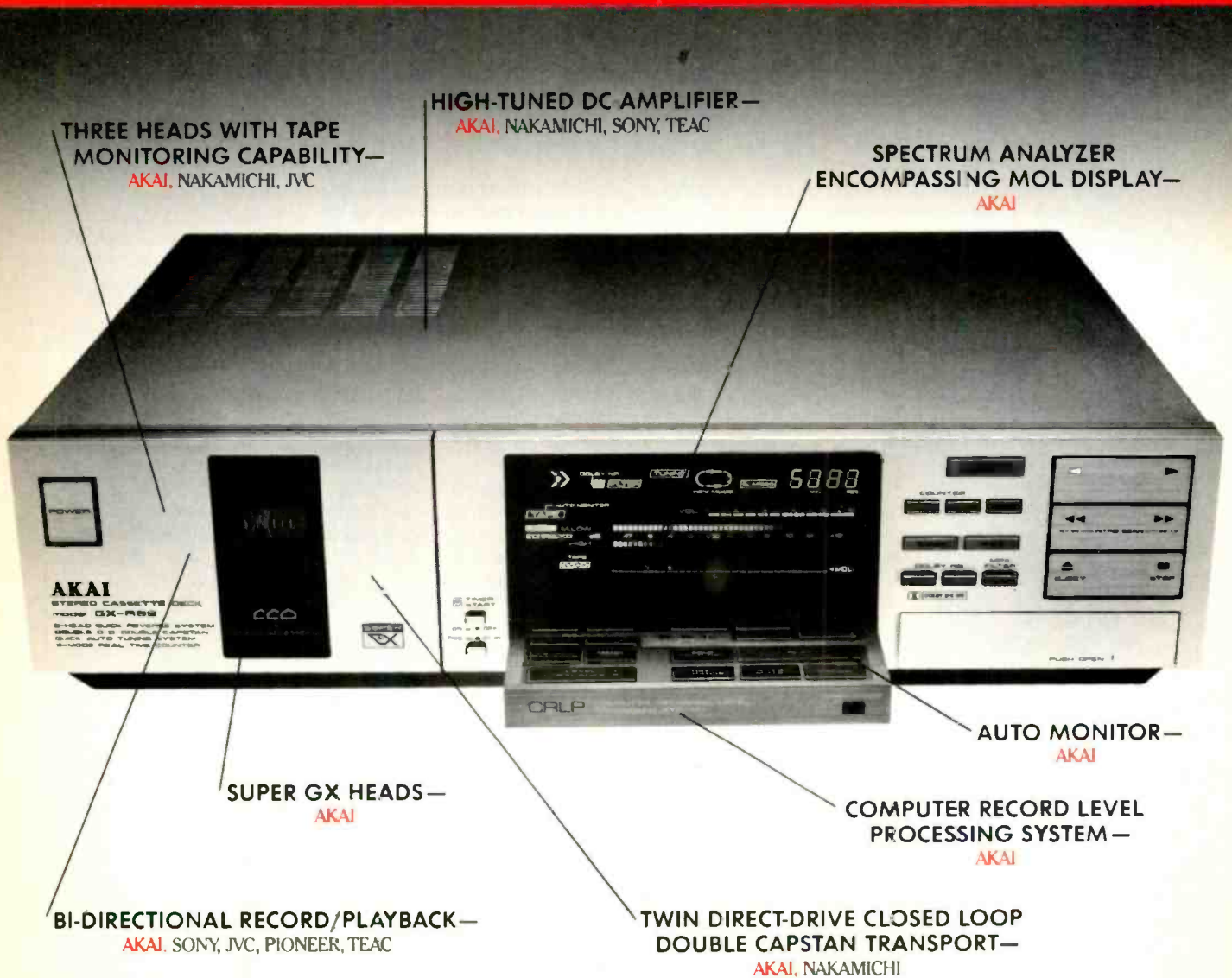
What fired me up in early 1940 was a new, light Astatic crystal cutting head that was said to cut a usable 6,000 cycles, phenomenal for the day, at least in home or semipro equipment. Also, and coincidentally, there was a new semipro recording lathe that was fastened onto a home turntable (sturdy type) like an extra pickup arm and then lowered down over the (short) spindle. The revolving table then screwed the

overhead cartridge sidewise, as in larger and heavier professional models. All in all, this was more than I could pass up. I bought the whole shebang and began experimenting only a few months before this large wedding came along, my childhood friend Sally and her Jack.

Some wedding! A dozen bridesmaids under white parasols, innumerable male attendants, Mother of the Bride in a white hat with a large dove, a veritable pigeon, wings outspread, nodding and dipping as she greeted her friends. And a state policeman. Also a colossal thunderstorm which burst just as the knot was tied (outdoors) and immediately knocked out the power transformer right outside the house, leaving us groping in darkness for the champagne. No—I wasn't allowed to record the ceremony. Would have been thought blasphemous. Nor could I take 8-mm movies, though I got all the visible rest of the wedding from start to end (clearing the debris).

Instead, I set up my sound equipment in a small room next to the wedding buffet supper, the power having been restored. The idea was to record a brief, personal wedding message from every guest who could be snagged into that side room, though I missed a few in the general exuberance. For this purpose I employed,

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I have come to realize that tape editing is one of the great and primary innovations in our field.

shall we say, beaters. They rounded up the guests, fair game, and ushered them or dragged them, one by one, towards the fatal mike. Most had never seen one before. They got flustered, muttered to the mike—as though it wouldn't listen—"What shall I say? I don't know what to say!" Or, loudly at the end, "Is that enough? Shall I say something else?" And almost every one of them forgot to give his or her name. (Shouts in the background: "Your name! Say your name." Then suddenly, triple forte, "Oh, AUNT RACHHEL!" 200% overload.) Absolutely no mike technique. Except for those inevitable few, including some elderly people, who were born with an instinctive microphone charisma and did it exactly right with no coaching at all. One was the Governor of the State of Connecticut. He went ape. ("I'm de boid on de top of your mudder's hat.")

There was one, hideous, overwhelming deficiency in my 78-rpm disc equipment that defied improvement. The chip. Not the electronic chip of today, nor the chip-off-the-old-block, but that wiry, horsehair-like, coarse black thread which sprang out from the cutting stylus (steel?) as it chiselled through the shiny surface of the recording disc. At 78 rpm, that chip really shot out. Being a species of plastic, it was prone to static and would instantly stick to almost anything it touched. With much more coming along at high speed, a snarl and tangle would build up, almost impossible to stop. Worst was the wraparound: The chip would stick to the disc and whirl around like lightning to hurl itself under the rear of the cartridge. Instant drop-out, derailment and lift off; instead of cutting, the stylus tried to ride over the chip. No grooves, no sound. You had to stop and start again.

We tried everything. You learned to grab the chip and haul it to one side—if you could get hold of it fast enough. Then, briefly, it might pour, by gravity, over the edge of the table for an unscathed recording. With care, I got three or four uninterrupted minutes on rare occasions, but in the hubbub and hurly-burly of a wedding supper, with more champagne, the chip problem became acute. I did my best. Sometimes I achieved maybe 20 seconds before tailspin, often much less. (All

you could do was to stop and then try again a bit further on the disc.) Mostly I got fragments, punctuated by hideous noises and those insane repeats as the groove broke down. But I went straight ahead, undaunted. The courage of the pioneer! Well, yes, if on a very modest scale.

What did the professionals do about the chip? Just what they do now. An elaborate vacuum-cleaner system, sucking it up silently at the instant it leaves the cutting point. But, short of mounting a real vacuum cleaner in some distant closet with a 100-foot tube from there to the recorder, I could not imagine any vacuum cure that might be practical for me. Old vacs made even more noise than new ones today. So I had to make do. Or, if you wish, I made did.

That August day in 1940, and part of the next for leftover guests, I filled up both sides of a big 12-inch blank disc, which could ideally hold considerably more at 78 rpm than the standard commercial record due to its smaller, closer grooves. The results were pathetic, but touching. The disc, with all its faults intact, was later presented to the wedding pair, who of course had left before the party began. They didn't even know, so it was a surprise. In spite of the noise, here were the voices of all their wedding guests, friends, their relatives, preserved—for posterity? Snippets, little bits, but even so, precious. Sally and Jack scarcely dared play the record (rightly) for fear of damage by heavy 1940 pickups. They tried it, and then put it away for safety. I suspect this was among the first (non-Hollywood) weddings to be sonically recorded as well as photographed in depth.

So—came the War and, after those long, depressing years, came peace—and recording tape. In time, a long time, this new idea got through to Sally and Jack, who by then had children, almost ready to listen.

Why not copy the disc on this new tape? What an idea. (Well, not so new, but even so) It was done. And what a job! Almost impossible. At least two-thirds of the disc wouldn't track unless the stylus was ever so carefully edged with a finger, then pushed on to the next usable (maybe) portion. Some perfectly good passages had grooves

you could barely see. It was enough to drive any willing technician nuts—for this was awhile back, when we weren't so familiar with the tricks as we are now.

Worst of all, the disc turned out to have been recorded too high in pitch, producing semi-Donald Duck sounds, quaint but unnatural. That wasn't the idea at all. This early tape copy, perforce, skipped a lot of unmanageable stuff, and it still played too high in pitch. But at least the original was preserved.

Without editing, that would have been the end for this audible chain of recorded voices, so far away and yet so poignant, because by this time many were already in their graves. Poignant for me, too, not merely because I made the recording (and on occasion narrated), but because my own mother and father, as well as the bride's, all deceased, are movingly heard in the midst of all the noise. Also other old, mutual friends, now dead.

The rest is simple. By no coincidence at all, the bride and groom of 1940 have been my hosts each recent spring in Eugene, Oregon. So this is another Eugene story, and even includes another Eugene audio concern. Last year, Sally and Jack, who will celebrate their 44th this coming summer, got out the old record and the copy for me to look at. Could *anything* be done? The copy was already old and not really very satisfactory; they no longer dared play the original at all. What could I do?

I think you can understand that I could do a lot, but I needed professional help and good equipment. I dared to play the disc, using their Fisher, which had a relatively lightweight cartridge. Yes, there was indeed a lot more material that might be retrieved, with immense care and pains and a very delicate finger to push the pickup. Yes, the pitch was too high, and would have to be adjusted in any copy. I used my finger to slow the table and got an approximation—much improvement. Now, was there, I asked, a suitable pro in town who could make us the basic corrected copy with all this taken care of? With that, I could then do the actual editing myself.

Right across the street was a curious audio studio with an intriguing name,

Sansui has developed an amazing new receiver; we call it the S-X1050. You'll call it incredible. That's because no other 35 watt* stereo receiver can match the Sansui S-X1050 for great sound, beauty and value.

Achieving more than any other receiver in its range, the S-X1050 incorporates a 5-band graphic equalizer. It's a built-in exclusive for a receiver at this level, that gives you complete tonal versatility for tailoring sound and attaining flat frequency response.

The Sansui S-X1050 also features Quartz PLL synthesizer tuning that assures you of drift-free reception. Clean bass response is provided by our DC servo circuitry, and our 5-LED power display lets you see what's happening—even in daylight.

We put all this overachievement under easy control with velvet-touch slides, tabs and push-buttons, to make the S-X1050 as pleasurable to operate as it is to listen to. For instance, simultaneous switching lets you go instantly from one source to another at the

touch of a tab. And when you want to lock in your favorite music stations, you can at the touch of a button with 2 presets (FM, 6AM).

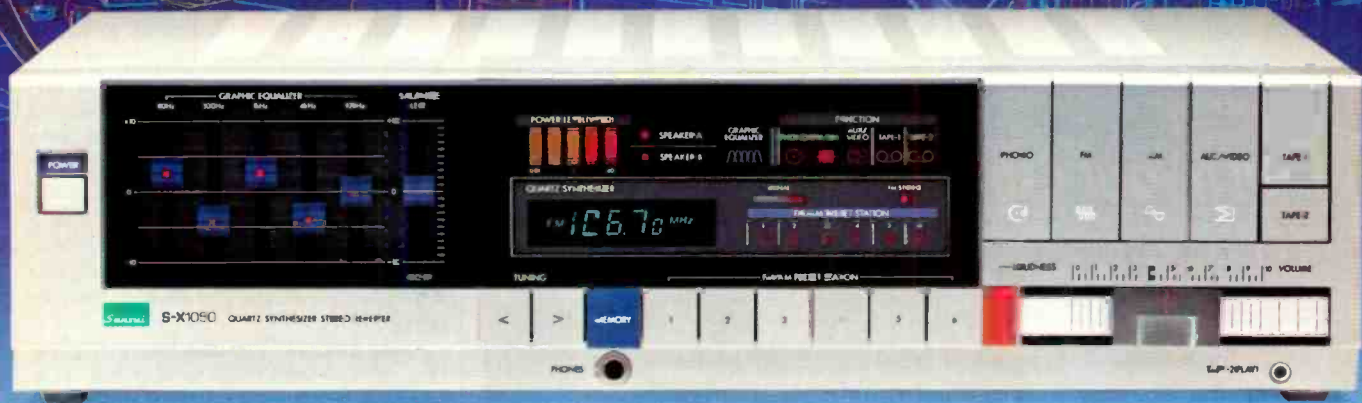
All this, plus playing two pairs of speakers simultaneously, slide volume control and a 2-deck connector for tape 1 to 2 dubbing make the S-X1050 a most incredible unit.

So achieve a new level of sound quality, convenience and value with Sansui's S-X1050. We know you'll be overwhelmed. SANSUI ELECTRONICS CORPORATION, Lyndhurst, NJ 07071; Carson, CA 90746, Sansui Electric Co., Ltd., Tokyo, Japan



Our S-X1030 25 watt* receiver is another Sansui achiever with many of the great features of our S-X1050 unit.

OVERACHIEVER.



Putting More Pleasure in Sound.



*S-X1050—35 watts, 0.02% THD; S-X1030—25 watts, 0.05% THD. Minimum RMS, both channels driven into 8 ohms, from 20-20 kHz.

Enter No. 37 on Reader Service Card

A tape I edited skips a lot of noise, which made the original disc unmanageable, and also corrects a too-high pitch.

Real To Reel. Somebody must have a lot on the ball, I thought, to devise that neat pun. So we walked right over to chat. Dark, dismal front hall, closed doors. A frantically barking dog behind one of them. Nothing else. So I had to go along home, East, wondering what kind of an audio place this was. Sally,

the bride and now a grandma, had to follow up.

A tape arrived in my mail! Wow—they did it. Real to even realer. It was, when I played it, a superb and really understanding job, such as I could scarcely believe. The pitch, to begin with, was perfectly restored; the voices

were themselves to the life, no longer vintage Donald Duck. Most of the formerly missing material, unplayable, was miraculously retrieved, often after many brave and careful tries. That included my own father, who died in 1961. Now at last the recording was of real people! And sibilants. At 6 kHz, you do get them and they add presence and intelligibility.

What was most important for me was editability. Those people knew exactly what I needed. As made, their tape was a nightmare of noise, all the original and a lot more added. Appalling. Dozens of new 78-rpm closed-loop repeats, as they tried again and again, enough to drive you crazy. More pops and scrapes, more added blank stretches. All this, the folks at Real To Reel evidently understood, was easily removable, both the original sounds and their additions, and they were right.

So I edited. Razor blade, Editall (thanks, Joel Tall), and splicing tape. I took out, seemingly, miles of taped junk. The floor was littered with it. Everything, the squawls and pops and hisses that made the tape sound like a sandblasting operation, the insane one-syllable repeats, over and over, the false starts. All easily removed. I left one repeat, deliberately—Sally's now-departed mother, at the very end, saying, "sends love, sends love, sends love . . ." I joined syllables from several tries, damaged, to make a complete version; I restored husbands to wives (two couples), reversed the order here and there for drama, timed each entrance for best impact, and in the end hooked up the entire thing into one smooth, even continuity, both sides of the old disc. Miraculously, the good parts of the recording, where the stylus was doing its job right, were not excessively noisy. In the final version you can scarcely notice the 78-rpm turning noise.

I was proud of this little job and gratified at how well it all turned out. The finished result is strictly synthetic, of course, but it is also real. Just as I would have had it in 1940.

Its importance to you, and you, is simply to attest to the power of this idea of sound editing. It is indeed one of our most fundamental audio discoveries. Need I say more? **A**

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BERT WHYTE

GARDEN OF UNEARTHLY DELIGHTS

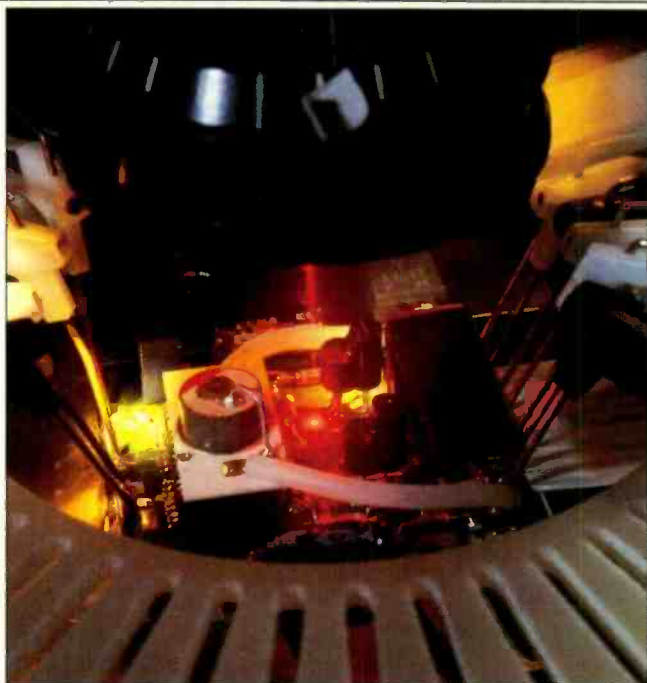
Every year at the Consumer Electronics Shows, the mind boggles at the sheer numbers of new products that are displayed. There is such a vast array of new equipment that, regrettably, full coverage is just not feasible. Thus, I wander through this audio garden of delights and pick what I feel are some of the most interesting and worthwhile components. Last month I reported on several interesting new loudspeakers shown in Las Vegas at the WCES, and herewith some other models worth an audition.

Magneplanar introduced their MG-III loudspeaker, an imposing unit standing 6 feet high and nearly 2 feet wide, but only 2 inches deep. This is a three-way system whose bass and midrange section utilizes Magneplanar's well-known planar magnetic principle. The company states this speaker has the largest bass/midrange driver they have ever designed, with bass response extending into the 30-Hz range. At 3 kHz, this driver crosses over to a 5-foot-long bipolar ribbon tweeter. Frequency response is rated at ± 4 dB from 37 Hz to 40 kHz. This 8-ohm speaker can handle amplifiers up to 200 watts, and it has provisions for biamplication. The demonstration I heard offered a very clean, exceptionally smooth sound, with good definition and excellent imaging. Bass response was quite good, but some people might want to add a subwoofer for more extension and impact. The MG-III is priced at \$1,950 a pair.

In the Sound-Lab room was a demonstration of their new 57½ in. H x 29 in. W x 6½ in. D electrostatic loudspeaker, Model A-2X. This was a good-sounding unit having all the desirable characteristics associated with electrostatic speakers—very clean and highly detailed, with exceptional transient response. However, the item that intrigued me was a prototype electrostatic subwoofer! Approximately the same size as the A-2X, it produced a nice, full bass sound that was notable for its clean delineation, low coloration, and lack of overhang. With further development, with a view towards more impact, this could have considerable potential.

Staying with electrostatic loudspeakers, a Stax system was used in the

While test signals are fed to this custom, thick-film hybrid circuit (used in the Citation XX amp), a laser trims its component values to 0.03% accuracy, for minimum distortion.



Photograph: Courtesy of Harman/Kardon

impressive Citation demonstration. This was one of the larger rooms, and Citation (a division of Harman/Kardon) had gone to considerable trouble and expense to treat the room with Sonex in a semi live-end/dead-end fashion. Dr. Matti Otala, designer of the Citation XX 250 watt/channel amplifier and the XXP preamplifier, was on hand. It is always such a pleasure to meet this brilliant scientist. He discussed some of the updating and refinements recently implemented in his Citation designs. Dr. Otala then demonstrated the system with some splendid Swedish choral recordings, and the reproduction was really quite beautiful—open, transparent, highly detailed, and certainly one of the nicest sounds at the show.

One interesting aspect of Citation's technology is their use of a custom, thick-film hybrid circuit in the XX. A computer system trims it to 0.03% accuracy by feeding it test signals, measuring its output, and trimming its components with a laser till the output is precisely right.

One can always expect interesting new speaker designs at the B & W exhibit. This year they demonstrated their new DM2000 and DM3000 speakers, specifically designed to cope with the digital dynamics of the Compact

Disc. The DM2000 is 32 inches high, and the DM3000 stands 38 inches high; both are 12¼ inches wide and 15¼ inches deep. The DM2000 employs a passive bass radiator, an active 6½-inch bass/midrange driver, and a 1-inch TX26 tweeter. The DM3000 has the same driver complement except for the addition of another active 6½-inch bass/midrange driver. Crossovers for both units are fourth-order Butterworth. The in-line drive units are electronically corrected for minimum inter-unit time delay.

There is much new technology here. The new drivers are made in the B & W factory and employ Kevlar cones, all designed and optimized using B & W's laser interferometer. The back of each loudspeaker is triangular, and this design is said to help reduce standing waves. At 87 and 89 dB SPL at 1 watt/1 meter respectively, the DM2000 and DM3000 are fairly efficient.

As you might expect, the imaging of these new speakers is in the B & W tradition—which is to say, outstanding and with precise, stable localization. Treble and midrange are very clean, with good launch into the listening space. Bass is clean and well defined, if a bit on the weighty side. Most important, these characteristics do not deteriorate at high levels. I did not feel the

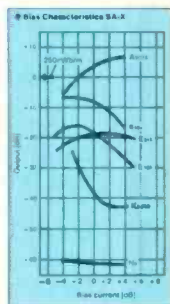
*** TDK AUDIO (MOL) TEST
MODE ***

Sonic Tonic from TDK



What comes out of your audio cassette deck is only as good as what goes in. And if you want unmatched dynamic performance, you need the highest performance audio cassette you can get. You need a TDK Pro Reference Series cassette. Each is designed to maximize the untapped potential of your cassette deck by generating clear, crisp, full-bodied sound.

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sure the energy never fluctuates, each TDK cassette is protected by our specially engineered cassette mechanisms for reliable, trouble-free performance. Plus a Full Lifetime Warranty.

Before you waste energy on any other brand, put more life back into your cassette deck with TDK's Pro Reference Series cassettes. They're pure Sonic Tonic.

TDK
THE MACHINE FOR YOUR MACHINE

The imaging of B & W's new speakers, the DM2000 and DM3000, is outstanding, with precise and stable localization.



Real Radio

Throughout your home or office, the Proton 300 FM/AM Radio delivers beautiful high fidelity sound. Real high fidelity, simplified.

FM stereo reception is magnificent with the Proton Schotz Detector.*

The Radio has separate bass and treble controls. You can connect your tape deck and add multiple pairs of Proton 301 bi-amplified two-way speakers, to fill every room with true high fidelity sound.

PROTON
Audio

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*Schotz Detector Patent Pending.
Industrial Design of the Proton 300/301: Reinhold Weiss Design, Chicago.

B & W demo material was as good as it usually is, but it certainly served to emphasize that these speakers are ready for the dynamics of digital sound. However, if someone gets too enthusiastic about high SPL, both speakers are equipped with overload-protection circuitry.

Several amplifiers at the show were of more than passing interest. One was a new tube design from Counterpoint, their 50-pound SA-4. This is a mono amplifier and, of course, is sold as a pair (\$4,495) for stereo. The SA-4 uses direct coupling (with no output transformer, à la the Futterman amplifier), only 26 dB of feedback, and a dual triode-differential input stage. There are no electronic limiters to restrict voltage or current output. The SA-4 employs eight 6LF6 output tubes. There is a meter to measure bias and tube performance and controls for bias adjustment. The power-supply transformer is rated at 1 kW. A power output of 100 watts into 8 ohms was claimed at the show but has since been upped to 140 watts into 8 ohms. Distortion is rated at less than 0.1% at full power. This appears to be a significant new tube amplifier, and what I heard sounded very good indeed, with excellent transient response and better bass detailing than is the case with many tube amps.

Another amplifier creating quite a bit of interest was the Robertson Audio Sixty Ten. Rated at 200 watts/channel into 8 ohms, it is claimed to produce up to 1,600 watts into a 1-ohm load. Each channel is modular and can be entirely replaced in a matter of minutes. No details of the power supply were given, but it was claimed that it is big enough for an output of 46 amperes. Frequency response is 0.5 Hz to 250 kHz. This Sixty Ten amplifier is priced at \$2,995.

(Editor's Note: Two amplifiers which caught my eye were the Streets Model 950 and the Electron Kinetics Eagle 7A, which last is John Iverson's new baby. The Streets uses no V-I limiters in its output stage and has a wide-band, low-feedback design, with a recommended minimum load of 2 ohms. More important is the Streets 950's ability to deliver high levels of current—60 amps peak and 15 amps continuous. The Eagle 7A is a dual-mono



Morning Fidelity

Now you can awaken to beautiful high fidelity sound. Sound that's never before been heard in something others call a clock radio. But the Proton 320 is something else.

With separate bass and treble controls and a large, full-range speaker. Two independent alarms. A clock memory so you'll always be on time, even if the power fails. And many more innovative features. It's sound and time performance so advanced, it can only be a Proton.

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Industrial Design of the Proton 320: Reinhold Weiss Design, Chicago.

UDAR The Perfectionist's Auto-Reverse!



Why sacrifice performance for convenience! If you've always wanted an auto-reverse deck but were too much a perfectionist to settle for questionable response, Nakamichi has the answer—*UDAR*—*Unidirectional Auto Reverse*—a revolutionary development in the *true* sense of the word! Ordinary auto-reverse decks *change* direction at the end of the side causing tape to track along a different path and produce "bidirectional azimuth error." Since azimuth differs on the two sides, frequency response differs too.

Compare this with UDAR. At the end of the side, UDAR disengages the cassette, flips it, reloads, and resumes operation in under 2 seconds! Tape plays in the *same* direction on Side A *and* on Side B so there's no "bidirectional azimuth error." UDAR *automates* the steps *you* perform on a conventional deck to give you auto-reverse convenience and *unidirectional* performance.

You'll find UDAR in the Nakamichi RX-202—a perfectionist's auto-reverse recorder with some surprising features at an even more surprising price!
See it now at your Nakamichi dealer.

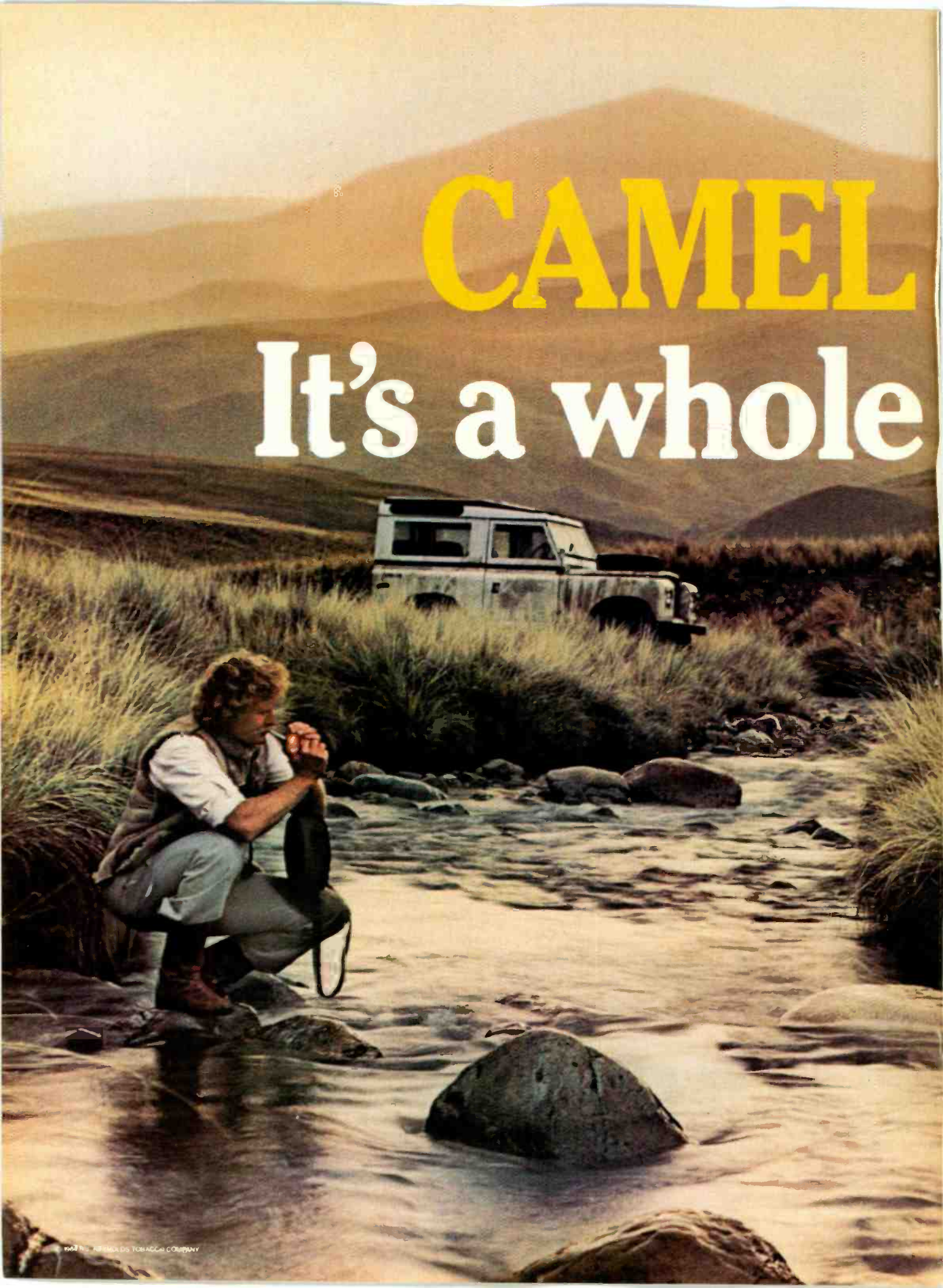
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RX-202



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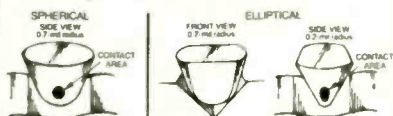
audio-talk from audio-technica.

Number 3 in a series

Elliptically Speaking

Stylus size and shape are critical to the performance of any phono cartridge. Small is generally better to trace more accurately the highest frequencies. However, if the radius is *too* small, the stylus will ride at the bottom of the groove, where dirt and debris tend to gather, and noisy playback is the inevitable result. Fortunately, stylus designers have found a way for you to have your cake and eat it too!

One Stylus, Two Radii



The answer is the elliptical (or BiRadial) stylus. Seen from the front it appears to have the same radius as a spherical tip (usually 0.7-mil) so that it touches the groove walls about halfway down. But from the side, the radius may be from 30% to 60% smaller. This smaller side radius still tracks halfway down the groove wall, but now can fit into much smaller groove variations. A major difference in elliptical stylus choices is the exact size of this 'side' radius. A-T offers BiRadial tips with a choice of 0.2-, 0.3-, and 0.4-mil side radius. The smaller the side radius the more benefits in terms of tracing ability, especially at very high frequencies and at the crowded inner grooves.

For Better Systems Only

While an elliptical stylus better fits the record groove, its small contact area (rather egg-shaped and smaller than the spherical contact area) puts increased pressure on the groove wall for the same vertical tracking force (VTF). For this reason, elliptical styli are recommended only when low VTF can be achieved. This demands a cartridge mechanism with good responsiveness (compliance) and a good tone arm. Fortunately, most modern systems can take full advantage of the benefits of the BiRadial stylus.

A Microscopic Look

Since most better styli are almost invisible, and some advertising claims a bit optimistic, you may well question whether you are getting the precision you're paying for. Which is why we encourage A-T dealers to install sophisticated stereo microscopes designed to display styli correctly. Viewed ultra close-up, A-T styli display accurately dimensioned, well-polished tips. (We don't believe your valuable records should do the final polishing.) The microscope can also display any faults of your present stylus, including the inevitable wear. We urge you to take a close look for yourself at your Audio-Technica dealer. And our next installment will tell you about another class of very advanced stylus designs.

Good listening.

Jon R. Kelly, President
Audio-Technica U.S., Inc.
1221 Commerce Dr., Stow, OH 44224



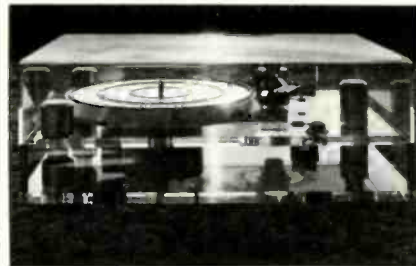
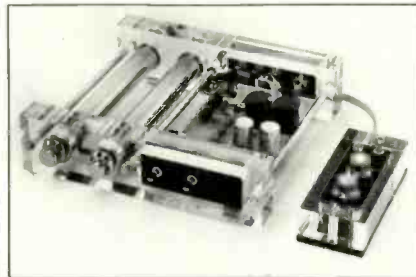
audio-technica.

The World's Favorite Phono Cartridge

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The Win SEC turntable, made of half-inch-thick plexiglass, is visually the most beautiful turntable extant.

design, also of wide bandwidth; flat at d.c. and -3 dB at 300 kHz. Power output from this beely fellow is 300 watts continuous into 8 ohms with 1.4 horsepower, peak, per channel; at 3 ohms, 1,600 watts is available.—E.P.)



Win Labs preamp and turntable

Last month I promised to tell you about the brilliant new technology in the design of Sao Win's new moving-coil cartridge, preamplifier, turntable and arm.

As I am sure you are aware, most audiophiles seem to have a predilection for belt-driven turntables rather than direct-drive types. Although direct-drive turntables have much more accurate rotational speed and stability, audiophiles claim that they also have too much vertical rumble, which superimposes noise on the reproduced sound. This has been a controversial point for some years.

Enter Sao Win and his SEC (servo encoder control) turntable. First off, I must comment that this is visually the most beautiful turntable extant. It is made of sparkling, half-inch thick, crystal-clear plexiglass. It has a special three-point suspension, with springs fabricated and combined with a new type of damping compound for a spring rate of less than 3 Hz. The SEC-10 motor is a d.c. brushless, multi-slot, multiple-pole unit free of cogging effects. It rests on a motor bearing which is internally suspended on a magnetic field. The turntable

speed is referenced to a 1.048-MHz quartz crystal. Speed is monitored by an infrared optical encoder which samples speed 600 times during each revolution of the platter, feeding its data into a digital servo system to regulate the speed. Wow and flutter is rated at $\pm 0.003\%$ (DIN) and rumble at -78 dB. The turntable will be fitted with a double-tube pantograph arm system with virtually no tracking error.

The Win Jewel moving-coil cartridge employs much new technology. The stylus, the Win-Vital, has a tip radius of 0.006×0.040 mils. Tip mass is 11 micrograms, and the stylus tip is super-polished in a plasma bath to a finish of 40 angstroms. The cantilever is a complex structure made of alpha alumina (essentially the same as synthetic ruby or sapphire). Tracking force is 1.2 to 1.5 grams.

The Win phono preamplifier is sold only in combination with the Win Jewel cartridge. Here again, the unit is encased in plexiglass. It uses a specially manufactured low-noise integrated circuit that has a super-regulated and controlled power supply with a bipolar cascode input. Because of its extremely wide bandwidth (d.c. to 6 MHz) and high gain, the preamp IC is housed inside a chromed copper tube, using waveguide design principles to eliminate r.f.i. Controls are activated by the use of photoelectric cells with operational-amplifier-controlled light-emitting diodes—in other words, no potentiometer wiper blades or conductive plastic. There is a high-level input in addition to the phono input which, needless to say, has impedance optimized for the Win cartridge. The RIAA equalization is flat, ± 0.5 dB, from 15 Hz to 20 kHz. Output of the system (cartridge and preamp) is 7.75 mV at 5 cm/S recorded velocity. The preamplifier's THD is rated at less than 0.001%, and phase linearity is claimed to be $\pm 2^\circ$ over the entire audio spectrum. Rise-time is a super-fast 580 nS.

Together, the Win Jewel cartridge and preamplifier cost \$1,000. An optional remote control for the preamp, with a muting switch plus volume and balance controls, will be available for about \$150 to \$200. As you can see, this is very likely the most sophisticated phono playback system currently available.

HARMAN KARDON'S STATE-OF-THE-MIND TECHNOLOGY TAKES TO THE ROAD



With the introduction of the CA260 high fidelity car amplifier, Harman Kardon blazes new trails. The commitment to sonic superiority that's synonymous with Harman Kardon Home audio equipment is now ready for those who demand the same quality on the road.

At Harman Kardon, we believed that there was a need for quality car audio components for the discerning listener... A car amplifier that would outperform any car amplifier on the market. Harman Kardon's thirty years of audio expertise is unleashed with the CA260.

The unrivaled design technologies that are embodied in the CA260 include: High instantaneous Current Capability, Low Negative Feedback, Ultrawidebandwidth and Discrete Components. The CA260 goes beyond industry standards to set new ones.

Incorporated in the Harman Kardon CA260 is 30 amps of High instantaneous Current Capability to provide 60 Watts of power into 4 Ohms, 30 Watts into 2 Ohms, and 180 Watts bridged mono into 4 Ohms. Two 10,000 μ F capacitors provide full power even at 20Hz.

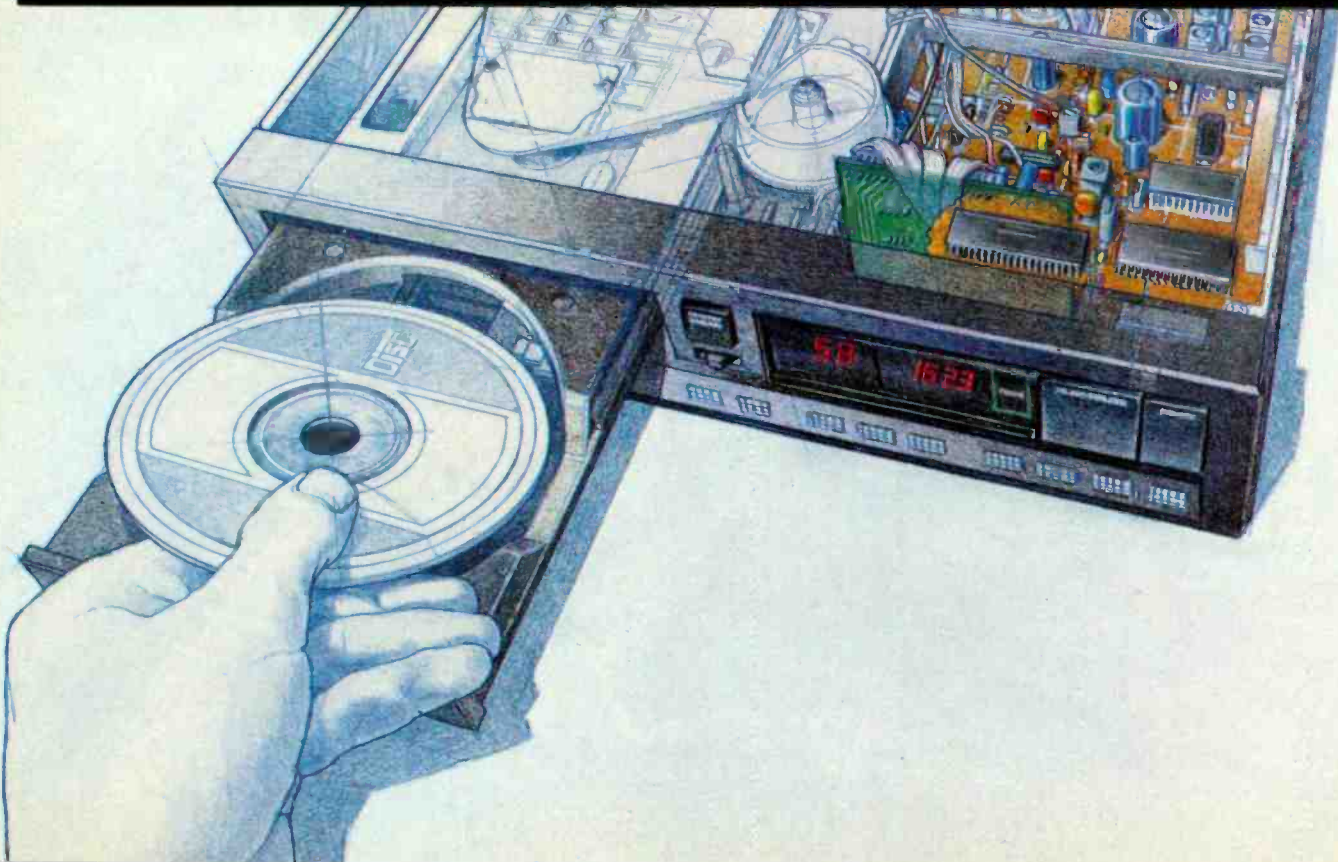
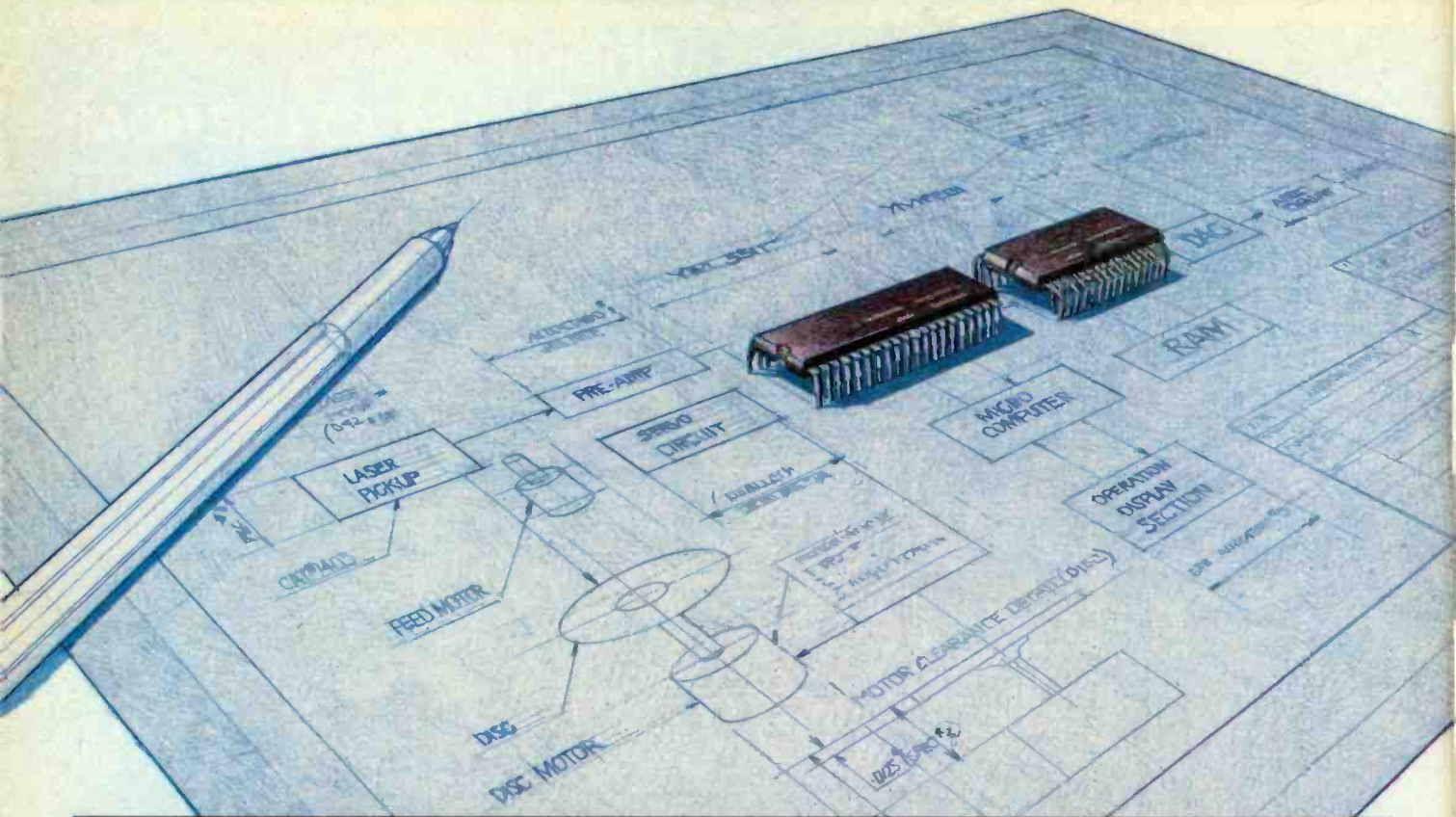
The CA260 is rugged and reliable enough to perform under any environmental and automotive conditions. It has been designed to overcome extreme humidity, varying voltages in the car's electrical system, mechanical vibrations, intense temperatures and engine noise.

The CA260 is the debut of a line of superior and fundamentally advanced car stereo products from Harman Kardon.

Harman Kardon's state-of-the-mind technology. Unparalleled excellence in advanced audio equipment now journeys with you.

harman/kardon

Our state-of-the-mind is tomorrow's state-of-the-art.



YAMAHA INTRODUCES THE SECOND-GENERATION GAP.

Second generation CD players have come a long way. But none come close to the new Yamaha CD-X1. It is the most technically advanced, user-friendly high-performance CD player you can buy. For two small reasons.

LSI.Q.

Meet the YM-3511 and the YM-2201, two high density, highly "intelligent" LSI's specially developed and patented by Yamaha. Together, they can do the work of many multiple LSI's and integrated circuits. And do it better. (See sidebar)

Because of them, the CD-X1 performs better, weighs less, takes up less space. And costs less money.

OUR LASER'S EDGE.

The CD-X1 also incorporates a remarkably compact three-beam laser combined with a super-smooth ceramic bearing in the disc drive motor. This advance, coupled with our proprietary LSI's servo control circuitry, provides exceptionally stable beam tracking for exceptional audio performance.

TRUE CONVERSION.

Highly accurate conversion of the digital signal to an analog signal is critical for optimum playback performance. Most CD players perform this conversion at the standard sampling rate of 44.1 kHz. Again because of our superior LSI technology, the digital filter system in the CD-X1 doubles this rate to 88.2 kHz. This oversampling virtually eliminates phase distortion and greatly improves playback resolution.

AT YOUR CONVENIENCE.

To make using it as pleasurable as listening to it, the CD-X1 has a long list of user-friendly features. Like three different play modes for greater playback flexibility. A multi-function time indicator. Simple and versatile memory programming. And a very convenient music search function that allows you to find selections or individual passages within a selection at the touch of a button.

But perhaps its most user-friendly feature is the \$599* price tag.

The CD-X1 from Yamaha. The others don't have anything like it. But you can have one just like it. At your Yamaha dealer now.

*Suggested Retail Price

The LSI Story.

The 40-pin YM-3511 LSI (Large Scale Integrated circuit), using a process called Cross Redundancy Check, "inventories" the digitally encoded information on the compact disc into audio bits (used to code the music), parity bits (used for error correction), control and display bits (used to index program selection and give front panel readout information).

The YM-3511 also checks playback speed by referencing a crystal oscillator against additional synchronization bits to control disc motor speed.

At this point the digitized signal is fed to the 64-pin YM-2201 LSI which digitally doubles the sampling frequency from the standard 44.1 kHz to 88.2 kHz.

The YM-2201 then performs a digital filtration process before the signal is passed to the digital-to-analog converter. When this process is performed by conventional CD players, a very sharp 50dB/octave analog filter is used to cut off frequencies above 20 kHz that are generated by the 44.1 kHz carrier signal. This causes phase anomalies which tend to degrade the correct harmonic structure of the music. The result is a loss of dimensionality in the music.

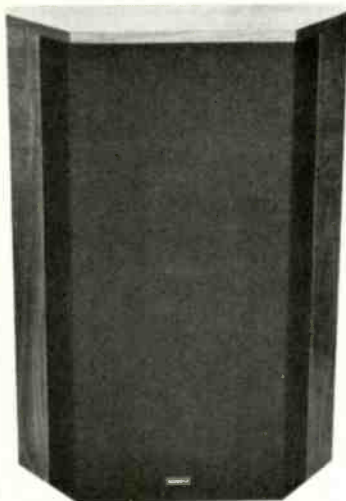
Since the YM-2201 performs this function digitally at 88.2 kHz, proper phase relationships remain intact and the music retains the live sound of the original performance.

Listen To This Rebate.

Advent speakers are legendary for incredible performance at a reasonable price. Now there's another reason to buy Advent. Until April 30, Advent will give you money back—**REBATES up to \$60**—on the full line of speakers.

The ageless Advent two-way design can blow the grills off of many highly-touted three-way speakers, and the new Advent 6003 three-way performance speaks for itself. Now you can get the Advent sound you've always wanted, and put money back in your pocket.

For the location of the nearest participating authorized Advent retailer, you can call (toll free) 800-323-1566 or in Illinois 800-942-0502. (Void where prohibited by law.)



Advent 6003

ADVENT

Enter No. 2 on Reader Service Card

TAPE GUIDE

HERMAN BURSTEIN

Feedthrough

Q. I own an integrated amplifier, separate tuner, cassette deck, and graphic equalizer. I have found that I can record from the tuner to the deck by turning on only the deck and tuner. Can you please tell me how this works with the tuner connected directly to the amplifier and yet without the amplifier turned on? The deck is connected to the equalizer, and this doesn't have to be turned on either.

Also, does a cassette deck have its own preamp, so that no matter how fine an amplifier one has, it does not affect the recording quality?—Mrs. W. J. Place, Winsted, Conn.

A. In the case of your integrated amplifier, it appears that high-level inputs, such as for a tuner, are fed directly to the tape-output jack via the selector switch; hence, the amplifier need not be on. In the case of your equalizer, it appears that when the unit is off, the incoming signal is fed straight through to the output.

Yes, a tape deck has its own recording amplifier. This supplies recording equalization (mainly treble boost, to overcome recording losses), a bias signal (that minimizes distortion and maximizes the signal level recorded on the tape), and amplification.

Azimuth in Reversing Decks

Q. I plan to buy a cassette deck and am considering one that reverses. However, I've been told that if high-fidelity performance is important, I should forget about reversing decks because they entail a compromise of audio performance in exchange for the convenience of reverse operation. I was told that azimuth alignment is compromised, resulting in inferior treble response in one direction of operation or both. Is there much truth in this?—Freeman Matthews, Columbus, Ohio

A. Yes, there is truth in this. Because the tape tends to skew differently in each direction (that is, when running left to right as compared with running from right to left), azimuth alignment may have to be a compromise between the best alignments for each direction. However, solutions have been worked out. Some decks rotate the heads 180° to record and play the tape in reverse, and provide a sepa-

rate azimuth adjustment, often in the form of a set screw, for each direction. One manufacturer (Nakamichi) makes a deck whose transport operates in only one direction, but records and plays in both directions by flipping the cassette over in the way one flips the page of a book—that is, like manually turning the cassette over.

Why So Expensive?

Q. I'm interested in buying a portable cassette deck both for home use and for live field recording, but the models that have the features I want are so expensive. Why do these portables cost so much?—Paul Rubin, Berkeley, Cal.

A. Good portable decks tend to be on the expensive side because they are made to quite exacting specifications to achieve high performance under often difficult conditions. Further, they are made for a rather limited market, so each unit has to bear a high share of the model's design and development cost.

Demagnetization Again

Q. What type of demagnetizer do you recommend? I feel this is a rather risky business because, if not done properly, it can permanently magnetize the heads. An authorized technician told me not to demagnetize more than every six months.—Thomas Eltrup, Elsmere, Ky.

A. A relatively powerful hand-held demagnetizer is usually considered best, but if the heads are difficult to reach, a demagnetizer contained in a cassette can be used. The heads can be magnetized if the degausser is shut off while in contact with, or in very close proximity to, the heads; otherwise, there is no danger. Depending on the type of material used for the heads and on the electronic circuitry employed, heads may need only occasional degaussing or possibly none at all. The usual advice is to degauss after every 8 to 16 hours of use, but the best thing is to follow the advice of the deck manufacturer, usually given in the instruction manual. **A**

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.

AUDIOPHILE FILE™ XL-S

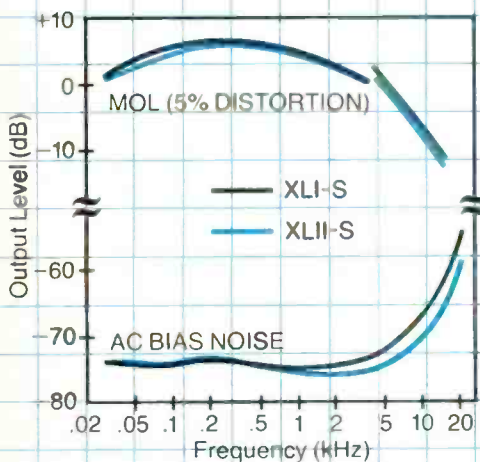
COMPACT DISC COMPATIBLE

Maxell introduces the new XL-S audio cassettes; a series of ferric oxide tapes which deliver a level of performance that can capture the sound nuances found on Compact Discs more faithfully than other ferric oxide cassettes on the market.

There are a number of areas where this achievement is apparent.

GREATER DYNAMIC RANGE.

Through a new formulation of our magnetic particles, we were able to reduce the perceived residual AC bias noise level by 1 dB in the critical 2 kHz to 10 kHz mid-frequency range. And simultaneously increase sensitivity and maximum output levels by as much as 2 dB.

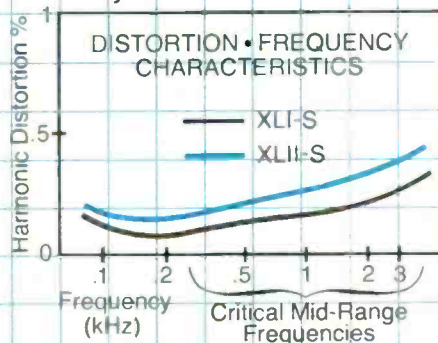


As a result, the dynamic range of each tape has been significantly expanded. So you get a

better signal to noise ratio and a fuller impact of the dynamic transients exclusively inherent to digital CD recordings.

LOWER DISTORTION.

The newly formulated particles also contribute considerably to XL-S's low output fluctuation, as well as its virtual distortion-free reproduction, especially in the critical mid-range frequencies. This, in turn, accounts for our XL-S tape's enhanced sound clarity.



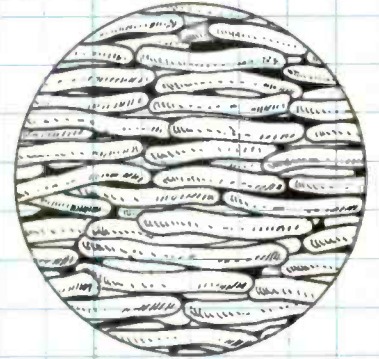
IMPROVED MAGNETIC PARTICLES.

Our refined particle crystallization process is the basis for all of these accomplishments. Maxell engineers are now able to produce a more compact needle-shaped Epitaxial magnetic particle of extremely high uniformity.

This allows us to create a greater ratio of total surface area to unit weight of magnetic particles.

As a result, our XL-S

tapes now have the ability to record more information per unit area than ever before.



PACKING DENSITY OF UNIFORM PARTICLES.

Which is why Maxell high bias XLII-S and normal bias XLI-S are unsurpassed at reproducing the sound qualities found on today's finest recordings. Regardless of whether your frame of reference is analog or digital audio discs.

For technical specifications on the XL-S series, write to: Audiophile File, Maxell Corp. of America, 60 Oxford Drive, Moonachie, New Jersey 07074.



IT'S WORTH IT.

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KEN POHLMANN

TAKE A NUMBER

I was surprised when the editor telephoned me and said he wanted a second installment in this digital department. I had figured that my first number had pretty much iced the cake; my comments concerning analog recordings had been pretty abusive and seemed to be especially delinquent in a magazine which has so diligently followed the evolution of analog audio for so many years. When I picked up the phone, I figured I was being slapped with a lawsuit or something. But the editor said he was willing to go again. Although he didn't exactly sound enthusiastic, I suspected that, like so many others, he was willing to pay whatever dues were required to get to the bottom of this digital thing, before the fad was over.

Digital audio is foremost a numerical technology; to properly understand it, we must first lay some groundwork with a discussion of number systems. So let's talk numbers—and I don't mean things like S/N ratio, frequency response, and wow and flutter. As everyone knows, the specifications of digital audio products are incredibly good and thus incredibly boring: Flat, flat, none, none, etc. Besides, those specifications were mainly devised to gauge the quality of analog devices and perhaps don't even apply to digital ones. When reviewers listen to two different Compact Disc players having identical specifications and yet hear a subtle difference, it's pretty clear that it's time to devise some new and more meaningful measures of quality. No, the numbers I have in mind connote an entirely different idea.

That's one of the most interesting things about numbers—the fact that a few numerals can represent so many different kinds of information. Let's take an example. I ride two motorcycles (rarely simultaneously); one of them is a classic BMW R50/2 built in 1962 with a 500-cc engine, the other is a Triumph 750 built in 1977 with a 750-cc engine. The Triumph has license plate number 680314, while the BMW is licensed with 029907. Obviously, there are a lot of numbers here. Not so obvious is the important context of each of them. For example, 1977 is the year the Triumph was built, while 680314 represents a special kind of coded information so that the State of Florida can properly

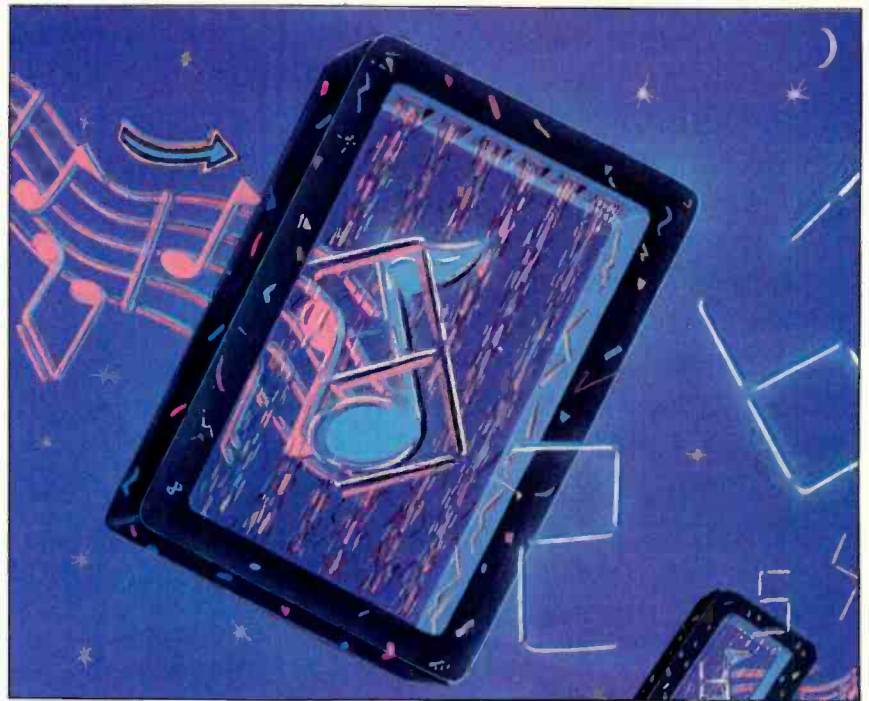


Illustration: George Blume

monitor my moving violations. These various numbers are useful only by virtue of their arbitrarily assigned contexts. If that context is confused or missing, then the numbers quickly go awry; for example, I could have 680,314 motorcycles, 750 of them with engines with displacements of 1,962 cubic years. Similarly, the numerical operations we perform upon numbers are a question of interpretation; the sum of my moving violations determines when my license will be suspended, but the sum of my engine's displacements probably won't inconvenience me so much. Information, you see, and how it is coded, processed, and decoded, can make a lot of difference in our lives. Numbers, if properly defined, provide a good method to keep our data straight. As we've seen, the negative implication is that the numbers and their meanings have to be accurately used. Such is the price of civilization.

Speaking of civilization, ours is lucky because it has pretty good number systems. Early societies were stuck with the unitary system, which used a series of marks to answer the essential question "how many?" That's a great system, but only if the numbers are small, or your clay tablets are particu-

larly large and slow drying. The Mesopotamians, who considered themselves to be a fairly advanced bunch, rejected the unitary system and devised a number system which used 60 symbols instead of just one. It was a little cumbersome, but even today, 3,700 years later, we still use their technique to divide an hour into 60 minutes, a minute into 60 seconds, and a circle into 360 degrees.

Frankly, I think a system with 60 symbols is a little pretentious, but the point is that any number system, in essence, is a question of how many different symbols you think you need. Most of us feel partial to our base-10 system which we owe to some ninth-century Arabs who rather cleverly conceived of the 0 numeral to represent nothing, and appended it to nine other symbols already in use. Our base-10 system uses *positional notation*: Each next place is multiplied by a higher power of 10; 10 is the *radix* of the system. Not coincidentally, a base-10 system is convenient for 10-fingered organisms such as humans (for really big numbers I take off my shoes), but any number base can be the favorite, depending on the application. Of course, you have to know the radix; the numerals "10" in base 10 is the total

number of fingers we have, but "10" in base eight is the number of fingers minus the thumbs. Similarly, would you rather have 1,000 dollars in base seven, or 500 in base 60?

Currently, radix 2 is hot, thanks to the digital computer. Its base-two number system is highly efficient; the idea of a voltage/no-voltage, on/off binary system is terrific for an electrical machine. Ask yourself—would you rather deal with 10 voltage levels, a hundred, an infinitely analog number of them—or two? A binary system is ruthlessly efficient—and fast. Imagine how quickly you can turn a switch on and off or watch a square wave go by (which means a machine is operating the switch for you). The result is a high-powered information handler which simultaneously processes information to yield yet more information, which in turn necessitates the need for still more information. It enables us to more dynamically direct information back into itself. A plugged-in civilization can never unplug; the information system

breeds complexity and facilitates it.

Okay, this is an audio magazine, there are supposed to be discussions about recordings. What does a discussion about numbers have to do with recordings? Plenty. From your conceptual seat in your conceptual concert hall, you lean forward in anticipation as the conceptual orchestra begins its conceptual performance of the Tchaikovsky Seventh Symphony (no, I'm not conceptualizing, there really are seven). Your job is to write down all the information you hear. Ready? Begin!

Whew! Only after a few bars, you give up. Even writing down the score real-time in musical notation was too much, let alone documenting all the timbres, acoustics, aesthetic considerations, etc. We have to conclude that music is a surprisingly complex phenomenon; it is filled with information. To store it, we require a system which can deal with incredible amounts of information. Not surprisingly, the latest and highest technology, historically, was always utilized to make recordings, be-

cause only the best technology satisfied our current expectations of what a good recording should sound like. And as higher technology was devised and pressed into service, our expectations were redefined, often times much to the chagrin of the people with a lot of money tied up in the older technology.

Our conclusion is very clear. Changing technology has again changed our expectations of what good reproduction should sound like. Digital technology has redefined the science of information coding, processing, and decoding; thus, the art of sound reproduction must be redefined. All those who thought that direct-to-disc half-speed recordings, or something along those lines, were the ultimate were right at the time, but now they are wrong. The sound will get even better. All those who think that it can't get any better, that their ears simply won't detect any more fidelity, are wrong. It will sound better. And I can say this, too: It will sound drastically better because it will sound more real. **A**



“The construction of the GFP-1A is, to put it mildly, robust...The cabinet and chassis are made of steel...

everything is on a single large circuit board, with an open, uncluttered parts layout and a minimum of point-to-point wiring. All of this indicates probable long-term reliability.

Both on the test bench and as part of a hi-fi system, the Adcom GFP-1A left nothing to be desired. It has all the flexibility one could ever want combined with smooth, silent and bug-free operation. An excellent preamplifier at a very reasonable price.”

Julian Hirsch in Stereo Review

“The GFP-1A gives us just about everything—in features, technology, and performance—that we’ve ever really wanted in a preamplifier.

That response and distortion measurements are beyond reproach goes without saying... and the feel and appearance of the controls further inspire confidence. Had we not been delighted by what we heard through the GFP-1A, we would have been astonished. But the only real surprise was the price... which was modest relative to some of the high-tech preamplifiers to which its performance invites comparison.”

High Fidelity

Now, if you still want to pay more than \$375 for a high-performance preamplifier, that's up to you.

ADCOM®

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Sherwood's new car stereo - Everything you're looking for plus something more: AM STEREO

The broadcast industry has been talking about AM stereo for a long time. But the talk is over. Stations all over are now using this exciting new technique.

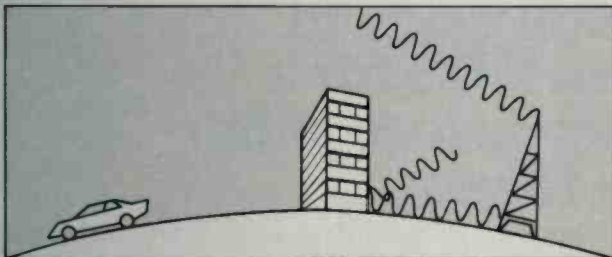
Why AM stereo?

The excitement of AM stereo is revolutionizing AM programming. Music, of course, takes on new realism, but that's just the beginning. Talk radio, a growing trend in AM broadcasting, is more exciting, more intimate in stereo.

What about FM Stereo?

Stereo FM is terrific. The new CRD-150, like all Sherwood receivers, sounds great on FM. But sometimes you can't pull in FM clearly, no matter what receiver you have, because FM signals have short range and travel in straight lines.

This wouldn't matter if we lived (and drove) on a flat, open surface. But since the earth is curved and covered with obstructions, it's difficult to get and hold clean FM where signals are weak or in congested urban areas or moving cars. That's when you need AM stereo.



FM Stereo has short range and is easily obstructed.

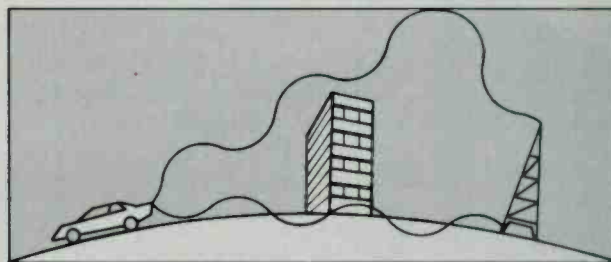
No "fupp, fupp, fupp."

On the edge of clear reception FM makes a "fupp, fupp, fupp" noise, a result of its short range and direc-

tional nature. AM signals bounce off the earth's atmosphere, creating an "energy umbrella" from above. So with AM stereo there's no "fupp, fupp, fupp."

Not just for the boonies.

Because AM stereo is long-range, most people think it's just for remote areas. Not so. In big cities, too many FM stations make for poor selectivity, and high-rise structures make good FM reception even tougher. AM stereo is for the country *and* the city.



AM Stereo has long range and is not directional.

An all new car stereo at a price you can afford.

Now you can enjoy the benefits of AM stereo as well as all the features you would expect in an advanced cassette/receiver. Sherwood's new CRD-150 has digital readout, 10 station presets, Dolby* noise reduction, separate bass and treble controls, metal tape capability, and more. (The radio even plays when the tape deck is in fast forward or rewind.) And, like all Sherwood products, the CRD-150 gives you quality and innovation at a price you can afford.

To experience AM stereo and find out just how good (and how affordable) Sherwood's new CRD-150 is, see your nearest Sherwood auto sound dealer. To find him, call (800) 841-1412 during West coast business hours.

*Dolby is a registered trademark of Dolby Laboratories.

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17107 Kingsview Avenue, Carson, CA 90746. In Canada: The Pringle Group, Don Mills, Ontario

10th ANNUAL CAR STEREO DIRECTORY

Ten years ago, we acknowledged car stereo's increasing fidelity by running our first Car Stereo Directory. It included four pages of radios/tape players (at least half of which used 8-track cartridges) and a bit over two pages of speakers. Only a handful of the manufacturers (ADS, Craig, Jensen, Pioneer, Sanyo and Sony/Superscope) would have been familiar to home audio buyers. The Directory has grown in size and sophistication, reflecting the increased variety and sophistication of the products listed. We've long since added amps and equalizers; this year, we've added active crossovers to the amp/EQ section. We've also rearranged the radio and speaker specs, to group related questions more logically, and added a few new specs (amplifier power bandwidth, speaker sensitivity and weatherproofing). And we no longer ask whether a deck plays 8-track tapes.

RADIOS/TAPE PLAYERS

MANUFACTURER	Model	Price, \$	AMPLIFIER										RADIO				TAPE			
			Average Watts Channel, per IHF A-202	Power Bandwidth, Hz to kHz, per IHF A-202	THD in Rated Output, % per IHF A-202	Distortion, %	Speaker Level (S), Both (Both)	Number of Tone or EQ Controls	FM Sensitivity, dB (For 30-dB Dwell)	Selectivity, dB	FM S/N Ratio, dB	Total Number of Presets	Local Distant Control	Manual Switch (M), Noise-Reduction Circuit? See Code	Tape S/N Ratio, dB (With NR if applicable)	Auto Reverse?	Tape EQ Switch?	In-Dash (I), Under-Dash (U), Convertible (C)	Application Guide Available?	Dimensions, inches
ALPINE	7150	159.95	6	70-20	8.0	S	1	16.3	60	60	0	A		55	Yes	Yes	Yes	Yes	2 x 6 1/4 x 4 1/2	
	7160	179.95	6	70-20	8.0	S	1	16.3	80	60	0	M		55	Yes	Yes	Yes	Yes	2 x 2 x 5 1/2	
	7151	199.95	6	70-20	8.0	Both	2	16.3	80	60	0	A		55	Yes	Yes	Yes	Yes	2 x 7 1/8 x 5 1/8	
	7152	269.95	6	70-20	8.0	Both	2	16.3	80	70	0	A	B/C	72	Yes	Yes	Yes	Yes	2 x 7 1/8 x 5 1/8	
	7225	249.95	16	40-20	8.0	Both	2	16.3	60	65	0	M		55	Yes	Yes	Yes	Yes	2 x 6 1/4 x 5 1/8	
	7128	249.95	6	70-20	8.0	Both	1	16.3	80	55	10	M		50	Yes	Yes	Yes	Yes	2 x 7 x 5 1/4	
	7138	299.95	6	70-20	8.0	Both	1	16.3	80	60	10	M	B	65	Yes	Yes	Yes	Yes	2 x 7 x 5 1/4	
	7162	249.95	6	70-20	8.0	S	2	16.3	80	60	12	M		55	Yes	Yes	Yes	Yes	7 x 2 x 5 1/2	
	7263	299.95	16	40-20	8.0	Both	2	16.3	80	60	12	M		55	Yes	Yes	Yes	Yes	7 x 2 x 5 1/2	
	7135	299.95	6	70-20	8.0	Both	2	16.3	80	60	10	M		55	Yes	Yes	Yes	Yes	2 x 6 1/4 x 5 1/8	
	7136	349.95	6	70-20	8.0	Both	2	16.3	80	60	10	M	B	65	Yes	Yes	Yes	Yes	2 x 6 1/4 x 5 1/8	
	7337	399.95	6	70-20	8.0	P	2	16.3	80	60	10	M	B	65	No	Yes	Yes	Yes	2 x 6 1/4 x 5 1/8	
	7164	349.95	6	70-20	8.0	Both	2	16.3	80	60	12	M	B	64	Yes	Yes	Yes	Yes	7 x 2 x 5 1/2	
	7165	379.95	6	70-20	8.0	Both	2	16.3	80	60	12	M	B/C	72	Yes	Yes	Yes	Yes	7 x 2 x 5 1/2	
	7146	499.95	6	70-20	8.0	Both	2	16.3	80	70	10	M	B	65	Yes	Yes	Yes	Yes	2 x 7 1/8 x 5 1/8	
	7347	599.95	6	70-20	8.0	P	2	16.3	80	60	10	M	A/B/C	86	No	Yes	Yes	Yes	2 x 7 1/8 x 5 1/8	
	7154	329.95	6	70-20	8.0	Both	2	16.3	80	60	12	M		55	Yes	Yes	Yes	Yes	2 x 7 x 5 1/4	
7155	399.95	6	70-20	8.0	Both	2	16.3	80	60	12	M		55	Yes	Yes	Yes	Yes	2 x 7 x 5 1/4		
5114	149.95	6	70-20	8.0	S	2	16.3	80	60	12	M	B/C	72	Yes	Yes	Yes	Yes	2 x 7 x 5 1/4		
ARA	PER1000	359.95	3	60-15 ±3	1.0	Both	2	19	50	57	12	M	B	50	Yes	Yes	Yes	Yes	2 1/8 x 5 x 7	
	PER1100	499.95	20	60-15 ±3	1.0	Both	2	19	50	60	12	A	B/D	50	Yes	Yes	Yes	Yes	2 1/8 x 5 x 7	
	PER3000	499.95	20	60-15 ±3	1.0	S	2	16	50		12	M	B/D	50	Yes	Yes	Yes	Yes		
	FEX23		4 x 2, 12 x 2	60-15 ±3	1.0	S	2	19	50	63	8	A						Yes	2 1/4 x 7 1/8 x 7	
	FEP23		4 x 2, 12 x 2	60-15 ±5	1.0	S	2	19	50	63	8	A	B	50	Yes	Yes	Yes	Yes	2 1/4 x 7 1/8 x 7	
	P-100	189.95	3	60-15 ±5	1.0	S	1	22	50	55	0	A		48	No	No	Yes	Yes	2 1/8 x 5 x 7	
	P-200	209.95	3	60-15 ±5	1.0	S	1	22	50	55	5	A		48	No	No	Yes	Yes	2 1/8 x 5 x 7	
	P-300	229.95	3	60-15 ±5	1.0	S	2	22	50	55	0	A	B	56	Yes	Yes	Yes	Yes	2 1/8 x 5 x 7	
	P-400	259.95	3	60-15 ±5	1.0	S	2	22	50	55	5	A	B	56	Yes	Yes	Yes	Yes	2 1/8 x 5 x 7	
	P-500	269.95	3	60-15 ±5	1.0	Both	2	22	50	55	5	A	B	56	Yes	Yes	Yes	Yes	2 1/8 x 5 x 7	
	DEX23		12	60-15 ±5	1.0	S	2	19	50	45	8	A						Yes	3 1/2 x 5 1/4 x 7 1/8	
	DEP23		12	60-15 ±5	1.0	S	2	19	50	45	8	A	D	48	Yes	Yes	Yes	Yes	3 1/2 x 5 1/4 x 7 1/8	
	JEX23		12	60-15 ±5	1.0	S	2	19	50	45	12	A						Yes	3 3/8 x 5 1/4 x 7 1/8	
JEP23		12	60-15 ±5	1.0	S	2	19	50	45	12	A	D	48	Yes	Yes	Yes	Yes	3 3/8 x 5 1/4 x 7 1/8		
PER600	249.95	7	60-15 ±5	1.0	S	1				12	M			Yes	No	Yes	Yes	2 x 5 x 7		
PER700	299.95	14	60-15 ±5	1.0	S	1				12	M	D		Yes	Yes	Yes	Yes	2 x 5 x 7		
AUDIA	TRX-10	350.00	11.5	40-20	0.8	Both	3	12	70	58	5	A	B/D	62	Yes	Yes	Yes	No	7 1/4 x 2 x 4 5/8	
	TRX-100	460.00	11.5	40-20	0.8	Both	3	12	70	58	10	A	B/D	62	Yes	Yes	Yes	No	7 1/4 x 2 x 4 5/8	
	DTX-1000	625.00				P	4	12	70	58	10	A	B/D	62	No	Yes	Yes	No	7 1/4 x 2 x 4 5/8	
AUTOTEK	CSR-5550E	399.95	6.25	100-20	1	Both	2	17.6	60	60	10	M/A	B	65	Yes	Yes	Yes	No	2 x 6 1/4 x 4 3/4	
	CSR-5350E	329.95	6.25	100-20	1	Both	2	17.6	60	60	10	M/A	B	55	Yes	No	Yes	No	2 x 6 1/4 x 4 3/4	
	CSR-3500E	329.95	5	100-20	1	Both	2	17.6	65	60	5	M	B/D	70	Yes	No	Yes	No	2 x 7 x 5 1/4	
	CSR-3250E	219.95	5	100-20	1	S	1	17.6	65	60	5	M		55	Yes	No	Yes	No	1 1/4 x 6 1/4 x 4 3/4	

For Company Addresses, see page 64

RADIOS/TAPE PLAYERS

MANUFACTURER	Model	Price, \$	AMPLIFIER											RADIO							TAPE			
			Average Watts Channel per IHF A-202	Power Bandwidth per IHF A-202	THD at Rated Dist-pwr, % per IHF A-202	Distortion: Preamp (P) Speaker Level (S), %	Number of Tones or EQ Controls	FM Sensitivity (dB) (For 30-dB Quieting)	Selectivity, dB	FM S/N Ratio, dB	Total Number of Presets	Local Distort Control	Manual Switch (M)	Note-Reduction Circuit? See Code	Tape S/N Ratio, dB (With MP if Applicable)	Auto Reverse?	Tape EQ Switch?	In-Dash (I) Under-Dash (U) Convertible (C)	Application Guide Available?	Dimensions, inches				
			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
AUTOTEK (Continued)	CSR-5300	299.95	6.25	100-20	1	Both	2	17.6	65	60	12	M A	B	60	Yes	Yes	I	No	1 1/4 x 7 x 4 1/4					
	CSR-5200	259.95	6.25	100-20	1	Both	2	17.6	65	60	12	M A	B	55	Yes	No	I	No	1 1/4 x 7 x 4 1/4					
	CSR-5100	209.95	12	100-20	1	S	2	17.6	65	60	12	M	A	55	No	No	I	No	2 x 7 x 4 1/8					
	CSR-3050	179.95	12	100-20	1	S	2	17.6	65	60	5	A	A	55	No	No	I	No	1 1/4 x 6 1/4 x 4 1/2					
	CSR-2100	159.95	5	100-20	1	Both	2	17.6	60	60	60	M	A	55	Yes	No	I	No	1 1/4 x 7 x 5 1/4					
	CSR-7750E	399.95	6.25	100-20	1	Both	2	17.6	60	60	10	M A	B D	70	Yes	Yes	I	No	2 x 7 x 6					
BELTEK	MR740	399.95	25	40-18	0.5	Both	2	16.0	75	60	12	M	B	65	Yes	Yes	I	Yes	2 x 7 x 5 1/2					
	MR200	369.95	7.5	40-18	0.5	Both	2	16.0	70	60	12	M	B	55	Yes	Yes	I	Yes	2 x 6 1/4 x 4 1/4					
	MR210	309.95	7.5	40-18	0.5	Both	2	16.0	70	60	12	M	B	55	Yes	Yes	I	Yes	2 x 6 1/4 x 4 1/4					
	MR823	299.95	25	40-18	0.5	Both	2	16.0	70	60	5	M	B	55	Yes	Yes	I	Yes	1 1/4 x 7 x 5 1/4					
	MR813	289.95	25	40-16	0.5	Both	2	14.5	70	60	5	M	B	58	Yes	Yes	I	Yes	1 1/4 x 7 x 5 1/4					
	MR640	229.95	25	40-15	0.5	Both	2	15.0	75	62	5	M	M	55	Yes	Yes	I	Yes	1 1/4 x 7 x 5 1/4					
	MR100	199.95	7.5	40-16	0.5	S	1	14.6	80	62	5	M	B	55	Yes	No	I	Yes	1 1/4 x 6 1/4 x 4 1/4					
	MR808	179.95	7.5	40-15	0.5	S	1	14.6	75	62	5	M	B	55	Yes	No	I	Yes	2 x 7 x 5 1/4					
	MR20	79.95	7.5	40-12	0.5	S	1	21.0	60	55	5	M	A	50	Yes	No	I	Yes	2 x 7 x 5 1/4					
	BEVADA INTERNATIONAL	BEC-811	145.00	B	50-10	0.35	S	1	25.2	30	35	0	M	M	45	No	No	I	Yes	1 1/4 x 7 x 5 1/4				
		MDL-1000	89.95	10	50-10	0.35	S	1	25.2	30	35	0	M	M	45	No	No	I	Yes	1 1/2 x 6 3/8 x 4				
BLAUPUNKT	Frankfurt	159.95	4	80-20	1.0	Both	2	13	65	70	5	M	D	62	Yes	Yes	I	Yes	1 1/4 x 7 x 5 1/4					
	Seattle	249.95	4	80-20	1.0	Both	2	13	65	70	0	M	D	62	Yes	Yes	I	Yes	2 x 7 x 5					
	Richmond	299.95	4	80-20	1.0	Both	2	13	65	70	5	M	D	62	Yes	Yes	I	Yes	2 x 7 x 5					
	Manhattan	299.95	4	80-20	0.15	P	2	13	65	60	5	M	B	62	Yes	Yes	I	Yes	2 x 7 x 5					
	Aspen	279.95	4	80-20	1.0	S	1	13	65	70	6	M	D	62	Yes	No	I	Yes	2 x 7 x 5					
	Sacramento	399.95	4	80-20	1.0	Both	2	14	65	68	6	M	D	60	Yes	Yes	I	Yes	2 x 6 1/2 x 5					
	Tucson	499.95	5	80-20	0.15	P	2	13	65	60	6	M	B	62	Yes	Yes	I	Yes	2 x 7 x 5					
	Houston	599.95	5	80-20	0.15	P	2	13	65	60	6	M	B	62	Yes	Yes	I	Yes	2 x 7 x 5					
	Washington	599.95	5 x 4	80-20	1.0	S	2	16	74	63	6	M	B	64	Yes	Yes	I	Yes	2 x 7 x 6 1/2					
	SQR 32																							
	New York	749.95	15 x 4	80-20	1.0	S	2	16	74	63	6	M	B	63	Yes	Yes	I	Yes	Two Pieces					
	SQR 83																							
	Berlin SQR 83	1850.00	15 x 4	80-20	1.0	S	2	16	73	63	4	M	B	63	Yes	Yes	I	Yes	Three Pieces					
Chicago with ARI	319.95				0.15	P	2	13	65	60	5	M	B	62	Yes	Yes	I	Yes	2 x 7 x 5					
Vancouver with ARI	349.95				0.15	P	2	13	65	60	5	M	B	62	Yes	Yes	I	Yes	2 x 7 x 5					
CLARION	PE894A	129.95	3.2	50-15	5	S	1						50	Yes	Yes	U	Yes	5 1/2 x 2 x 4 1/2						
	PE895A	169.95	12	50-15	5	S	1						56	Yes	Yes	U	Yes	5 1/2 x 2 x 5 1/8						
	6900RT	339.95	3.2	50-15	5	Both	3	12	70	58	5	A	B	56	Yes	Yes	I	Yes	7 1/4 x 2 x 4 1/8					
	6950RT	339.95	3.2	50-15	5	Both	3	12	70	58	5	A	B	56	Yes	Yes	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
	8100R	319.95	3.2	50-15	5	S	2	12	70	58	10	A	No	53	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	8500R	349.95	3.2	50-15	5	S	2	12	70	58	10	A	No	53	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	8550R	349.95	3.2	50-15	5	S	2	12	70	58	10	A	No	53	Yes	No	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
	PE881A	79.95	3.2	50-10	5	S	1							50	No	No	U	Yes	5 1/2 x 1 1/2 x 5 3/8					
	6100R	239.95	3.2	50-15	5	S	2	12	70	58	0	A	No	53	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	6150R	239.95	3.2	50-15	5	S	2	12	70	58	0	A	No	53	Yes	No	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
	6300R	269.95	3.2	50-15	5	S	2	12	70	58	5	A	No	53	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	6350R	269.95	3.2	50-15	5	S	2	12	70	58	5	A	No	53	Yes	No	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
	6700RT	309.95	3.2	50-15	5	Both	2	12	70	58	0	A	B	56	Yes	Yes	I	Yes	7 1/4 x 2 x 4 5/8					
	6900RT	339.95	3.2	50-15	5	Both	2	12	70	58	5	A	B	56	Yes	Yes	I	Yes	7 1/4 x 2 x 4 5/8					
	4100R	139.95	3.2	50-15	5	S	1	13	65	58	0	A	No	50	No	No	I	Yes	7 1/4 x 2 x 4 5/8					
	4300R	159.95	3.2	50-15	5	S	1	13	65	58	0	A	No	50	No	No	I	Yes	7 1/4 x 2 x 4 5/8					
	4350R	159.95	3.2	50-15	5	S	1	13	65	58	0	A	No	50	No	No	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
	4500R	209.95	3.2	50-15	5	S	1	13	65	58	0	A	No	50	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	4700R	229.95	3.2	50-15	5	S	1	13	65	58	5	A	No	50	Yes	No	I	Yes	7 1/4 x 2 x 4 5/8					
	4750R	229.95	3.2	50-15	5	S	1	13	65	58	5	A	No	50	Yes	No	I	Yes	6 3/4 x 1 7/8 x 4 5/8					
CONCORD SYSTEMS	HPL-101	179.95	10	30-15	0.8	Both	2	11.2	68	68	0	A	No	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-121	279.95							68	68	10	A	B	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-122	299.95	10	30-16	0.8	Both	2	11.2	68	68	10	A	B	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-502	249.95	25	30-20	0.8	Both	2	11.2	68	68	0	A	B	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-504	299.95	25	30-20	0.8	Both	2	11.2	68	68	0	A	B	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-516	319.95	25	30-20	0.8	Both	2	11.2	68	68	0	A	B	58	No	No	I	No	2 x 7 1/8 x 4 3/4					
	HPL-525	429.95	25 x 2, 10 x 4	30-20	0.8	Both	4	11.2	68	68	10	A	B	58	No	Yes	I	No	2 x 7 1/8 x 4 3/4					
	HPL-532	499.95	25 x 2, 10 x 4	30-20	0.8	Both	4	11.2	68	68	10	A	B	58	No	Yes	I	No	2 x 7 1/8 x 4 3/4					
	CRAIG	T502	79.95	4.5	150-20	1.0	S	1		70	60			M	50	No	No	C	Yes	1 1/4 x 6 1/4 x 4 3/4				
T700		99.95	4.5	90-20	1.0	S	1		65	60			M	50	No	No	C	Yes	2 x 7 x 5 1/8					
T503		134.95	4.5	90-20	1.0	S	1		62	60			M	52	Yes	No	C	Yes	1 3/4 x 6 1/4 x 4 3/4					
T701		159.95	4.5	90-20	1.0	S	1		65	60			M	50	Yes	No	C	Yes	1 3/4 x 7 x 4 3/4					
T720		169.95	4	200-20	2.0	S	1		60	60			M	56	Yes	No	C	Yes	2 x 7 x 5					
T721		199.95	4.5	90-20	1.0	S	1		65	55			M	50	Yes	No	C	Yes	2 x 7 x 4 3/4					
T561		209.95	4.5	90-20	1.0	Both	2		70	65	5	M	50	Yes	No	C	Yes	2 x 6 1/4 x 4 3/4						
T740		199.95	4.5	70-20	1.0	Both	2		67	60			A	52	Yes	No	C	Yes	2 x 7 x 5 1/8					
T741		229.95	4.5	70-20	1.0	Both	2		67	60			A	64	Yes	Yes	C	Yes	2 x 7 x 5 1/8					
T742		289.95	12	80-20	0.5	Both	2		67	60			A	61	Yes	Yes	C	Yes	2 x 7 x 5 1/8					
T760		249.95	4.5	90-20	1.0	Both	2		67	60	5	A	D	56	Yes	Yes	C	Yes	2 x 7 x 5 1/8					
W460		369.95																						

RADIOS/TAPE PLAYERS

MANUFACTURER	Model	Price, \$	AMPLIFIER										RADIO							TAPE				
			Average Watts Channel, per IHF A-202	Power Bandwidth, per IHF A-202	THD at Rated Output per IHF A-202	Outputs, Preamp (P), Speaker Level (S)	Number of Taps or EQ Controls	FM Sensitivity dB (For 30-dB Quieting)	Selectivity, dB	FM S/N Ratio, dB	Total Number of Presets	Local Station Control: Manual Switch (M), Noise-Reduction Circuit? (N)	Automatic (A)	Tape S/N Ratio, dB (With IIR if Applicable)	Auto Reverse?	Tape EQ Switch?	In Dash (I), Under-Dash (U), Convertible (C)	Application Guide Available?	Dimensions, inches					
																				Power per IHF A-202	THD at Rated Output per IHF A-202	Outputs, Preamp (P), Speaker Level (S)	Number of Taps or EQ Controls	FM Sensitivity dB (For 30-dB Quieting)
FUJITSU TEN	CE-4133	659.95		20-70	P	5	15	64		10	M	B	55	Yes	Yes	I	Yes	7 x 2 x 5 1/2						
	CE-4130	399.95	10	40-15	Both	2	15	64		10	M	B	55	Yes	Yes	I	Yes	7 x 2 x 5 1/2						
	CE-4830	349.95	3	50-15	Both	2	15	60		10	M	B	55	Yes	Yes	I	Yes	7 1/2 x 2 x 4 1/4						
	CE-4434	259.95	3	50-15	Both	1	17.3	60		10	M	B	50	Yes	Yes	I	Yes	7 1/2 x 2 x 4 1/4						
	CE-4432	299.95	3	50-15	Both	2	15	60		12	M	D	53	Yes	Yes	I	Yes	7 1/2 x 2 x 4 1/4						
	CR-1134	319.95	12	40-15	S	2	15	60		5	A	B	55	Yes	Yes	I	Yes	7 x 1 3/4 x 5 1/2						
	CM-6530	269.95	12	40-15	Both	2	20	60		5	A	D	53	Yes	Yes	I	Yes	7 x 2 x 5 1/2						
	CM-6430	179.95	3	50-15	Both	1	20	60		0	A		53	Yes	Yes	I	Yes	7 x 2 x 5 1/2						
	FULTRON	16-7600	349.95	4	100-14	Both	2				12	A	D		Yes	Yes	I	Yes	2 1/4 x 7 1/2 x 5 1/2					
16-7100		269.95	4	100-14	Both	2				12	M	D		Yes	Yes	I	Yes	2 x 7 x 4 1/2						
16-6900		249.95	4	100-14	Both	2				12	A	D		Yes	Yes	I	Yes	2 x 7 x 4 1/2						
16-7000		229.95	4	100-14	Both	2				12	M			Yes	Yes	I	Yes	1 1/2 x 7 x 5 1/4						
16-6800		199.95	4	100-14	S	1				12	A			Yes	Yes	I	Yes	2 x 7 x 4 1/2						
16-6700		179.95	4	100-14	Both	2				5	A	D		Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
16-5700		159.95	4	100-14	Both	2				0	A	D		Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
16-6600		149.95	4	100-14	Both	2				5	A			Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
16-5300		139.95	4	100-14	Both	1				0	A			Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
16-5200		119.95	4	100-14	S	1				0	A			Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
16-5000		79.95	4	100-14	S	1				0	M			Yes	Yes	I	Yes	1 1/2 x 7 x 4 1/2						
HI-COMP		HCC-1250	13	7.5	50-20	1	Both	2	11	74	62	12	M	B	61	Yes	Yes	I	Yes	6 1/4 x 2 x 5				
		HCC-1200	13	3.5	50-20	1	Both	2	11	74	62	12	M	B	65	Yes	Yes	I	Yes	6 1/4 x 2 x 5				
		HCC-1150	13	3.5	50-20	1	Both	2	11	74	62	12	M	D	51	Yes	Yes	I	Yes	6 1/4 x 2 x 5				
	HCC-1050	13	3.5	70-15	1	S	2	11	74	62	12	M	B	50	No	Yes	I	Yes	6 1/4 x 2 x 5					
	HCC-565	13	13	50-20	1	Both	2	11	74	62	5	A	B	64	Yes	Yes	I	Yes	7 x 2 x 5 1/2					
JENSEN	ATZ500	519.95	18	50-15	2.5	Both	2	19.2	65		12	A	B/C	70	Yes	Yes	I	Yes	2 x 7 x 5 1/2					
	ATZ400	469.95	12	50-15	2.5	Both	2	19.2	65		12	A	B	60	Yes	Yes	I	Yes	2 x 7 x 5 1/2					
	ATZ300	419.95	7.5	50-15	2.5	Both	2	19.2	65		12	A	B	60	Yes	Yes	I	Yes	2 x 7 x 5 1/2					
	ATZ200	369.95	4	50-15	2.5	Both	2	19.2	65		12	A	B	50	Yes	Yes	I	Yes	2 x 7 x 4 1/4					
	ATZ100	319.95	4	50-15	2.5	Both	2	19.2	65		12	A	B	50	Yes	Yes	I	Yes	2 x 7 x 4 1/4					
	RE530	499.95	4	50-15	2.5	Both	2	19.2	65		10	A	B/D	60	Yes	Yes	I	Yes	2 x 7 x 5 1/2					
	RE520	419.94	4	50-15	2.5	Both	2	19.2	60		10	A	B	60	Yes	Yes	I	Yes	1 1/2 x 7 x 4 3/4					
	RE518	399.95	4	30-15	2.5	S	2	19.2	60		10	M	B	60	Yes	Yes	I	Yes	1 1/2 x 7 x 4 3/4					
	RE508	299.95	4	50-15	2.5	S	1	19.2	60		8	A	B	50	Yes	No	I	Yes	1 1/2 x 7 x 4 3/4					
	R408	289.95	4	50-15	2.5	Both	2	19.2	65		5	A	B	60	Yes	Yes	I	Yes	1 1/2 x 7 1/4 x 5 1/2					
	R220	249.95	3.5	50-15	2.5	Both	1	19.2	60		5	A	B	50	No	No	I	Yes	1 1/2 x 6 3/4 x 4 3/4					
	R210	199.95	3.5	50-15	2.5	S	1	25.2	60		5	A	B	50	No	No	I	Yes	1 1/2 x 6 3/4 x 4 3/4					
	JR105	169.95	3.5	50-15	2.5	S	2	21.4	65		0	A		50	No	No	I	Yes	1 1/2 x 7 x 4 3/4					
	JET SOUND ELECTRONICS	9505	59.95	4.5	20-18	1	S	1	23	65	60	0	M		55	No	No	I	No	1 1/4 x 6 3/4 x 4 3/4				
9515		79.95	10	20-18	1	Both	2	23	70	60	0	M		60	No	No	I	No	1 1/4 x 6 1/2 x 4 3/4					
9525		119.95	10	20-18	1	Both	2	23	70	60	0	M		60	Yes	No	I	No	1 1/4 x 6 1/2 x 5					
9530		179.95	10	20-18	1	Both	2	23	70	60	5	M	D	80	Yes	Yes	I	No	1 1/4 x 6 1/2 x 4 3/4					
9540		199.95	10	20-18	1	Both	2	23	70	65	10	M	B	85	Yes	Yes	I	No	1 1/2 x 7 x 4 1/2					
9570		279.95	10	20-18	1	Both	2	23	70	65	12	M	B	85	Yes	Yes	I	No	1 1/2 x 7 x 4 1/2					
JVC		KS-R05	159.95	3	100-20	0.8		1	16.3	65			M	B	60		Yes	I	6 3/8 x 1 1/4 x 4 1/2					
	KS-R10	179.95	3	100-20	0.8		2	16.3	65			M	B	60		Yes	I	6 3/8 x 1 1/4 x 4 1/4						
	KS-R15	209.95	3	100-20	0.8		2	16.3	65			M	B	60		Yes	I	6 3/8 x 1 1/4 x 4 1/4						
	KS-R3	219.95	10	50-15	1.0		2	16.3	65		10	M	B	60		Yes	I	7 x 1 3/4 x 5 1/2						
	KS-R30	239.95	3	100-20	0.8		2	16.3	65		10	A	B	60	Yes	Yes	I	6 3/4 x 2 x 4 1/2						
	KS-R35	269.95	3	100-20	0.8		2	16.3	65		10	A	B	60	Yes	Yes	I	6 3/4 x 2 x 4 1/2						
	KS-R50	279.95	3	100-20	0.8		1				10	M	B		Yes	Yes	I	6 3/4 x 2 x 5 1/2						
	KS-R70	319.95	3	100-20	0.8		1				10	M	B		Yes	Yes	I	6 3/4 x 2 x 5 1/2						
	KS-RX150	259.95	8	40-20	0.8		2				10	A	B		Yes	Yes	I	6 3/4 x 2 x 5 1/2						
	KS-RX200	289.95	8	40-20	0.8		2				10	M	B		Yes	Yes	I	6 3/4 x 2 x 5 1/2						
	KS-C100	399.95						2	16.3	65		12	M	B/C	60	Yes	Yes	I	6 3/4 x 2 x 5 1/2					
	KS-C200	569.95						5			12	M	B/C		Yes	Yes	I	7 1/2 x 2 x 4 3/4						
	KS-Q8	449.95	8	40-20	0.8				16.3	65		10	M			Yes	Yes	I	7 1/2 x 2 x 5 1/2					
	KENWOOD	KRC-929	729.00			P	2	18.4@50 dB	80	70	24	M	A/B/C	89	Yes	Yes	I	Yes	2 x 7 1/2 x 6 1/2					
		KRC-1022	599.00			P	2	18.4@50 dB	65	70	12	M	B	62	Yes	Yes	I	Yes	2 1/2 x 7 1/2 x 6 1/2					
		KRC-9900	599.00			P	2	18.4@50 dB	80	70	24	M	A/B/C	86	Yes	Yes	I	Yes	2 x 7 1/2 x 5 3/4					
		KRC-922	499.00			P	2	18.4@50 dB	65	70	10	M	B	63	Yes	Yes	I	Yes	2 x 7 1/2 x 5 3/4					
KRC-8000		459.00	4	50-40	1	Both	2	18.4@50 dB	65	70	24	M	B/C	68	Yes	Yes	I	Yes	2 x 7 1/2 x 5 1/2					
KRC-626		399.00	4.5	40-40	1	Both	2	18.6@50 dB	65	70	12	M	B/C	64	Yes	Yes	I	Yes	2 x 7 1/2 x 6 3/4					
KRC-7100		379.00	4	40-30	1	Both	2	18.4@50 dB	65	70	10	M	B	63	Yes	Yes	I	Yes	2 x 7 1/2 x 5 1/2					
KRC-512		319.00	4	40-30	1	Both	2	19.0@50 dB	65	68	10	A	B	60	Yes	Yes	I	Yes	1 1/4 x 6 3/8 x 4 3/4					
KRC-3100		299.00	4	40-30	1	Both	2	18.4@50 dB	65	70	10	M		58	Yes	Yes	I	Yes	2 x 7 1/2 x 5					
KRC-2100		199.00	4	40-30	1	Both	2	22.2@50 dB	65	68	5	A		52	Yes	Yes	I	Yes	2 x 7 1/2 x 5 3/4					
KRACO	ETR 1089	279.95	15	15-10	10	S	2	26.8	40	65	12	M	B	85	Yes	Yes	C	Yes	7 x 5 1/2 x 2					
	ETR 1088	249.95	15	15-10	10	S	2	26.8	40	60	12	M	D	80	Yes	Yes	C	Yes	7 x 5 x 2					
	ETR 1086	229.95	5	6-10	10	S	2	26.8	40	60	10	M	D	80	Yes	Yes	C	Yes	7 x 5 1/2 x 2					
	KHP 1085	249.95	15	15-10	10	S	2	26.8	40	60	0	M	B	85	No	No	C	Yes	7 x 5 1/2 x 2					
	ETR 1081	199.95	5	6-10	10	S	2	26.8	40	60	10	M	No	55	No	No	C	Yes	7 x 5 1/2 x 2					
	KGE 803	249.95	15	15-10	10	S	5	26.1																

RADIOS/TAPE PLAYERS

MANUFACTURER	Model	Price, \$	AMPLIFIER										RADIO					TAPE				
			Average Watts Channel, per IHF A-202	Power Bandwidth, Hz to MHz, per IHF A-202	TWO at Rated Output, %	Outputs, Preamp (P), Speaker Level (S)	Number of Tone or EQ Controls	FM Sensitivity, dB (For 30-dB Quieting)	Selectivity, dB	FM S/N Ratio, dB	Total Number of Presets	Local/Distant Control	Manual Switch	Noise-Reduction (NR)	See Code	Tape S/N Ratio, dB (With NR N/A)	Automatic (A)	Auto Reverse?	Tape EQ Switch?	In-Dash (I), Under-Dash (U), Convertible (C)	Application Guide Available?	Dimensions, Inches
MAJESTIC ELECTRONICS	MCR1000AM	99.95	6			P	2	19.2	75	60	0	M		45	No	No	I	No	6 3/4 x 1 3/4 x 4 3/4			
	MCR1700ANMS	149.95	6			P	4	19.2	75	60	0	M		45	No	No	I	No	6 3/4 x 1 3/4 x 4 3/4			
	MCR1800	149.95	6			P	3	19.2	75	60	5	M		45	No	No	I	No	6 7/8 x 1 3/4 x 4 3/4			
	MCR4400	279.95	6			P	3	19.2	75	60	12	M	D	40	No	No	I	No	7 x 1 3/4 x 4 7/8			
	MCR3600	349.95	8			P	3	15		60	12	M	D	50	Yes	No	I	Yes	7 x 1 3/4 x 4 3/4			
	MCR2900	199.95	7			P	3	25.2		60	10	M	D	50	Yes	No	I	Yes	6 1/2 x 1 3/4 x 4 7/8			
MARANTZ	CAR-320	165.00	4		0.9	S	1	16.4	60	60	0	M		50	Yes		I	No	1 3/4 x 6 3/4 x 4 3/4			
	CAR-312	200.00	4		0.9	S	2	16.4	60	60	0	M		50	Yes		I	No	1 3/4 x 6 7/8 x 4 3/4			
	CAR-322	250.00	4		0.9	S	2	14.8	70	60	0	M	B	50	Yes	Yes	I	No	1 3/4 x 7 1/8 x 4 3/4			
	CAR-302	250.00	4		0.9	S	2	14.8	65	60	5	M	B	56	Yes		I	No	2 3/4 x 7 1/8 x 4 3/4			
	CAR-355	300.00	4.5 x 4		0.9	Both	2	16.4	60	60	12	M		50	Yes	Yes	I	No	2 x 7 1/8 x 4 3/4			
	CAR-360	360.00	4.5 x 4		0.9	Both	2	16.4	60	60	12	M	B	58	Yes	Yes	I	No	2 x 7 1/8 x 4 3/4			
MIDLAND INTERNATIONAL	67-434	64.95	5		10	S	1	25.2	45	65	0	M	No	50	No	No	I	No	1 3/4 x 6 3/4 x 4 3/4			
	67-420	129.95	15		10	S	5	25.2	60	60	0	M	No	50	No	No	I	No	2 x 7 x 5			
	67-430	179.95	5		10	S	2	25.2	20	55	12	M	No	50	Yes	No	I	No	2 x 7 x 5			
	67-450	249.95	15		10	S	2	25.2	20	50	12	M	No	50	Yes	No	I	No	2 x 7 x 5			
	67-480	269.95	15		10	Both	3	25.2	20	50	12	M	B	50	Yes	No	I	No	2 x 7 x 5 1/8			
MITSUBISHI	CZ-757	399.95				P	2	16.0	65	60	12	A	B	59	Yes	Yes	I	Yes	2 1/8 x 7 x 4 3/4			
	RX-737	379.95	4	50-20	5	S	2	16.0	65	60	12	A	B	59	Yes	Yes	I	Yes	2 1/8 x 7 x 4 3/4			
	RX-735	329.95	4	50-20	5	S	1	15.0	65	60	12	M		55	Yes		I	Yes	2 1/8 x 7 x 4 3/4			
	RX-733	289.95	4	50-20	5	S	1	16.0	65	60	10	M		50	Yes		I	Yes	2 1/8 x 7 x 4 3/4			
	RX-755	269.95	4	50-30	5	S	1	22.0	86	60	5	A		50	Yes		I	Yes	2 x 7 x 5 7/8			
	RX-711	179.95	4.5	50-26	5	S	1	23.0	65	62	5	M		50	Yes	Yes	I	Yes	2 1/2 x 7 3/8 x 4 3/4			
	CZ-727	249.95				P	2	20.0	80	64		M	D	55	Yes	Yes	I	Yes	2 x 6 1/4 x 4 3/4			
	RX-707	229.95	4	50-20	5	S	1	22.0	86	64	5	A		50	Yes	Yes	I	Yes	2 x 7 x 4 3/4			
	RX-726	199.95	4	70-20	5	S	1	22.0	80	64		M		50	Yes	Yes	I	Yes	2 x 6 1/4 x 4 3/4			
	RX-724	139.95	4	50-20	5	S	1	22.0	80	60		M		50	Yes	Yes	I	Yes	1 3/4 x 7 1/8 x 4 1/4			
	RX-909	319.95	14	50-20	5	S	2	22.0	86	64	5	A	D	60	Yes	Yes	I	Yes	2 x 7 x 5 7/8			
	NAKAMICHI	TD-1200H	1260.00				P	3	22	60	65	10	A	B/C	70	Yes	Yes	I	Yes	7 1/8 x 2 1/8 x 7 1/8		
		TD-800	890.00				P	3	22	60	65	10	A	B/C	70	No	Yes	I	Yes	7 1/8 x 2 1/8 x 7 1/8		
	PANASONIC	CQ-S958	539.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A	B	60	Yes	Yes	I	Yes	2 1/8 x 7 x 6		
CQ-S934		429.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A	A/B	60	Yes	Yes	I	Yes	6 3/8 x 5 1/4 x 2			
CQ-S884		379.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A	B	60	Yes	Yes	I	Yes	6 3/8 x 5 1/4 x 2			
CQ-S818		349.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A	B	50	No	Yes	I	Yes	6 3/8 x 5 x 2 1/8			
CQ-S834		329.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A		60	Yes	Yes	I	Yes	6 3/8 x 5 1/4 x 2			
CQ-S804		289.95	3 x 4		3	Both	0	19@ 50 dB	35		10	A	B	60	Yes	Yes	I	Yes	6 3/8 x 5 1/4 x 2			
CQ-S768		289.95	3 x 4		3	S	0	19@ 50 dB	35		5	A		50	Yes	Yes	I	Yes	7 x 5 1/4 x 2 1/8			
CQ-S793		289.95	3 x 4		3	S	0	19@ 50 dB	35		5	A	A	80	Yes	Yes	I	Yes	7 x 5 1/4 x 2 1/8			
CQ-S788		299.95	3 x 4		3	S	0	19@ 50 dB	35		10	A	B	50	No	Yes	I	Yes	6 3/8 x 5 x 2 1/8			
CQ-S774		259.95						19@ 50 dB														
CQ-S747		249.95						19@ 50 dB														
CQ-S744								19@ 50 dB														
CQ-S734		219.95	3 x 4		3	S	0	19@ 50 dB	35		5	A		50	No	No	C	Yes	6 3/8 x 5 1/4 x 2			
CQ-S713		219.95	3 x 4	40-20	3	S	0	19@ 50 dB	35		5	A		50	No	No	I	Yes	7 x 5 1/4 x 2 1/8			
CQ-S687		189.95	3 x 4		3	S	0	19@ 50 dB	35		5	M		50	No	No	I	Yes	7 x 5 1/4 x 2 1/8			
CQ-S682		189.95	3 x 4		3	S	0	19@ 50 dB	35		5	A		50	No	No	I	Yes	7 x 5 1/4 x 2			
CQ-S668		169.95	3		3	S	0	19@ 50 dB	35		5	A		50	No	No	I	Yes	7 x 5 1/4 x 2			
CQ-6868		149.95	2		3	S	0	19@ 50 dB	35			A		50	No	No	I	Yes	7 x 5 1/4 x 1 3/4			
RM-710		1399.95	7.5 x 4	20-40	3	S	0	18@ 50 dB	20	72	12	A	B	63	Yes	Yes	†	Yes	27 7/8 x 8 x 1 1/8; †Overhead			
RM-310	599.95	2.5 x 4	15-20	3	S	0	18@ 50 dB	23	73	3	A		55	No	No	†	Yes	27 7/8 x 8 3/8 x 1 1/8; †Overhead				
PARASOUND	RDR90	169.95	4	30-20	0.8	Both	3	14.0	66	62	10	M		60	Yes	Yes	I		6 3/4 x 1 3/4 x 5 1/4			
	ETR1200	269.95	4	20-20	0.5	Both	3	12.7	68	62	12	A		62	Yes	Yes	I		6 3/4 x 1 3/4 x 5 1/4			
PHILIPS AUTO AUDIO	825	599.95				P	2	25	69	65	12	M	B	67	No	Yes	I	No	2 x 7 x 5 3/4			
PIONEER	KP-2000	129.95	3.2	50-15	5.0	S	1	23.2	50	65			52	No	No	I	Yes	2 x 7 1/8 x 5 1/4				
	KP-2205	159.95	3.2	50-15	5.0	S	1	23.2	50	65			52	No	No	I	Yes	1 3/4 x 7 1/8 x 4 3/4				
	KP-4205	184.95	3.2	50-15	5.0	S	1	23.2	50	65			52	Yes	No	I	Yes	1 3/4 x 7 1/8 x 4 3/4				
	KP-A400	199.95	3.2	50-15	5.0	S	1	17	70	70	5		52	No	No	I	Yes	2 x 7 1/8 x 5 1/4				
	KE-A330	219.95	3.2	50-15	5.0	S	1	17	70	70	18		52	No	No	I	Yes	2 x 7 1/8 x 5 3/8				
	KP-A450	219.95	10.0	50-15	5.0	S	2	23.2	50	65			52	Yes	No	I	Yes	2 x 7 1/8 x 5 7/8				
	KP-A500	219.95	3.2	50-15	5.0	Both	2	17.0	70	70	5		52	No	No	I	Yes	2 x 7 1/8 x 5 1/4				
	KP-A600	249.95	2.9	50-15	5.0	S	1	17.0	70	70	5		52	Yes	No	I	Yes	2 x 7 1/8 x 5 1/4				
	KP-A700	249.95	3.2	50-15	5.0	Both	2	17.0	70	70	5		52	Yes	No	I	Yes	2 x 7 1/8 x 5 1/4				
	KE-A430	259.95	2.9	50-15	5.0	S	1	17.0	70	70	18		52	No	Yes	I	Yes	2 x 7 1/8 x 5 3/8				
	KP-A750	279.95	10.0	50-15	5.0	Both	2	17.0	70	70		B	60	Yes	Yes	I	Yes	2 x 7 1/8 x 5 7/8				
	KE-A630	309.95	2.9	50-15	5.0	Both	2	17.0	70	70	18		52	Yes	Yes	I	Yes	2 x 7 1/8 x 5 3/8				
	KE-7200	349.95	3.2	50-15	5.0	S	2	17.0	70	70	15		B	60	Yes	Yes	I	Yes	2 x 7 1/8 x 4 3/4			
	KE-A880	399.95	10.0	50-15	5.0	Both	2	17.0	70	70	18		B	60	Yes	Yes	I	Yes	2 x 7 1/8 x 5 7/8			
	FEX-95	699.95					P	2	17.0	70	70	18		B/C	70	Yes	Auto	I	Yes	2 x 7 1/8 x 6 1/2		

RADIOS/TAPE PLAYERS

MANUFACTURER	Model	Price, \$	AMPLIFIER						RADIO					TAPE						
			Average Watts/Channel, per IHF A-202	Power Bandwidth Hz to 1kHz, per IHF A-202	THD at Rated Output, %	Outputs: Preamp (P), Speaker Level (S), Both (Both)	Number of Tone or EQ Controls	FM Sensitivity (dB) (For 30-dB Distortion)	Selectivity, dB	FM S/N Ratio, dB	Total Number of Presets	Local/Distant Control	Manual Switch (M), Noise-Reduction (N), See Code	Tape S/N Ratio, Automatic (A), (With NR if Applicable)	Auto Reverse?	Tape EQ Switch?	In-Dash (I), Under-Dash (U), Convertible (C)	Application Guide Available?	Dimensions, inches	
PRDTON	202A	220.00	2.2	30-20	0.5	Both	2	14.1	60	65	0	M	B	67	No	Yes	I	No	6 1/4 x 1 1/4 x 5 1/2	
	204	320.00	2.2	20-30	0.5	Both	2	12.4	65	65	10	M	B	68.5	Yes	Yes	I	No	6 1/4 x 2 x 5 1/2	
	212	380.00	12	20-30	0.3	Both	2	12.4	65	65	10	M	B	68.5	Yes	Yes	I	No	6 1/4 x 2 x 6	
	207	500.00		20-30	0.09	P	2	10.8	65	70	10	M	BC	74	Yes	Yes	I	No	7 1/8 x 2 x 5 3/8	
ROYAL SOUND	RS2000S	125.00	10			S	1	17.2	50	55	0	M	No	No	No	No	I	Yes	1 3/4 x 7 x 5	
	RS2300S	200.00	10			S	1	17.2	50	60	0	M	No	55	Yes	No	I	Yes	1 3/4 x 7 x 5	
SANSUI	CX-990	519.00				P	2	18.4	50	70	24	M	BC	73	Yes	Yes	I	Yes	7 1/8 x 2 x 4 3/8	
	CX-900	499.00				P	2	18.4	50	70	24	M	BC	73	Yes	Yes	I	Yes	7 1/8 x 2 x 4 3/8	
	CX-910	499.00				P	2	18.4	50	70	24	M	BC	73	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	RX-700	429.00	15	30-40	1.0	Both	2	18.4	50	70	24	M	B	62	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	RX-710	429.00	15	30-40	1.0	Both	2	18.4	50	70	24	M	B	62	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	RX-500	339.00	4.4	30-30	1.0	S	2	18.4	50	70	24	M	B	52	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	RX-510	339.00	4.4	30-30	1.0	S	2	18.4	50	70	24	M	B	52	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	SX-7	279.00											B	62	Yes	Yes	C	Yes	6 x 2 x 6	
	ST-7	269.00						18	40	73	10	M			Yes	Yes	C	Yes	5 1/8 x 1 x 5 3/4	
	SY-7	399.00	20	30-20	10	Both	2						B	62	Yes	Yes	C	Yes	6 x 2 x 7 1/2	
SANYO	FT-U12	99.95	9.5	50-20	1	S	1	24.2	35			M		50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U22	119.95	9.5	50-20	1	S	1	20.8	60			M		50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U32	149.95	9.5	50-20	1	S	2	20.8	60			M		50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U42	179.95	9.5	50-20	1	Both	2	20.8	60			M	B	50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U52	229.95	9.5	50-20	1	Both	5	19.2	70			M	BC	50	Yes	Yes	I	Yes	6 3/4 x 2 x 5	
	FT-U35	149.95	9.5	50-20	1	S	1	20.8	60		5	M		50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U45	179.95	9.5	50-20	1	Both	2	20.8	60		5	M	B	50	Yes	Yes	I	Yes	6 3/4 x 2 x 4 3/4	
	FT-U55	219.95	9.5	50-20	1	Both	2	19.2	70		5	M	B	50	Yes	Yes	I	Yes	6 3/4 x 2 x 5	
	FT-E15 (ETR)	239.95	9.5	50-20	1	Both	1	19.2	65		12	M		50	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	FT-E20 (ETR)	279.95	9.5	50-20	1	Both	1	19.2	65		12	M	B	50	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
SHERWOOD	CRD 80	119.95	6	40-20	0.5	Both	1	20.7	65	67	0	M	D	62	No	Yes	I	Yes	4 7/8 x 2 x 6 1/8	
	CRD 90	149.95	6	40-20	0.5	Both	2	20.7	65	67	0	M	B	62	No	Yes	I	Yes	6 5/8 x 2 x 4 7/8	
	CRD 100	159.95	20	40-20	0.5	Both	1	20.7	65	67	0	M	D	62	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
	CRD 150 with AM Stereo	209.95	6	40-20	0.5	Both	2	14.8	65	67	10	M	B	62	No	Yes	I	Yes	6 5/8 x 2 x 4 7/8	
	CRD 200	239.95	20	40-20	0.5	Both	2	19.1	65	67	10	M	B	62	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8	
CRD 300	279.95	20	40-20	0.5	Both	2	17.3	65	67	12	M	B	62	Yes	Yes	I	Yes	7 1/8 x 2 x 5 1/8		
SONY	XR-100	649.95		40-20		P	2	11	80	65	12	M	BC	75	Yes	Yes	I	Yes	2 x 7 1/8 x 6	
	XR-85	474.95	14		0.5	Both	3	15	70	65	12	M	B	58	Yes	Yes	I	Yes	2 1/4 x 7 1/8 x 6	
	XR-75	474.95				P	3	15	70	65	12	M	B	65	Yes	Yes	I	Yes	2 x 7 1/8 x 6	
	XR-65	329.95	4	150-20	1.5	Both	3	15	70	65	10	M	B	67	Yes	Yes	I	Yes	2 x 7 1/8 x 5 1/8	
	XR-45	279.95	4	150-20	1.5	Both	2	15	70	65	10	M		59	Yes	Yes	I	Yes	2 x 7 1/8 x 5 1/8	
	XR-40	239.95	4	150-20	1.5	Both	4	15	65	66				59	Yes	Yes	I	Yes	2 x 6 3/4 x 4 3/4	
	XR-30	199.95	4	150-20	1.5	Both	2	15	65	66				59	Yes	Yes	I	Yes	2 x 6 3/4 x 4 3/4	
	XR-20	179.95	4	150-20	1.5	S	2	15	65	66				59	Yes	Yes	I	Yes	2 x 6 3/4 x 4 3/4	
	XR-10	169.95	4	180-10	1.0	S	2	20	60	60				53	Yes	Yes	I	Yes	2 x 7 1/8 x 6	
SPARKOMATIC	SR-315	349.95	22.5	20-20	10	S	5	25.2	65	65	10		B/C/D	60	Yes	Yes	I	Yes	7 x 1 7/8 x 5 1/4	
	SR-308	249.95	22.5	20-20	10	S	2	25.2	65	65	10	M	D	60	Yes	Yes	I	Yes	7 x 1 7/8 x 5 1/4	
	SR-314	189.95	12	80-17	10	S	1	34.7	55	60	10			60	No	No	I	Yes	7 x 1 7/8 x 4 3/8	
	SR-338	139.95	10	70-12	10	S	1	34.7	55	57	10			55	No	No	I	Yes	7 x 1 7/8 x 4 3/8	
	SR-307	189.95	22.5	20-20	10	S	5	31.2	60	60	0		D	50	Yes	Yes	I	Yes	7 x 1 7/8 x 5 1/8	
	SR-325	229.95	22.5	20-20	10	S	1	29.3	65	65	10		D		No	No	I	Yes	7 1/8 x 2 x 6	
	SR-305	129.95	22.5	20-20	10	S	5	16.7	55	60	0	M		38	No	No	I	Yes	7 1/8 x 1 3/4 x 5 1/8	
	SR-334	119.95	10	75-10	10	S	1	22.9	55	60	0			35	Yes	No	I	Yes	6 5/8 x 1 3/4 x 4 3/8	
	SR-300	69.95	10	75-10	10	S	1	22.9	55	60	0	M		35	No	No	I	Yes	7 x 1 3/4 x 4 3/8	
	SS-31E	129.95	22.5	20-20	10	S	2						D	50	Yes	Yes	U	Yes	5 1/4 x 1 3/4 x 6 3/4	
	SS-30E	89.95	22.5	20-20	10	S	2						D	50	No	Yes	U	Yes	5 1/4 x 1 3/4 x 5 3/8	
TANCREDI	TC1150	99.95	6	50-12	0.5	S	1	21	75	60	0	M		60	No	No	I	No	1.7 x 6.3 x 4.5	
	TC2010	79.95	8	50-12	0.5	S	1	21	75	60	0	M		60	No	No	I	No	1.7 x 6.7 x 4.7	
	TC5050	129.95	8 x 4	50-12	0.5	S	1	21	75	60	0	M		60	Yes	No	I	No	1.7 x 6.7 x 4.7	
	TSS2020	99.95	25 x 4	50-12	0.5	S	1	21	75	60	0	M		60	No	No	I	No	1.7 x 7 x 5.1	
	TSS3030	139.95	25 x 4	50-12	0.5	S	3	21	75	60	0	M	D	60	No	No	I	No	1.7 x 7 x 5.1	
	TCX7100	279.95	8 x 4	30-15	0.5	Both	1	21	75	60	12	M	D	60	Yes	No	I	No	2 x 7 x 4.9	
UNISEF	CR-18M		5	40-15			1				0	A	No	No	No	No	I	No	7 x 1 3/4 x 4 3/4	
	CR-21M		5	40-15			1				0	A	No	Yes	No	No	I	No	7 x 1 3/4 x 4 3/4	
VECTOR RESEARCH	VM-950	500.00	15	20-20	0.9	Both	2	18	60	58	12	M	A	B	62	Yes	Yes	I	No	2 x 7 x 5 1/2
	VM-900	400.00	5	20-20	0.9	Both	2	18	60	58	12	M	A	B	62	Yes	Yes	I	No	2 x 6 1/4 x 4 3/4
	VM-700	300.00	15	20-20	0.9	Both	2	20	60	58	5	M	A	B	62	Yes	Yes	I	No	1 3/4 x 7 x 5 1/8
YAMAHA	YCR-900	550.00	12		1	S	3	17.3	80	70	12	M	8	65	Yes	Yes	I	No	7 x 2 x 5 1/2	
	YCR-700	480.00	3.5		1	S	3	17.3	80	70	10	M	8	65	Yes	Yes	I	No	6 1/4 x 2 x 4	
	YCR-500	400.00	3.5		1	S	2	17.3	80	70	1									

Good news for your new Corvette, Mark VII LSC, 745, Quattro, 380SEC, Quattrovalvole, etc.



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ADS

The new ADS P80 and P120 are designed for everyone who loves lots of car and lots of music.

Electronically they're miles ahead of any other amplifiers including the ADS "replicas" who claim to be as good.

Frankly, they represent the state-of-the-art. Anything with four wheels and a pedigree deserves nothing less.

Both new powerplates are light and compact. Both power *two* pairs of speakers easily. Both use new circuitry designed for cool operation.

The result: exceptional performance and a lot more flexibility designing your installation.

The P80 (on top, above) puts out 40 clear, clean, watts per side. Money can't buy a better car amplifier.

Money can, however, buy more power and flexibility. The P120 at 60 watts per side is also "bridgeable" which means it's a stereo amp til you want more power. Then with the push of a button you can have a 90 watt mono amp to power a single side, adding another P120 for the other.

Naturally, these new Powerplates sound best mated to ADS speakers (300i, 320i). But that's another ad.

Till we write it see an ADS dealer for more info. Write us: Analog & Digital Systems, 215 Progress Way, Wilmington MA, 01887. Or call 800-824-7888 (in CA 800-852-7777) Operator 483.

ADS Audio apart.

AMPS/EQUALIZERS/CROSSOVERS

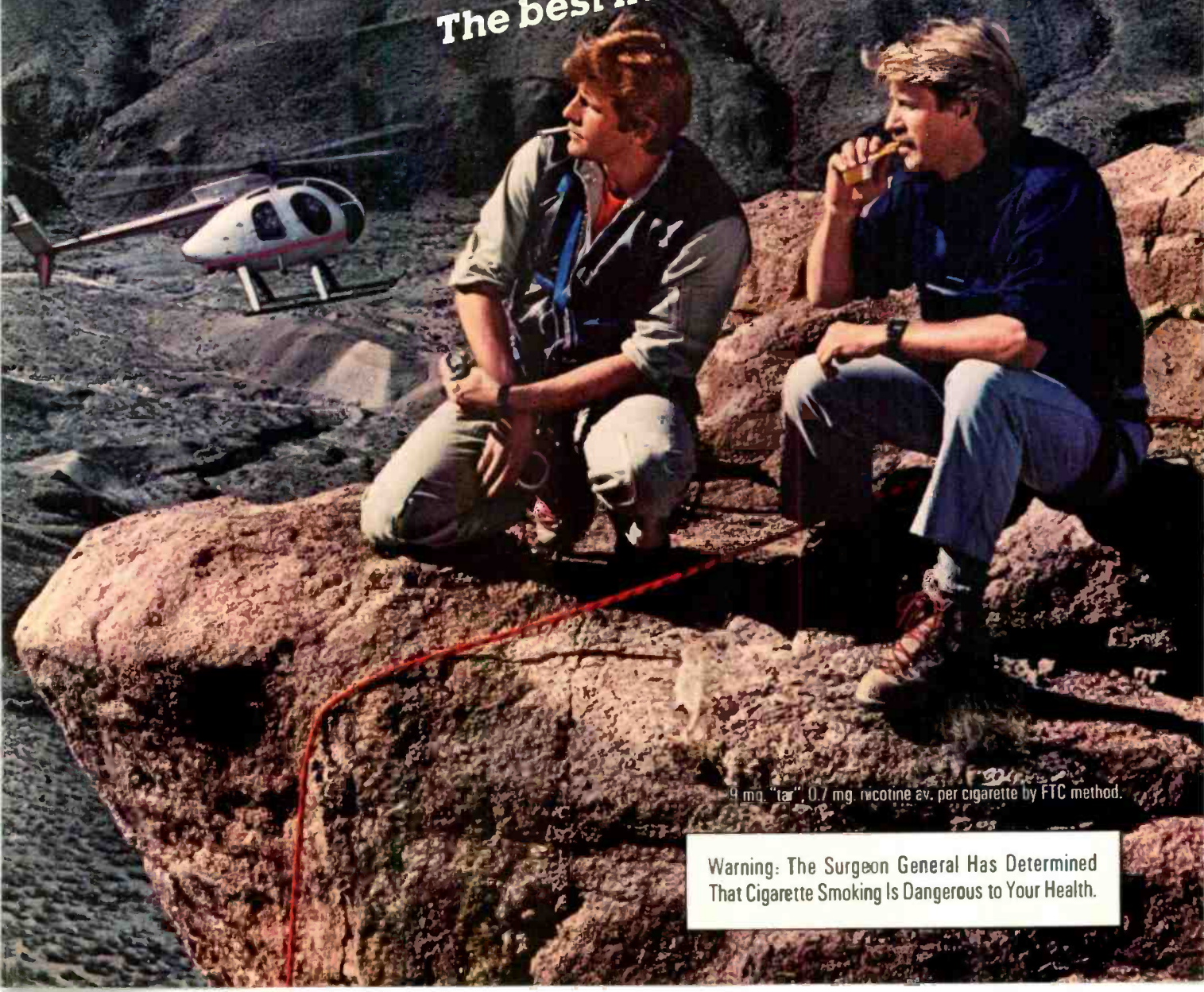
MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E), Active Crossover (C)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB	Watts Into 4 Ohms, Per IHF A-202	Power Bandwidth, Hz, Per IHF A-202	THD at Rated Output, Hz, Per IHF A-202	Input Level: Preamp (P), Speaker (S), Selectable (Sel.)	Fader Control?	Application Guide Available?	Dimensions, Inches	Notes
ADS	P80 P120 AX2	259.00 329.00 99.00	A A C			90 90 90	40 60	20-20 20-20	0.1 0.1 0.05	Sel. Sel. P	No No No	No No No	2 x 11 1/4 x 6 1/4 2 x 11 1/4 x 6 1/4 1 1/2 x 6 1/4 x 3 1/4	Rated for 2-ohm loads. As above, bridgeable. Plug-in frequency selection, adjustable in/out levels.
ALPHASONIK	AS2001 EX-2 A225 A240B A255 A265 PEQ-7 AEQ-720	145.00 125.00 125.00 175.00 250.00 350.00 100.00 150.00	A C A A A A E A/E			85 90 90 90 85 90 85 75	60 x 1 25 40 35 55 65 20	20-20 20-20 20-20 20-20 20-20 20-20	0.25 0.01 0.05 0.05 0.1 0.01 0.02 1.0	S P Sel. Sel. Sel. Sel. Sel. Sel.	No No No No No No Yes Yes	No No No No No No Yes No	5 3/4 x 2 1/4 x 6 1/2 7 x 1 1/2 x 5 1/2 2 1/2 x 6 x 6 1/2 2 1/2 x 7 1/2 x 8 1/2 2 1/2 x 9 1/2 x 8 1/2 2 1/2 x 10 1/2 x 6 1/2 1 1/2 x 5 1/4 x 4 1/4 1 1/2 x 6 1/4 x 4 1/4	Subsonic filter, 12-dB slope. Bridgeable. As above. As above. As above, Class-A circuit. Dual amp fader. Preamp out, power meter LED, headphone out.
ALPINE ELECTRONICS	3011 3000 3214 3023 3015 3316 3650 3516 3518 3512 3506 3508 3502	149.95 219.95 109.95 149.95 399.95 199.95 129.95 59.95 159.95 249.95 199.95 249.95 349.95	P/E/C A/E/C A/E A/E P/E P/E/C P/C A A A A A	5 5 7 7 7 7	12 12 12 12 12 12		18 x 4 18 18	40-20 30-20 40-30	8.0 8.0 8.0	Sel. Sel. P Sel. P P	Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes	5 1/2 x 1 1/2 x 3 1/2 7 x 1 1/2 x 5 1/2 5 1/2 x 1 1/2 x 5 1/2 5 1/2 x 1 1/2 x 5 1/2 6 1/4 x 2 x 5 1/2 6 1/4 x 1 x 4 1/4 6 1/4 x 1 1/2 x 4 1/4 8 1/4 x 1 1/2 x 2 1/4 7 1/2 x 2 1/2 x 5 1/2 7 1/2 x 2 1/2 x 7 1/2 8 1/4 x 2 x 7 1/2 6 1/4 x 2 x 7 1/2 7 1/2 x 3 1/2 x 9 1/4	80-Hz blamp crossover. As above. Computerized graphic EQ. Subwoofer output, 80 Hz, 12-dB slope. Bridgeable. As above. As above.
ARA	PA200 PEQ100 PEQ200	99.95 89.95 129.95	A E E			75 70 70	15 x 4	60-17	0.9	Sel. Sel. Sel.		No Yes No	5 1/2 x 5 1/2 x 1 1/2 4 1/4 x 6 1/4 x 1 1/2 4 1/4 x 6 1/4 x 1 1/2	Selectable 2/4 channel preamp input. Preamp output only. Three-band ambience control.
AUDIA	AFX150 EQX-7	450.00 100.00	A E			90 80	75	10-30	0.04	Sel. P			2 1/2 x 8 x 10 5 1/2 x 2 x 4	
AUDIOMOBILE	SA-452 SA-1600 SA-1052 SA-2050 CX-150 SP-300 System 1600 MOX-200 MDX-400 MDX-480	269.95 599.95 1299.95 999.95 319.95 319.95 1089.95 1699.95 2399.95 4289.95	A/C A/C A A C P A/C A/C A/C A/C			110 110 110 110 110 110 110 110 110	20† 20 x 4† 50 x 4† 100† 40 x 4† 50 x 4† 100 x 4† 20 x 4, 50 x 4, 100 x 2†	20-20 20-20 20-20 20-20 20-20 20-20 20-20	0.03 0.03 0.003 0.003 0.03 0.003 0.003 0.003	Sel. Sel. Sel. Sel. Sel. Sel. Sel. Sel.		Yes Yes	4 1/4 x 6 1/4 x 2 5 1/2 x 15 1/4 x 2 9 1/2 x 15 1/2 x 2 1/2 9 1/2 x 11 1/2 x 2 1/2 1 1/2 x 7 x 2 1/2 4 1/2 x 3 1/2 x 1 1/2 2 1/2 x 17 1/2 x 9 1/2 2 1/2 x 24 1/4 x 9 1/2 2 1/2 x 33 x 9 1/2	†40 watts into 2 ohms. †40 watts x 4 into 2 ohms. †100 watts x 4 into 2 ohms. †175 watts into 2 ohms. †into 2 ohms; four satellites and two subwoofers Inc.; bass shelving. Blamplified; †80 watts x 4 into 2 ohms; bass shelving. Blamplified; †160 watts x 4 into 2 ohms; bass shelving. Triamplified; †800 watts total into 2 ohms; bass shelving.
AUTOTEK	EQA-140E A-150E EQL-300 EQL-400	149.95 79.95 99.95 119.95	A/E A A/E A/E	7 5 7	12 12 12	80 85 75 75	13	20-40 60-80 50-20 50-20	1 1 1 1	Sel. Sel. S S	Yes Yes Yes Yes	No No No No	1 x 6 x 4 3/4 1 x 6 x 4 3/4 2 x 5 1/2 x 7 2 x 5 1/2 x 7	Remote switching, LED output indicator. Remote switching. LED output indicator. As above.
BELTEK	SE138 AP50 AP100	89.95 49.95 135.95	A/E A A	7	12	65 60 65	25 25 50	40-30 30-30 20-40	0.25 0.07 0.07	P P P	Yes		1 x 6 x 6 1 x 6 x 6 2 x 6 x 6 1/4	
BEVADA INTERNATIONAL	BEQ-1021 BEQ-7250 BEQ-580 BEQ-720	129.50 135.00 65.00 89.95	A/E/C A/E/C A/E/C A/E/C	10 7 5 7	12 12 12 12	70 75 60 70	50 30 25 50	30-30 20-20 20-20 30-30	0.35 0.25 0.35 0.35	Sel. Sel. Sel. Sel.	Yes Yes Yes Yes	Yes Yes Yes Yes	1 1/4 x 6 1/4 x 5 3/4 2 x 6 1/4 x 6 1/4 1 x 4 1/4 x 4 1/4 1 1/4 x 6 1/2 x 5 3/4	Four-channel echo/reverb. Bypass switch and LED level display.
BGW SYSTEMS	602B 600B 302B 304B	450.00 340.00 250.00 250.00	A A E C	3 4	12	80 80 72 72	75 50	10-100 10-100 10-100 10-100	0.05 0.05 0.05 0.05	Sel. Sel. Sel. F		No	3.2 x 7.5 x 5.7 3.7 x 7.1 x 5.5 1.8 x 4.6 x 3.5 1.8 x 4.6 x 3.5	Bridgeable. As above. Low, mid-bass and high EQ. x30 frequency multiplier for use as low/mid/high crossover.
BLAUPUNKT	BE 55 BEA 155 BEQ-60 BPA-415A BPA-430 BPA-260 SCN-3000	99.95 169.95 149.95 109.95 279.95 279.95 49.95	E A/E A/E A A A C	5 5 5	12 12 12	87 87 90 90	8 x 4 8 x 4 30 x 4 60	40-20 40-20 10-30 10-30	0.07 1.0 0.1 1.0 0.1 0.1	Sel. Sel. Sel. P P P S	Yes Yes Yes No No No No	No No No No No No	1 1/2 x 5 1/2 x 3 3/4 1 1/2 x 5 1/2 x 5 1/2 3 x 4 1/4 x 2 1 1/2 x 7 1/2 x 5 2 1/4 x 7 1/2 x 10 3/8 2 1/4 x 7 1/2 x 10 3/8	Mounted on flexible stalk. For use with SCT, SCM, and SCW systems (see "Speakers").
BDSE	1401-II	549.00	A/E			70	25 x 4	20-20	0.09	Sel.	No		10 x 2 1/2 x 5	For large vehicles, two 6 x 9 inch and two 4 1/2-inch speakers Inc.; for small vehicles, four 4 1/2-inch speakers Inc., \$496.00.

AMPS/EQUALIZERS/CROSSOVERS

MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E), Active Crossover (C)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB	Watts Into 4 Ohms per IHF A-202	Power Bandwidth, Hz to kHz Per IHF A-202	THD at Rated Output, % Per IHF A-202	Input Levels: Preamp (P), Speaker (S), Selectable (Sel.)	Fader Control?	Application Guide Available?	Dimensions, inches	Notes
BOSE (Continued)	1201	349.00	A/E		70	25	15-40	0.2	Sel.	No			8 1/4 x 1 3/4 x 5 3/8	Deck mount, two 6 x 9-inch speakers inc.; for door mount, two 4 1/2-inch speakers inc., \$299.00.
CERWIN-VEGA	CSX-110		C							S				29 to 110 Hz.
CLARION	100EQB4 200EQB2 300EQB3 400A-II 800A-II	129.95 179.95 249.95 89.95 149.95	A/E A/E A/E A A	5 7 5	12 12 12	75 75 75 75 75	15 15 15 x 4 20 20 x 4	20-20 20-20 20-20 20-20 20-20	10 10 10 10 10	Sel. Sel. Sel. Sel. Sel.	Yes Yes Yes No No	Yes No Yes No No	5 1/2 x 1 7/8 x 5 1/8 6 1/2 x 1 7/8 x 6 1/2 6 1/2 x 1 7/8 x 6 1/2	
CONCORD SYSTEMS	HPA-26 HPA-51 HPA-71	124.95 199.95 279.95	A A A			86 86 90	18 50 70	20-20 20-20 20-20	0.8 0.5 0.5	Sel. Sel. Sel.	No No No	No No No	1 3/4 x 5 1/2 x 4 2 3/8 x 8 3/4 x 6 1/4 3 1/2 x 9 x 8	
CRAIG	V506 V507A R501 R502	49.95 79.95 49.95 89.95	A/E/C A/E/C A A	5 7	12 15	65 80 75 75	12 12 15 25	80-15 80-15 50-15 50-15	5.0 5.0 3.0 1.0	S S Sel. Sel.	Yes Yes Yes Yes	No No No No	1 1/4 x 3 3/8 x 5 1/2 1 1/4 x 5 1/8 x 5 3/8 1 7/8 x 6 7/8 x 4 1/8 2 3/8 x 8 1/8 x 5 3/8	
CYBERNET	CMS-3050	336.00	A/E	5	12	80	50		0.4	S	No	No	3 x 7 1/2 x 11 3/4	
FUJITSU TEN	QE-231 QM-251 QM-104 UM-114 UM-116	119.95 149.95 120.00 74.95 29.95	P/E A A A A	9	12	70 70 70 70 70	50 22 x 4 25 9	40-20 20-70 40-50 100-15	0.3 1 1 1 5	P Sel. P Sel. P	Yes No No No No	Yes Yes Yes Yes Yes	5 7/8 x 2 x 4 3/8 5 7/8 x 2 x 6 1/4 7 3/4 x 1 3/8 x 5 3/8 5 1/2 x 1 3/8 x 3 3/8 3 x 1 x 2	
FULTRON	15-0736 15-0735 15-0734 15-0732 15-0731 15-0725	179.95 179.95 139.95 109.95 79.95 49.95	A/E A/E A/E A/E A/E A/E	7 7 7 7 5 2	12 12 12 12 12 12	40 40 40 16 16 16				Sel. Sel. Sel. Sel. Sel. S	Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes	1 7/8 x 7 x 7 1 7/8 x 7 x 7 1 7/8 x 7 x 7 1 7/8 x 5 7/8 x 6 1/4 1 7/8 x 7 x 4 1 7/8 x 7 x 4	
HARMAN KARDON	CA260	400.00	A/C			80	60†	10-100	0.1	Sel.	No	No	3 1/8 x 8 x 15 3/8	†90 watts into 2 ohms; bridged mono, 180 watts into 4 ohms.
HI-COMP	HCE-760 HCB-860		A/E A	7	12	65 65	20 60	30-20 15-20	10 0.3	Sel. Sel.	Yes Yes	Yes Yes	6 x 1 x 6 7 x 3 1/2 x 8 1/4	Echo with adjustable gain. Remote on/off switch.
HIFONICS	Zeus Thor Odin Vulcan Mercury Calisto	575.00 370.00 275.00 195.00 100.00 150.00	A A A A A C			90 90 90 90 75 98	200 100 65 40 16 16	10-80 10-55 10-55 10-55 20-40 70-7	0.02 0.05 0.05 0.05 0.25 0.05	Sel. Sel. Sel. Sel. Sel. P			2 3/8 x 9 1/2 x 14 1/2 2 3/8 x 9 1/2 x 9 2 3/8 x 9 1/2 x 6 3/4 2 3/8 x 9 1/2 x 4 7/8 2 3/8 x 9 1/2 x 2 6 x 1 7/8 x 6	
JENSEN	A35 EQA5000	74.95 139.95	A A/E	7	+18, -6	80 80	20 20	60-12	0.3 0.3	Sel. Sel.	No Yes	No No	1 1/4 x 4 1/2 x 3 1/4 1 1/2 x 6 x 6 3/8	LED output power meters.
JET SOUND ELECTRONICS	JSE-100 JSE-201 JSE-203 JSE-214 JSE-224 JSE-234	89.95 39.95 189.95 99.95 139.95 179.95	P/E A A A/E A/E A/E	9 5 7 9	12 12 12 12	85 60 85 60 60 60	 25 80 25 50 25 x 2, 50 x 2	20-20 20-20 20-20 20-20 20-20	 1 1 1 1 1	Sel. Sel. Sel. Sel. Sel.	Yes No No No Yes No	No No No No No No	1 7/8 x 6 7/8 x 5 1 x 4 x 4 1 3/8 x 6 3/8 x 9 1/2 1 1/8 x 5 1/2 x 6 1/8 1 1/8 x 6 7/8 x 6 1/8 1 7/8 x 6 7/8 x 6 1/8	Low-level input, variable, 150 to 750 mV; output, variable, 150 to 750 mV. As above. As above. As above. As above. Four-channel.
JVC	KS-EA50 KS-EA55 KS-E5 KS-E7 KS-A200	149.95 179.95 79.95 179.95 269.95	A/E A/E E E A	7 7 7 7	12 12 12 12	70 70 70 70 70	12 12 50	40-20 40-20 40-20	0.8 0.8 0.5	 Yes	Yes Yes Yes	 Yes	5 7/8 x 1 1/8 x 6 5 5/8 x 1 3/4 x 5 3/8 4 x 1 3/4 x 4 6 x 1 1/4 x 6 7 7/8 x 3 x 8 3/4	Biphonic processor inc.
KENWOOD	KGC-7400 KGC-447 KGC-7300 KGC-737 KEC-1000 KAC-901 KAC-8200 KAC-801 KAC-7200 KAC-887 KAC-501	199.00 139.00 199.00 139.00 219.00 369.00 299.00 249.00 199.00 149.00 85.00	E E A/E A/E C A A A A A A	9 5 7 7 3	12 12 12 12 12	97 70 92 85 100 92 100 100 80 98 92 85	 5 x 2, 15 x 2 5 x 2, 15 x 2 15 x 4 15	20-70 20-50 20-50 20-30 10-100 20-30 20-60 20-30 20-60 20-30 20-30 20-50	0.02 0.02 0.07 0.02 0.006 0.04 0.03 0.04 0.03 0.03 0.03 0.03	P P P P P Sel. Sel. Sel. Sel. Sel. Sel.	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	6 x 2 x 5 1/8 4 3/8 x 1 3/4 x 3 3/8 6 x 2 x 5 7/8 6 3/4 x 2 x 6 1/2 5 3/4 x 2 x 2 1/2 1 1/8 x 2 3/4 x 8 1/2 7 3/4 x 2 3/4 x 7 1/4 1 1/2 x 2 3/4 x 7 6 x 2 1/8 x 6 5 3/4 x 2 1/8 x 6 1/4 5 7/8 x 1 x 5 3/8	Subsonic filter, 6/12 dB slope.
KRACO	KE-7 KE-6 KE-5 KE-4	169.95 89.95 79.95 79.95	A/E A/E A/E A/E	7 5 5 5	12 12 12 12	20 15 15 15	35-10 15-10 15-10 12-10	10 10 10 10	S S S S	Yes Yes Yes Yes	No No No No	No No No No	7 1/8 x 7 7/8 x 2 3/8 6 3/8 x 6 1/8 x 1 1/8 5 1/2 x 7 1/2 x 2 4 x 4 1/2 x 1 1/4	Under dash. As above. As above. As above.

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9 mg. "tar", 0.7 mg. nicotine av. per cigarette by FTC method.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.

AMPS/EQUALIZERS/CROSSEOVERS

MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E), Active Crossover (C)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB	Watt. Imp. 4 Ohms, per IHP A-202	Power Bandwidth, Hz to kHz, per IHP A-202	THD at Rated Output, per IHP A-202	Input Levels: Preamp (P), Speaker (S), Selectable (Sel.)	Fader Control?	Application Guide Available?	Dimensions, inches	Notes	
LINEAR POWER	3002	749.95	A			98	150	12-150	0.05	Sel.	No	13 x 9 3/4 x 2 3/4	Blamp modular triamp, high- and low-pass filters.		
	2122	699.95	A			98	120 x 3	12-150	0.05	Sel.	No	13 x 9 3/4 x 2 3/4			
	2002	449.95	A			98	100	12-150	0.05	Sel.	No	9 x 9 3/4 x 2 3/4	Blamp; preset crossover at 75 Hz, 12-dB slope.		
	2602	389.95	A			98	60 x 3	12-150	0.05	Sel.	No	8 x 10 x 2 7/8			
	1002	299.95	A			98	50	12-150	0.05	Sel.	No	6 1/2 x 9 3/4 x 2 3/4	Switchable environmental EQ. Crossover from 32 Hz to 12.5 kHz, 12-dB slope.		
	602	219.95	A			98	30	12-150	0.05	Sel.	No	8 x 6 1/2 x 2 1/4			
402	159.95	A			95	20	8-45	0.15	Sel.	No	8 3/8 x 5 x 1 3/4				
XO-1	149.95	C			105		4-250	0.01	Sel.	No	4 1/2 x 5 1/8 x 1 1/4				
EQ-1	199.95	E	6	9	105		5-30	0.006	Sel.	No	No	4 1/2 x 5 1/8 x 1 1/4			
MAGTONE ELECTRONICS	205F		P/E C	5	7	10		40-20	0.08	P	Yes	No	3 3/4 x 2 x 3 3/4	Remote control inc.	
	4070		P/E/C	7	12	12		10-50	0.05	Sel.	Yes	No	5 1/2 x 1 3/8 x 4 1/4		
	207		A/E C	7	12		15 x 4	20-50	0.5	Sel.	No	No	5 1/2 x 1 3/8 x 4 1/4	†50 watts x 2, 50 watts x 1 and 25 watts x 2, or 25 watts x 4.	
	4030		P/E/C	3	12		70	40-25	0.5	Sel.	Yes	No	4 1/4 x 1 1/2 x 4		
	2340		P/A				85	†	20-25	0.04	Sel.	No	No	7 x 3 x 9 3/4	
	2150		P/A				80	75	20-40	0.04	Sel.	No	No	8 x 2 x 8	
2200		P/A				80	†	20-30	0.05	Sel.	No	No	13 7/8 x 3 1/4 x 8 3/4		
MAJESTIC ELECTRONICS	MPA 7000	79.95	P/E	7	12	65		60-15		Sel.	Yes	No	4 7/8 x 1 1/8 x 4	Passive EQ.	
	MA 300HO	299.95	A			65	150			Sel.	No	No			
	MEB 6900ET	169.95	A/E	9		65	30 x 4	50-12.8		Sel.	Yes	No			
	MEB 9120	179.95	A/E	9	12	65	75	50-12.8		Sel.	Yes	No	7 1/2 x 1 7/8 x 7	Spectrum analyzer, bypass switch.	
	MEB 5426S	149.95	A/E	5	12	70	30	60-10		Sel.	Yes	No	7 x 1 1/2 x 5 1/2		
MARANTZ	SA-250	170.00	A/E	7	12	92	15	50-15	0.8	Sel.	Yes		1 1/8 x 6 3/4 x 5 1/2		
	SA-2020	65.00	A				10	30-20	0.5	Sel.			2 x 2 3/4 x 6		
	SA-2040	125.00	A				10 x 4	30-20	0.5	Sel.			2 x 2 3/4 x 9 3/4		
MITSUBISHI	CV-251	129.95	A			70	17 x 4	25-25	5	P	Yes	Yes	1 1/8 x 5 1/2 x 6 1/4		
	CV-231	169.95	A/E	6	12	70	17	25-25	5	Sel.	Yes	Yes	2 x 5 3/8 x 6 1/4		
	CV-241	89.95	A			65	4 x 4	50-20	5	P	Yes	Yes	1 1/8 x 5 1/2 x 4 3/8		
	CY-261	79.95	A			70	17	25-15	5	S	Yes	Yes	1 1/8 x 5 1/2 x 4 3/8		
MONOLITHIC SOUND	PA-700	289.00	A				50	20-20	0.1	Adj.			2 1/2 x 6 1/2 x 6 1/2	Blampable. 50 to 300 Hz.	
	PA-1100	395.00	A				70	20-20	0.1	Adj.			2 1/2 x 6 1/2 x 9 1/2		
	PA-1600	495.00	A				80	20-20	0.1	Adj.			2 1/2 x 6 1/2 x 9 1/2		
	PA-1600M	495.00	A				160 x 1	20-20	0.1	Adj.			2 1/2 x 6 1/2 x 9 1/2		
	PA-1600Q	495.00	A				40 x 4	20-20	0.1	Adj.			2 1/2 x 6 1/2 x 9 1/2		
	EQ-4	289.00	P/E	4	18	90				0.05	Adj.				1 1/2 x 4 3/4 x 3 1/2
	EXO-2	189.00	C							0.05	Adj.				1 1/4 x 5 1/4 x 3 3/4
NAKAMICHI	PA-300	340.00	A			115	70	5-50	0.003	P	No	No	12 3/8 x 2 1/8 x 6 1/2	Model LA-50 inc. Adjustable input sensitivity. As above. †Matching line amp. 0 to 14 dB gain.	
	PA-350	390.00	A			110	35 x 4	5-50	0.003	P	No	No	12 3/8 x 2 1/8 x 6 1/2		
	PA-150	198.00	A			110	14 x 4	20-20	0.05	P	No	No	5 7/8 x 1 1/4 x 4 1/2		
	EC-200	195.00	C			105			0.003	P	No	No	4 3/4 x 1 3/8 x 4 1/8		
	LA-50	50.00	†			110			0.003	P	No	No	4 1/2 x 1 1/2 x 3		
PANASONIC	CY-SG100	219.95	A/E C	7	12	83	25 x 4	20-40	1	Sel.	Yes	Yes	7 x 6 x 2		
	CY-SG50	119.95	A/E	7		83	12.5 x 4	20-40	1	Sel.	Yes	Yes	6 3/8 x 5 x 2		
	CY-SA30	84.95	A					20-40		S	No	Yes	5 1/2 x 1 1/2 x 4 1/4		
	CY-SB25	79.95	A			85	25	20-40	1	S	No	Yes			
PARASOUND	400A B	129.95	A			80	40	20-20	0.8	Sel.			5 x 2 1/2 x 6 1/4		
	800A B	169.95	A			80	80	20-20	0.8	Sel.			8 1/4 x 2 x 7 7/8		
	160EQB	129.95	A/E	7	12	80	16	20-20	0.2	Sel.	Yes	Yes	7 x 1 3/4 x 7 7/8		
	700EQB	179.95	A/E	7	12	80	40	20-20	0.8	Sel.	Yes	Yes	7 1/4 x 1 7/8 x 7 1/2		
PHILIPS AUTO AUDIO	600	299.95	P/E	6	12	100		20-20	0.05	P	Yes	No	1 3/4 x 6 3/4 x 5 7/8	Variable input sensitivity.	
	220	199.95	A			100	20	20-20	0.05	P	No	No	2 1/8 x 5 3/8 x 7 1/8		
	250	349.95	A			100	50	20-20	0.05	P	No	No	2 1/8 x 9 3/4 x 7 1/4		
	2100	499.95	A			100	100	20-20	0.05	P	No	No	2 1/8 x 12 3/4 x 7 1/4		
PIONEER	GM-5	79.95	A			70	10	30-20	0.8	Sel.		No	1 x 5 7/8 x 6 5/8	With automatic sound levelizer. With IC echo.	
	GM-A120	169.95	A			80	30	30-20	0.3	Sel.		No	2 3/8 x 5 7/8 x 8 1/2		
	EQ-001	149.95	E	7	12	85				P	Yes	No	1 x 7 7/8 x 5 3/8		
	EQ-003	199.95	E	7	12	85				P	Yes	No	1 x 7 7/8 x 5 3/8		
	BP-520	109.95	A/E	7	12	70	10	50-20	5.0	S	Yes	No	2 x 5 7/8 x 6		
	BP-720	169.95	A/E	7	12	70	10	50-20	5.0	S	Yes	No	2 x 5 7/8 x 6		
PROSOUND PRODUCTS	PS-80	259.95	A			95	40	20-40	0.03	Sel.			9 x 8.2 x 2		
	PS-150	399.95	A			94	75	10-40	0.03	Sel.			8 x 8.2 x 2		
PROTON	222	150.00	A			90	22	20-30	0.04	P, S	No	No	7 1/2 x 1 1/2 x 4 1/2	18-dB slope; switchable, 75/150 Hz. As above.	
	250	290.00	A			90	65	10-50	0.04	P, S	No	No	10 1/4 x 1 1/4 x 6 1/2		
	270	80.00	C			90			0.05	P	No	No	5 1/4 x 6 3/4 x 1		
	271	180.00	E/C	7	12, 18	90			0.05	P	Yes	No	6 3/4 x 1 3/8 x 5 7/8		
PLYLE INDUSTRIES	X2W	13.50	C							S	No	Yes	3 1/2 x 2 3/4 x 3/4	Passive two-way. As above, 12-dB slope, 4 or 8 ohm. Passive three-way. As above, 4 or 8 ohm. Passive subwoofer crossover, 12-dB slope. Passive satellite crossover, 12-dB slope.	
	X2W-150-48-12D	19.95	C							S	No	Yes	4 3/4 x 3 3/8 x 1		
	X3W	19.50	C							S	No	Yes	4 3/4 x 3 3/8 x 1		
	X3W-150-48	22.95	C							S	No	Yes	4 3/4 x 3 3/8 x 1		
	XSUB1-150-4-12D	57.95	C							S	No	Yes	7 x 4 x 1 3/4		
XSAT3-150-12D	47.95	C							S	No	Yes	7 x 4 x 1			



Introducing Audia. The result of an uncompromising devotion to absolute performance.

Absolute performance is not just an attitude that can be created overnight. Audia was born out of 40 years of Clarion's expertise and success.

Audia is an entirely new and unique line of high end, no compromise speakers, amplifiers, equalizers, receivers and tuners, that meet the needs of even the most critical car audio purists.

Perfecting Performance in the Automotive Environment.

The FM Diversity Tuning System, a feature pioneered by Clarion, constantly monitors two FM front ends, picking out

the strongest signal in multipath conditions to virtually eliminate annoying "picket fencing" noise.

Typically, automobile interiors create an undesirable harmonic response in the low frequency ranges. The 180 Hz. Acoustic Compensation Control returns the bass to

its original deep, clean sound, while it allows the amplifier to run cooler.

The Auto Reverse Deck with Dual-Direction Automatic Azimuth Adjustment is more than just a convenience feature. It precisely adjusts the tapehead



to achieve zero-azimuth in both directions so you won't sacrifice high end frequency response.

Extend Your Limits of Perfection.

The entire Audia line represents total flexibility. It will easily interface with other components, allowing you to upgrade at any time and to create the most esoteric sound system.

Audia. A state of the art accomplishment that results from a philosophy of absolute performance.

AUDIA
CAR AUDIO PERFORMANCE

The Art of Sound in Motion.

AMPS/EQUALIZERS/CROSSOVERS

MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E), Active Crossover (C)	Number of EQ Bands	Boost/Cut Range, ±dB	S-N Ratio, dB	Watts into 4 Ohms, per IHF A-202	Power Bandwidth, Hz to kHz, per IHF A-202	THD at Rated Output, % per IHF A-202	Input Level: Preamp (P), Speaker (S), Selectable (Sel.)	Fader Control?	Application Guide Available?	Dimensions, inches	Notes
ROCKFORD FDSGATE	Punch 40	200.00	A/E	2	†	80	20	20-20	0.05	Sel.	No		1 7/8 x 7 1/4 x 5 1/4	†Bass, +18 dB; treble, +12 dB; bridgeable.
	Punch 75	300.00	A/E	2	†	80	37.5	20-20	0.05	Var.	No		1 7/8 x 7 1/4 x 8 1/4	As above, stable into 2 ohms.
	Punch 150	420.00	A/E	2	†	80	75	20-20	0.05	Var.	No		1 7/8 x 8 1/4 x 8 1/4	As above.
	Power 200	460.00	A			80	100	20-20	0.05	Var.	No		1 7/8 x 8 x 9 1/4	Bridgeable.
	Power 360	800.00	A/C			80	90 x 4, 180 x 2	20-20	0.05	Var.	No		2 1/4 x 8 1/4 x 15 1/4	As above, stable into 2 ohms.
Power 650	1060.00	A/C			80	125 x 4, 325 x 2	20-20	0.05	Var.	Yes		2 3/4 x 8 1/4 x 18 1/2	Stable into 2 ohms.	
ROYAL SOUND	EA 500	75.00	P/A/E	5	12	80	35 x 4			S	Yes	Yes	4.3 x 1.3 x 5.9	
	EA 700N	100.00	P/A/E	7	12	80	35 x 4			S	Yes	Yes	4.3 x 1.3 x 5.9	
SANSUI	SM-100	299.00	A			90	45	20-20	1.0	Sel.	No	Yes	7 7/8 x 2 1/4 x 8 3/4	
	SM-50	99.00	A			90	16	30-20	1.0	Sel.	No	Yes	3 3/4 x 1 1/4 x 6 1/2	
	SG-7B	99.00	E	7	12	85				P	No	Yes	4 1/4 x 1 1/4 x 3 1/2	
	SA-7	259.00	P/A			80	12	30-20	1.0	P	No	Yes	6 x 2 x 6	
	SA-5	199.00	P/A			80	12	30-20	1.0	P	No	Yes	6 x 2 x 6	
	SA-3	159.00	P/A			80	12	30-20	1.0	P	No	Yes	6 x 2 x 6	
SANYO	PA 6050	129.95	A			70	25	20-20	0.05	Sel.			7 1/2 x 8 x 2 1/4	
	PA 6100	159.95	A			70	50	20-20	0.05	Sel.			7 1/2 x 7 1/2 x 3 3/4	
	PA 6110	179.95	A			70	50	20-20	0.05	Sel.			7 1/2 x 7 1/2 x 3 3/4	†Motorized.
	EQZ 6210	79.95	E	7	12	70			0.1	Sel.	†	Yes	6 1/2 x 4 3/4 x 2	
	EQA 600	99.95	A/E	7	12	70	15	20-20	0.3	Sel.	Yes	Yes	6 x 5 1/4 x 2	
SHERWOOD	SCA 240	59.95	A				20	40-20	0.8				5 1/4 x 1 1/4 x 6 1/4	
	SCA 2100	199.95	A				70	40-20	0.5				7 1/8 x 5 1/4 x 7 7/8	
SONY	XM-120	349.95	A	2	6	92	60	20-20	0.1	Sel.	Yes	Yes	1 3/4 x 7 1/4 x 10 1/4	Bass drive filter.
	XM-100	259.00	A			80	30	20-20	0.8	P	Yes	Yes	8 3/4 x 2 1/4 x 5 1/4	As above, subsonic filter.
	XM-55	129.95	A			84	14	40-20	0.5	Sel.	Yes	Yes	1 3/4 x 5 1/2 x 6 1/2	As above.
	XM-45	99.95	A			78	10	50-20	0.8	Sel.	Yes	Yes	1 3/8 x 5 1/2 x 5 1/4	
	XM-25	59.95	A			80	4	40-20	0.8	P	Yes	Yes	1 1/8 x 3 3/4 x 4 1/4	
	XM-E70	179.95	A/E	7	12	65	12	80-20	1.0	P	Yes	Yes	7 1/4 x 1 7/8 x 6	Level indicator.
	XE-9	99.95	E	9	12	70				P	Yes	Yes	5 3/4 x 1 3/8 x 7	
SPARKOMATIC	GE-70	139.95	A/E	7	12	65	20 x 4	20-20	10	Sel.	Yes	No	6 1/4 x 2 1/8 x 6 1/4	
	GE-50	69.95	A/E	5	12		22.5	20-20	10	S	Yes	No	4 3/4 x 1 3/8 x 4 3/4	
	LC-52	29.95	A				20	20-20	10	S	Yes	No	4 1/4 x 1 1/4 x 4	
SPECO	EPB-150	137.50	A/E	10	12	60	75	20-20	1	Sel.	Yes	Yes	1 1/4 x 6 1/2 x 5	10 LED peak power indicator, common or floating ground.
	EPB-100	110.00	A/E	7	12	60	50	20-20	1	Sel.	Yes	Yes	1 x 5 1/2 x 5 1/8	As above.
	EPB-50	89.95	A/E	5	12	60	50	20-20	1	Sel.	Yes	Yes	1 1/8 x 4 1/2 x 6	5 LED peak power indicator, common or floating ground.
	SPB-50	39.50	A			60	25	100-10		Sel.			1 1/2 x 4 1/2 x 6 1/8	Common or floating ground.
TEI ELECTRONICS	49-151	45.83	A/E/C	2	12	40	30	35-20		S	No	No	4 3/4 x 1 1/2 x 4 3/4	
	49-180	138.75	A/E/C	7	12	60	15 x 4	30-20		S	Yes	No	6 x 6 x 1 3/8	
	49-185	122.08	A/E/C	7	12	55	7.5 x 4	30-20		S	Yes	No	5 1/4 x 6 1/4 x 1 7/8	
	49-187	114.58	A/E/C	7	12	58	7.5 x 4	20-20		S	Yes	No	5 1/4 x 6 1/4 x 1 7/8	
	49-188	115.26	A/E/C	5	12	58	15 x 4	20-20		S	Yes	No	5 1/2 x 6 1/2 x 1	
	49-191	110.96	A			60	75	20-20		Sel.	No	No	6 3/4 x 3 x 6	
	49-192	96.80	E/C	10	12	60		20-20		S	Yes	No	6 1/4 x 1 x 5 1/4	
	49-194	159.50	A/E/C	7	12	65	15 x 4	20-20		S	Yes	No	7 1/4 x 1 7/8 x 7 1/2	
	49-213	200.26	A/E/C	9	12	65	37.5 x 4	20-20		Sel.	Yes	No	7 x 6 3/4 x 1 3/4	
	49-250	89.98	A/C†	4		72	25 x 1	20-180 Hz		S	Yes	No	6 1/8 x 7 1/8 x 5 1/2	†Subwoofer and amp set (see "Speakers").
	49-215	115.39	A/E/C	5	12	55	15 x 4	20-20		S	Yes	No	7 x 5 x 2	
	YAMAHA	YPA-400	200.00	A	2		90	18 x 4	30-50	1.0	Sel.	No	No	6 1/4 x 1 3/4 x 7 7/8
YPA-800		350.00	A			95	†	30-50	1.0	Sel.	No	No	6 1/4 x 1 3/4 x 9 1/8	†40 watts x 4 four-way or 2 channel two-way with 200-Hz crossover, 100 x 2 BTL.
YGE-600		200.00	P/E	5	12	95		20-50	0.02	Sel.	Yes	No	6 1/4 x 2 x 4 7/8	Three tone presets, 21 factory preset curves, auto volume.
ZAPCO	System 200	570.00	A			105	100	10-100	0.15	S	No	No	†	†Amp, 5.2 x 5.8 x 3.2; power supply, 7 x 3.3 x 2.1.
	System 150	495.00	A			105	75	10-100	0.15	S	No	No	†	
	System 150A	686.00	A			105	75	5-100	0.03	S	No	No	†	
	System 200A	760.00	A			105	100	5-100	0.03	S	No	No	†	
	151	260.00	A			105	75	3-100	0.15	S	No	No	5.2 x 5.8 x 3.2	
	151A	380.00	A			105	75	3-100	0.03	S	No	No	5.2 x 5.8 x 3.2	
	PX	540.00	P/E/C	4	20	102		3-50	0.005	Sel.	No	No	2 x 4 x 6	Remote power supply inc.
	AEX	400.00	P/C			105		3-50	0.005	Sel.	No	No	2 x 4 x 6	Frequency continuously adjustable.
PEQ	352.00	P/E	9	18	86		3-50	0.05	Sel.	No	No	4.2 x 8.7 x 1.1	Variable active gain-matching module.	
AGM-V	50.00	P					3-50	0.05	Sel.	No	No	2 x 4 x 3		



Get it together—Buckle up.

The new '84 Ford Tempo. Technology never felt so comfortable.

The inside story.

Tempo's interior is a computer-refined compartment for five. Computer-designed placement of seats, door, roof and window areas afford maximum space efficiency.

Even Tempo's front-wheel-drive configuration was designed to provide more interior room. Since there is no drive shaft, there is no large hump to rob valuable floor space. In fact, Tempo actually has more rear room than a Mercedes 300D.*

For driver's convenience, controls are all placed

within easy reach. For added ease, wipers and washer, directionals, high-beams and flash-to-pass are located on the steering column itself.

Technology that works for you.

Outside, a unique aerodynamic shape channels the wind over and around Tempo to help increase fuel efficiency. It also directs the airflow, reducing overall lift for improved stability and directional control.

Its front-wheel drive delivers all-weather

traction, while its four-wheel independent suspension provides a smooth ride.

Plus, Tempo has the world's most advanced automotive computer, the EEC-IV. It processes up to 250,000 commands per second. Coupled with Tempo's 2300 HSC (High Swirl Combustion) engine, you get quick power response from a standing start and at cruising speed.

Best-built American cars.

When we say "Quality is Job 1," we are talking

about more than a commitment. We are talking about results. A recent survey concluded Ford makes the best-built American cars. The survey measured owner-reported problems during the first three months of ownership of 1983 cars designed and built in the U.S. And that commitment continues in 1984.

*Based on EPA Interior Volume Index.

Have you driven a Ford... lately?



Experience the car audio system that can raise your standard of listening: Panasonic Supreme Elite.



Panasonic brings you a remarkable stereo component system for your car: the Supreme Elite. Each component was engineered with advanced sound technology. Technology that provides this car audio system with some of the most sophisticated features on the road today.

The Supreme Elite Cassette/Stereo Receiver (CQ-S958) features the Panasonic Hypertuner that expands FM sensitivity — allowing you to enjoy a greater reception range than conventional FM tuners. Other features include electronic tuning with digital display for station frequency and time of day as well as an auto-reverse cassette player with locking fast forward/rewind.

If you're looking for a more compact unit, most of

these advanced features are also offered in the Bantam mini-chassis Supreme Elite Cassette/Stereo Receiver (CQ-S818).

To shape the performance of a Supreme Elite Cassette/Receiver to your own car, you can integrate either unit with the 100 Watt* Panasonic Commander Equalizer/Amplifier (CY-SG100). This component also features Ambience. To virtually surround you with sound.

So, if conventional car audio has been your usual standard of listening — now you can raise that standard with Panasonic Supreme Elite.

Panasonic car audio
The driving force

* Maximum Power Output: 100W (4 x 25W) at 1 kHz.

SPEAKERS

MANUFACTURER	Model	DRIVERS										Notes				
		Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Subwoofer Only (S), Tweeter Only (T)	Woofer Size, Inches	Woofer (W), S-Way (S), F-Way (F)	Applied Driver(s) = A, P, F, S		Full Range (R), Surround Mount (S)	Max. Requiring Mounting (M)	Weatherproofed?	Application Guide Available?
ACOUSTIC RESEARCH	1CS	129.99	259.98	100	94†	4	38-32††		5 1/4	2		F	1 1/4	Yes		†2.83 V, 0.5 m; ††OIN 45-500. Fits 6 x 9-inch cutouts. Fits 3 1/2-inch cutouts.
	1MS	124.99	249.98	75	85	4	95-25 ±3		4	2		F	Yes			
	1CSI	99.99	199.98	100	94†	4	38-32††		5 1/4	2		F	2 1/8	Yes		
	2CS	99.99	199.98	100	96†	4	65-32††		4	2		F	1 1/8	Yes		
	4CS	59.99	119.98	100	97†	4	42-27††		5 1/4	2		F	2 1/4	Yes		
	LFC 8.00	44.99	89.98	100	94†	8	28-2	S	8			F	3 3/4	Yes		
	LMFC 5.25	39.99	79.98	100	94†	4	40-4		5 1/4			F	2 1/4	Yes		
	3CS	32.99	65.98	20	100†	4	100-30††		4			F	1 3/4	Yes		
HFC 1.25	29.99	59.98	100	94†	8	2k-22k	T	4			F	3 3/4	Yes			
ADS	200C		269.00	50	90	4	85-20 ±3		4	2	P	S	No	No	Three pieces, incl. separate crossover. As above. AXZ crossover inc. (See "Crossovers.")	
	300C		349.00	75	91	4	68-20 ±3		5 1/4	2	P	S	No	No		
	300I		269.00	100	90	4	50-20 ±3		5 1/4	2	A, P	F, S	1 1/2	Yes		No
	320I		379.00	100	91	4	58-20 ±3		5 1/4	2	A, P	F, S	1 1/2	Yes		No
	315I CS700	279.00	299.00	100	90	4	58-20 ±3 30-Xover ±3	S	5 1/4 (2) 7 1/2	2	A, P	F, S	1 1/2 2 3/4	Yes Yes		No
ALPHASONIK	OT-12G	13.30	26.60	10	10	4	3k-20k ±4	T				F	3 3/8	Yes	No	
	T35-G	13.30	26.60	10	10	8	2.5k-18k ±4	T				F	1 1/4	Yes	No	
	MP-55G	26.10	52.20	25	4	4	500-6 ±4	M				F	2	Yes	No	
	WP-820	54.00	108.00	60	4	4	40-3 ±4	S	8			F	3 1/4	No	No	
	W6920	54.00	108.00	60	4	4	40-3 ±4	S	6 x 9			F	3 1/4	No	No	
	W620	54.00	108.00	60	4	4	45-3.5 ±4	S	6			F	3 1/4	No	No	
ALPINE	6130		44.95	20	88	4	130-20 ±3		3 1/2	W		F	1 1/2	No	Yes	
	6141		49.95	20	90	4	80-20		4	W		F	1 1/2	No	Yes	
	6142		49.95	40	91	4	80-20		4 x 6	W		F	1 1/2	No	Yes	
	6151		59.95	40	91	4	65-20		5	W		F	1 1/2	No	Yes	
	6161		69.95	60	91	4	60-20		6 1/2	W		F	1 1/2	No	Yes	
	6363		119.95	80	89	4	65-20		6 1/2	3		F	1 1/2	No	Yes	
	6292		119.95	80	89	4	30-20		6 x 9	2		F	2 1/4	No	Yes	
	6203		79.95	40	90	4	70-20		6 1/2	2		F	2 3/8	No	Yes	
	6216		69.95	40	89	4	60-20		4	2		F	1 1/8	No	Yes	
	6236		79.95	60	91	4	50-20		5 1/4	2		F	2	No	Yes	
	6226		89.95	80	91	4	45-20		6 1/2	2		F	2 1/2	No	Yes	
	6352		89.95	60	91	4	65-20		5 1/4	3		F	1 1/2	No	Yes	
	6205		89.95	40	91	4	50-18		6 x 9	2		F	3 1/4	No	Yes	
	6214		99.95	60	91	4	60-20		4 x 10	2		F	2 1/2	No	Yes	
	6209		99.95	80	93	4	45-25		6 x 9	2		F	2 3/8	No	Yes	
	6391		149.95	100	91	4	30-20		6 x 9	3		F	3 3/4	No	Yes	
	6217		109.95	60	86	4	80-20 ±3		4	2		F	1 1/8	No	Yes	
	6207		129.95	80	90	4	50-200 Hz		5 1/4	2		F	1 3/4	No	Yes	
	6227		199.95	80	86	4	70-35 ±3		5 1/4	2		F	1 1/4	No	Yes	
	6117		99.95	80	89	4	2k-30k	S	8	2		S	2 3/4	No	Yes	
6162		79.95	100	89	4	40-3	S	6 1/2	2		F	2 3/4	No	Yes		
6108		99.95	80	90	4	35-400 Hz	S	8			F	3 3/8	No	Yes		
ALTEC LANSING	6 x 9-4A		179.95	40	94	4	80-18 ±5		6 x 9	2		F	1 3/4	Yes	Yes	
	6 x 9-4B		259.95	75	95	4	60-18 ±5		6 x 9	2		F	2	Yes	Yes	
	6 x 9-4C		129.95	35	94	4	90-16 ±5		6 x 9	2		F	2 1/8	Yes	Yes	
	SW1			40	1k	35-150 Hz ±5	S	6 x 9				F	2 3/8	Yes	Yes	
	SK1		129.95	35	93	4	100-10 ±5		5 1/4			F	2	Yes	Yes	
	SK2		119.95	35	92	4	100-18 ±5		5 1/4	2		F	2 1/8	Yes	Yes	
	SK3		99.95	25	92	4	100-20 ±5		5 1/4			F	1	Yes	Yes	
TK1		79.95	20	94	4	5k-18k ±5	T	5 1/4			F	1 1/8	Yes	Yes		
ARA	6700638		69.95	25	92	6	60-20 ±5		6 x 9	3		F	3 3/4	No	Yes	
	6700639		59.95	25	92	6	60-20 ±5		6 x 9	2		F	2	No	Yes	
	6700641		29.95	20	88	6	100-17 ±5		4 x 6	2		F	2	No	Yes	
	6700642		49.95	25	92	6	60-20 ±5		6	3		F	2 1/2	No	Yes	
	6700643		39.95	25	92	6	60-20 ±5		6	2		F	2 1/2	No	Yes	
	6700646		34.95	20	86	6	100-19 ±5		5 1/4	2		F	1 1/2	No	Yes	
	6700647		32.95	25	80	6	125-20 ±5		4	2		F	2	No	Yes	
	6700649		17.95	20	80	6	200-12 ±5		3 1/2	W		F	1 1/2	No	Yes	
AUDIA	CSX-650		120.00	80	92	4	35-8	S	6 1/2	2		F	2.8	Yes	No	
	CSX-655		140.00	80	91	4	35-24		6 1/2			F	2.5	Yes	No	
	CSX-695		200.00	100	91	4	40-24		6 x 9	3		F	3.2	Yes	No	
	CSX-800		170.00	100	93	4	30-8		8			F	3.4	Yes	No	
	CSX-105		100.00	100	89	4	3k-20k	S				C	1	Yes	No	
	CSX-350		100.00	80	92	4	100-18	M				F	1.6	Yes	No	
	CSX-402		130.00	80	92	4	40-21		4	2		F	1.6	Yes	No	
	CSX-405		200.00	80	85	4	60-20		4	2		F	1.5	Yes	No	
	CSX-465		100.00	80	91	4	40-21		4	2		F	1.9	Yes	No	
	CSX-535		280.00	100	88	4	60-20		5 1/4	2		F	2	Yes	No	
AUDIOMOBILE	RSH-4.5		239.95	50	92	4	200-20 ±3			2	P	S	Yes		Blamp, needs subwoofer. As above. As above. Blamp, needs satellites. As above. As above.	
	RSV-4.5		239.95	50	92	4	200-20 ±3			2	P	S	Yes			
	FS-3.5		156.95	25	89	4	300-20 ±3			2	P	S	Yes			
	SW-69		129.95	75	89	2	20-200 Hz	S	6 x 9			S	5	Yes		
	SWB-32		199.95	100	89	2	20-200 Hz	S	(4) 5 1/4			S	Yes			
	SWB-41		199.95	100	89	2	20-200 Hz	S	(4) 5 1/4			S	Yes			



HOLOGRAPHIC INTERFEROMETRY DEMONSTRATION SHOWING DISTORTION IN A CONVENTIONAL SPEAKER AT 265 Hz.



HOLOGRAPHIC INTERFEROMETRY DEMONSTRATION SHOWING NO DISTORTION IN A SONY APM SPEAKER AT 265 Hz.



WHY WASTE THE PERFECTION OF DIGITAL SOUND ON THE IMPERFECTION OF A CONVENTIONAL SPEAKER?

As truly remarkable as the digital compact disc is, it has one equally remarkable side effect. Namely, along with taking the mask off sound, it also unmasks the flaws in your loudspeakers.

Distortions like "cone flexing," "split vibration" and "cavity effect," which were heretofore barely audible, are now discernible when listening to music.

To eliminate the flaws inherent in every conventional driver, Sony has radically redesigned the speaker from the bottom of the woofer to the top of the tweeter.

The buckling, flimsy paper cones have been replaced by a rigid, aluminum honeycomb construction.

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But Sony goes further. APM drivers are square to dramatically reduce split vibration.

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SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ± dB	DRIVERS										Notes
								Subwoofer Only (S) None Only (N)	Woofer Size, Inches	Woofer (W) 2-Way (2) 3-Way (3), 4-Way (4)	Angled Driver (A)	Pointable Driver (P)	Flat Mount (F), Surface Mount (S)	Max. Required Mounting Depth, Inches	Weatherproofed?	Application Guide Available?		
B & W	LM1/PM	225.00	450.00		85	3.2	31-16 ± 5		4	2	A	C	2 3/4	Yes		Model LM1, cabinet version, \$249.00 (each), \$498.00 (pair).		
CANTON	HC 100 AC 200 Pullman Set 200 Set 300		250.00 350.00 450.00 275.00 375.00	60 Inc. 80 70 100	4 4 4 4		48-30 ± 6 48-25 ± 6 45-30 ± 6		4 4 4 4 4	2 2 3 2 2	A A A P P	S S S C C		No No No No No	No No No No No	Blamped.		
CERWIN-VEGA	CS-18A CS-17 CSW-16 CSW-21	99.97 79.97 79.95 89.95	199.95 159.95 159.90 179.90	150 100 150 250	98 96 98 98	4 4 4 4	30-20 40-20 30-3 12-250 Hz		S S	6 x 9 6 x 9 6 x 9 12	2 2	S S S S	3 1 1/2 3 4 1/4	Yes Yes Yes Yes	No No No No	Special bass duct, trunk mount.		
CLARION	SE-970 SE-971 SE-980 SE-523 SE-524 SE-670 SE-530 SE-610 SE-611 SE-620 SE-621 SE-630 SE-310 SE-410 SE-411 SE-420 SE-510 SE-520		99.95 114.95 139.95 44.95 49.95 44.95 84.95 54.95 64.95 74.95 84.95 114.95 24.95 59.95 54.95 64.95 44.95 69.95	60 50 80 30 30 20 40 40 40 40 40 60 20 40 20 30 15 30	93 92 93 91 90 90 90 90 91 90 90 90 88 88 90 89 91 90	4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	50-20 50-21 50-21 60-21 75-21 90-17 50-21 70-20 40-20 80-22 55-22 40-22 140-20 50-18 50-20 120-20 75-18 80-18		S S	6 x 9 6 x 9 6 x 9 5 5 4 x 6 5 1/4 6 1/2 6 1/2 6 1/2 6 1/2 3 1/2 4 4 4 5 1/4 5 1/4	2 2 3 2 2 2 3 W W 2 2 W W W 2 2 2 2	F F F F F F F F F F F F F F F F F F	3.1 1.8 3.1 0.1 1.6 1.8 1.8 2.2 1.5 2.2 1.5 2.5 1.6 1.5 1.1 1.8 1.6 1.6	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No No No No No No No No No			
CONCORD SYSTEMS	HPS-151 HPS-152 HPS-260 HPS-265 HPS-266 HPS-263 HPS-271 HPS-125 HPS-135 HPS-140 HPS-250		79.95 89.95 99.95 109.95 109.95 129.95 159.95 39.95 69.95 79.95 89.95	30 30 50 80 120 90 120 40 25 40 25	4 4 4 4 4 4 4 4 4 4 4		40-20 40-20 40-10 40-18 40-20 75-17 65-18 65-20 55-20			6 x 9 6 x 9	2 2 2 2 2 2 2 2 2 2	A A A A A A A A A A	F F F F F F F F F F	1 1/4 1 1/4 2 3/4 2 3/4 2 3/4 3 2 3/4 1 1/2 1 3/8 1 3/8 1 1/4	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No No	Blamp capable. As above. As above.	
CRAIG	V306 V307 V324 V308 V325 V342 V204 V309 V326 V327 V330 V352 V364 V823 V831 V852 V863 V108 V109 V243 V231 V253		26.95 44.95 54.95 44.95 54.95 54.95 46.95 57.95 64.95 89.95 99.95 109.95 99.95 129.95 139.95 159.95 149.95 21.95 23.95 38.95 47.95 52.95	20 20 20 25 30 25 16 30 25 50 50 50 50 100 100 100 100 15 15 20 30 50	88 86.5 85 92 90 86 92 91.5 88 92 92 89 90.5 89 89 92 92.5 4 90.5 93.5 92.5 93	4 4	105-20 ± 10 80-20 ± 10 90-20 ± 10 95-20 ± 10 95-20 ± 10 80-20 ± 10 70-19.5 ± 10 50-18.5 ± 10 50-20 ± 10 50-22 ± 10 58-22 ± 10 50-22 ± 10 45-22 ± 10 50-22 ± 10 52-24 ± 10 50-23 ± 10 49-24 ± 10 55-17.5 ± 10 50-18 ± 10 60-20 ± 10 50-20 ± 10			3 1/2 4 4 5 5 4 x 6 6 1/2 6 1/2 6 1/2 6 1/2 6 1/2 6 x 9 6 x 9 6 1/2 6 1/2 6 x 9 6 x 9 4 6 1/2 6 x 9 6 1/2 6 x 9	W 2 W 2 2 2 2 2 2 3 3 3 3 2 3 3 2 2 2 W 3 3	F F	1 1/2 1 1/2 1 1/2 1 1/2 1 1/2 1 3/4 1 3/8 2 1 3/8 2 3/4 2 3/4 3 3 2 3/4 2 3/4 3 3 1 3/8 1 3/8 2 3/4 2 1/8 3	Yes Yes	Yes Yes			
CYBERNET	CSP-123 CSP-603		138.00 199.00	60 110	85 90	8 4	60-22 ± 6 60-20 ± 6		4 6 x 9		P P	S F	4 1/4 3 3/8	Yes Yes	No No			
EPI	LS-45 LS-55 LS-70 LS-81 LS-81C LS-641 LS-841		50.00 90.00 170.00 200.00 230.00 300.00 340.00	50 50 100 70 70 150 150	92 92 88 88 88 87 87	4 4 8 4 4 4 4	90-12 90-20 70-20 ± 3 80-20 ± 3 90-20 ± 3 55-20 ± 3 45-20 ± 3			5 1/4 5 1/4 6 4 1/2 4 1/2 6 8	2 2 2 2 2 3 3	F F F F S F F	1 1/4 1 1/2 2 1/4 1 1/2 No 3 3/8 4	No No No No No No No	No No No No No No No	Fits 6 x 9-inch cutouts. Fits 4 x 10-inch cutouts. Two pieces per side. As above.		
FUJITSU TEN	SG-6903 SG-6902 SG-1615 SG-1614 SG-1013		119.95 94.95 99.95 79.95 69.95	120 120 90 90 60	93 93 91 91 90	4 4 4 4 4	40-20 40-20 60-20 60-20 80-20			6 x 9 6 x 9 6 1/2 6 1/2 4	3 2 3 2 2	C C C C C	3 3 2 3/8 2 3/8 1 1/4	Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes			

SPEAKERS

MANUFACTURER	Model	DRIVERS											Notes						
		Price, \$ (if Sold Individually)	Price, \$ (if Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	Supervene: Only (1) Tweeter Only (2) Midrange Only (M)						Woofer Size, Inches	KHzes (W), 2-Way (2), 3-Way (3), 4-Way (4)	Applied Drivers (2) Pointable Driver(s) = A, Flush Mount (1) = P	Max. Required Mounting Depth, Inches	Weatherproof?	Application Guide Available?
								6 x 9	3	F	4 7/8	Yes							
FULTRON	15-9990	149.95	100	4	30-22	6 x 9	3							F	4 7/8	Yes	Yes		
	15-9790	119.95	75	4	40-20	6 1/2	3							F	2 3/4	Yes	Yes		
	15-9696	99.95	40	4	35-22	6 x 9	4							F	4	Yes	Yes		
	15-9690	79.95	40	4	40-20	6 x 9	3							F	4	Yes	Yes		
	15-9670	59.95	35	4	40-20	6 x 9	2							F	3 3/4	Yes	Yes		
	15-9490	69.95	30	4	50-20	6 1/2	3							F	2 3/8	Yes	Yes		
	15-9470	49.95	25	4	55-18	6 1/2	2							F	1 3/8	Yes	Yes		
	15-9435	39.95	20	4	70-17	4	2							F	1 1/2	Yes	Yes		
	15-9425	29.95	10	4	80-15	4	2							F	1 1/8	Yes	Yes		
	15-9240	24.95	7	4	130-8	5	W							C	5/8	Yes	Yes		
GENESIS PHYSICS	AS 165	240.00	100	92	8	50-20 ±3	6	2						F	3 1/4	No	No	Blamp capable.	
	AM 165	250.00	100	92	8	50-20 ±3	6	2						F	2 1/2	No	No	As above.	
	AM 135	200.00	60	91	8	60-20 ±3	5 1/4	2						F	1 1/8	No	No	As above.	
GOLD SOUND	GS 4	44.00	60	91	4	200-8 ±3			M					P	2	Yes	Yes		
	GS 5	44.00	60	92	4	80-5 ±3	5 1/4							P	2	Yes	Yes		
	GS 6	48.00	80	93	4, 8	45-4 ±3	6 1/2							P	2 3/4	Yes	Yes		
	GS 6A	72.00	120	95	4, 8	40-2.5 ±3	6 1/2							P	2 3/4	Yes	Yes		
	GS 4C	76.00	60	91	4	80-20 ±3	4 1/2	2						P	2	Yes	Yes		
	GS 5C	78.00	60	91	4	65-20 ±3	5 1/4	2						P	2	Yes	Yes		
	GS 6C	78.00	60	93	4	45-20 ±3	6 1/2	2						P	2 3/4	Yes	Yes		
	GS 69C	80.00	60	93	4	43-20 ±3	6 x 9	2						P	3 1/4	Yes	Yes		
	GS 8	39.00	120	90	4, 8	32-2 ±3	8		S					P	3 1/2	Yes	Yes		
	GS 10	49.00	120	92	4, 8	26-2 ±3	10		S					P	4	Yes	Yes		
	GS 10A	54.00	200	93	4, 8	22-1.5 ±3	10		S					P	4	Yes	Yes		
	GS 12A	66.00	200	95	4, 8	20-1 ±3	12		S					P	4 1/4	Yes	Yes		
	Little Thunder	488.00	100	118		Max.	38-200 Hz ±3	(4) 6		S				A, P	S	Yes	Yes		
	Big Thunder	588.00	100	118		Max.	34-200 Hz ±3	(4) 8		S				P	S	Yes	Yes		
Rolling Thunder	888.00	200	124		Max.	29-200 Hz ±3	(4) 10		S				P	S	Yes	Yes			
HI-COMP	HCS-80		100	91	4	40-20	6 x 9	3						F		No	Yes	Blamp capable.	
	HCS-70		100	91	4	40-18	6 x 9	2						F		No	Yes	As above.	
	HCS-60		100	91	4	80-19	5 1/4	3						F	2 3/8	Yes	Yes	As above.	
	HCS-50		40	96	4	80-20	5 1/4	2						F	2 1/8	No	Yes	As above.	
	HCS-40		25	92	4	100-18	4	2						F	2 1/8	No	Yes	As above.	
	HCS-30		20	90	4	90-18	3 1/2	W						F	1 1/2	No	Yes	As above.	
	HCS-20		20	86	4	160-18	4 x 6	2						F	2	No	Yes	As above.	
	HCS-15		20	90	4	120-16	4							F	1 1/2	No	Yes	As above.	
	CV-620		60		4/8	50-20 ±6	6 x 9	2		A				F	2 1/8	Yes	Yes	Blamped.	
	CV-520		60		4/8	60-20 ±6	5 1/4	2		A				F	2	Yes	Yes	As above.	
CV-410		32		4/8	100-20 ±6	4							F	7/8	Yes	Yes			
CV-SW1		44		4/8	45-350 Hz ±6	6 x 9		S					A	F	2 1/8	Yes	Yes		
INFINITY	RS A693	179.00	70	90	4	40-32 ±3	6 x 9	3						S	3	Yes	Yes		
	RS A692	129.00	70	90	4	40-18 ±3	6 x 9	2						S	2	Yes	Yes		
	RS A63	145.00	50	88	4	60-32 ±3	6 1/2	3						S	3	Yes	Yes		
	RS A62	99.00	50	88	4	80-18 ±3	6 1/2	2						S	2	Yes	Yes		
	RS A42	75.00	25	87	4	100-15 ±3	4	W						S	1 3/8	Yes	Yes		
	RS A462	44.00	20	86	4	100-15 ±3	4 x 6	W						F	1 3/4	Yes	Yes	Drop-in replacement.	
	RS A32	36.00	15	86	4	115-15 ±3	3 1/2	W						F	1 1/2	Yes	Yes	As above.	
	JBL	T105	34.95	30	85	4	120-20	3 1/2	W						F	1 1/2	Yes	Yes	Drop-in replacement.
		T115	44.95	30	88	4	100-20	4 x 6	W						F	1 7/8	Yes	Yes	As above.
T205		149.95	60	88	4	90-18	4 1/2	2						F	1 3/4	Yes	Yes		
T420		179.95	75	90	4	70-18	6 1/2	2		A				F	2 1/4	Yes	Yes		
T425		199.95	75	90	4	70-18	6 1/2	3		A				F	2 1/4	Yes	Yes		
T540		219.95	100	92	4	40-18	6 x 9	2		A				F	3 3/8	Yes	Yes		
T545		249.95	100	92	4	40-18	6 x 9	3		A				F	3 3/8	Yes	Yes	Blamp capable.	
ER/G 4.5		69.95	60	94	4	90-20	4 1/2	W						F	1 3/4	Yes	Yes		
ER G 6.5		99.95	60	92	4	80-22	6 1/2	2		A				F	2 1/8	Yes	Yes		
ER G 410		139.95	80	93	4	70-22	4 x 10	2		A				F	3	Yes	Yes		
ER G 690		159.95	80	95	4	55-22	6 x 9	2		A				F	3 3/8	Yes	Yes		
LT-1		299.95	100	87	4	100-20	5 1/4	2						S	5	No	No		
2105H		65.00	50	94	8	500-15			M					S	1 3/4	No	No		
LE8T-H		145.00	50	89	8	35-15	8							F	3 1/4	No	No		
115H	70.00	50	89	8	60-3.5	6 1/2							F	2 1/2	No	No			
LE10H-1	158.00	150	89	8	30-3	10							F	4 1/2	No	No			
JENSEN	J1242	159.95	55	103	4	40-20 ±3	6 x 9	4						F	4	Yes	Yes	Blamp capable.	
	J3033	159.95	100	103	4	38-40 ±3	6 x 9	3						F	3 7/8	Yes	Yes		
	J2020	139.95	65	101	4	38-40 ±3	6 x 9	3						F	3 7/8	Yes	Yes		
	J1365	129.95	50	101	4	40-20 ±3	6 x 9	3						C	1 7/8	Yes	Yes		
	J1065	129.95	50	102	4	40-20 ±3	6 x 9	3						F	3 3/4	Yes	Yes		
	J1401	129.95	45	99	4	40-20 ±3	4 x 10	3						F	1 3/4	Yes	Yes		
	J3023	139.95	75	101	4	52-40 ±3	6 1/2	3						F	1 7/8	Yes	Yes		
	J2037	119.95	90	102	4	38-20 ±3	6 x 9	2						F	3 1/8	Yes	Yes		
	J1369	84.95	50	100	4	40-16 ±3	6 x 9	2						C	1 7/8	Yes	Yes		
	J1069	84.95	45	101	4	40-18 ±3	6 x 9	2						F	3 3/4	Yes	Yes		

SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity dB SPL (1 Watt/1 Meter)	Impedance Ohms	Frequency Response, Hz to 4Hz. \pm dB	DRIVERS										Notes
								Supervener Only (S) Tweeter Only (T)	Woofer Size, Inches	Woofer (W), 2-way (2) 3-way (3), 4-way (4)	Applied Drivers = A, P Pointable Drivers = P Tweeter Mount (T) Convenient Mount (C)	Mag. Required	Mounting Depth, Inches	Weather-protect?	Application Guide Available?			
JENSEN (Continued)	J1405	84.95	45	99	4	45-18 \pm 3		4 x 10	2		F	1 1/4	Yes	Yes	Fits 5 1/4-inch cutouts. Removable angled collar. As above. As above. Fits 3 1/2- or 4 x 6-inch cutouts. Cabinet version, Model J1510, \$79.95 each.			
	J3013	109.95	75	100	4	52-40 \pm 3		6 1/2	2		F	1 1/4	Yes	Yes				
	J1188	84.95	45	99	4	58-18 \pm 3		6 1/2	2		F	1 1/4	Yes	Yes				
	J1077	79.95	45	99	4	60-18 \pm 3		5 1/4	2		F	2 1/2	Yes	Yes				
	J3003	89.95	50	98	4	63-40 \pm 3		4 1/2	2		F	1 1/4	Yes	Yes				
	J1093	71.95	40	97	4	65-18 \pm 3		4 1/2	2		F	1 1/4	Yes	Yes				
	J1245	49.95	40	94	4	50-14 \pm 3		6 1/2	W		A, P	2	Yes	Yes				
	J1186	76.95	40	97	4	65-18 \pm 3		4 1/2	2		A, P	2	Yes	Yes				
	J1445	34.95	25	95	4	70-17 \pm 3		4 1/2	W		A, P	1 1/4	Yes	Yes				
	J1292	59.95	40	96	4	58-16 \pm 3		5 1/4				1 1/4	Yes	Yes				
	J1283	49.95	30	95	4	65-20 \pm 3		4				1 1/4	Yes	Yes				
	J1435	37.95	25	97	4	65-18 \pm 3		4 x 6	W			1 1/2	Yes	Yes				
	J1350	32.95	25	90	4-8	80-15 \pm 3		3 1/2	W			1 1/2	Yes	Yes				
	J2090	59.95	75	98	4	40-3 \pm 3		6 x 9		S		3 1/4	Yes	Yes				
	J2060	44.95	65	99	4	52-5.6 \pm 3		6 1/2		S		2 1/2	Yes	Yes				
	J2080	59.95	65	92	6	35-1 \pm 3		8		S		4 1/4	Yes	Yes				
	J2094	54.95	75	94	4	1.7k-24k \pm 3		6 1/2		T		1	Yes	Yes				
J1500	74.95	50	99	4	68-20 \pm 3		6 1/2	2			F	1 1/4	Yes	No				
JET SOUND ELECTRONICS	JSE 411	34.95	20		4	70-16		4			F	1	Yes	No				
	JSE 426	34.95	30		4	80-16		5 1/2	2		F	1	Yes	No				
	JSE 541	39.95	50		4	60-20		6 1/2	3		F	2	Yes	No				
	JSE 571	64.95	80		4	60-20		6 1/2	3		F	2	Yes	No				
	JSE 975	69.95	100		4	60-20		6 x 9	2		F	3	Yes	No				
	JSE 985	89.95	100		4	60-20		6 x 9	3		F	3	Yes	No				
JVC	CS-410	49.95	30		4	45-16		4	W			1 1/4	Yes					
	CS-420	69.95	30		4	45-20		4	2			1 1/4	Yes					
	CS-610	59.95	40		4	40-18		6 1/2	W			1 1/4	Yes					
	CS-620	79.95	50		4	40-20		6 1/2	2			1 1/4	Yes					
	CS-6920	119.95	90		4	30-20		6 x 9	2			4 1/4	Yes					
	CS-6930	149.95	90		4	30-20		6 x 9	3			4 1/4	Yes					
	CS-300	29.95	20		4	80-15		3 1/2	W			1 1/2	Yes					
CS-4120	89.95	40		4	40-20		4 x 10	2			3 1/4	Yes						
KENWOOD	KFC-6990	169.00	110	92	4	35-21		6 x 9	3		F	4	Yes	Yes				
	KFC-6980	139.00	90	92	4	40-21		6 x 9	3		F	4	Yes	Yes				
	KFC-6970	79.00	40	92	4	45-20		6 x 9	2		F	3	Yes	Yes				
	KFC-160	125.00	60	90	4	35-20		6 1/2	3		F	2 1/4	Yes	Yes				
	KFC-1610	99.00	50	91	4	50-20		6 1/2	2		F	2 1/4	Yes	Yes				
	KFC-1620	85.00	30	90	4	50-20		6 1/2	2		F	2 1/4	Yes	Yes				
	KFC-1630	75.00	25	91	4	55-20		6 1/2	2		F	1 1/4	Yes	Yes				
	KFC-1640	55.00	25	89	4	55-20		6 1/2				1 1/4	Yes	Yes				
	KFC-120	75.00	25	91	4	60-20		5	2		F	1 1/4	Yes	Yes				
	KFC-1220	65.00	25	88	4	60-20		5			F	1 1/4	Yes	Yes				
	KFC-103	65.00	20	91	4	80-20		4			F	1 1/4	Yes	Yes				
	KFC-83	32.00	20	89	4	96-20		3 1/2			F	1 1/4	Yes	Yes				
	KFC-410G	79.00	60	93	4	50-20		4 x 10	2		F	3	Yes	Yes				
	KFC-571	119.00	60	91	4	50-20		5 x 7	2		F	2 3/4	Yes	Yes				
	KFC-4610	75.00	20	89	4	60-20		4 x 6	2		F	1 3/4	Yes	Yes				
	KFC-2020	149.00	100	88	4	20-3		8		S		3	Yes	Yes				
	KSC-1000	249.00	100	89	4	60-25		5	2	P		C	1 1/4	Yes	Yes			
KSC-5018	159.00	60	85	4	60-20		4	2			S		Yes	Yes				
KRACO	THP 693	129.95	100	92	4	40-20 \pm 10		6 x 9	3		F	3 1/4	Yes	Yes				
	THP 692	109.95	100	92	4	45-18 \pm 10		6 x 9	2		F	3 1/4	Yes	Yes				
	THP 413	129.95	75	91	4	70-15 \pm 10		4 x 10	3		F	3 1/2	Yes	Yes				
	THP 543	129.95	100	91	4	70-20 \pm 10		5 1/4	3		F	3	Yes	Yes				
	THP 545	59.95	50	89	4	90-15 \pm 10		5 1/4	2		F	1 1/2	Yes	Yes				
	THP 542	89.95	100	91	4	70-15 \pm 10		5 1/4	2		F	3	Yes	Yes				
LINEAR POWER	BV-1	199.95	150	89	4	28-100 Hz \pm 3		S	(2) 8		F	10	Yes	No	Slot-loaded.			
MAGTONE ELECTRONICS	4010		60	94	4	100-200 Hz		S	4	2	F	1 1/2	Yes	Yes				
	8020		120	94	4	50-4		8	W		C	3 3/8	Yes	Yes				
	4610		25	94	4	70-20		4 x 6	2		C	1 7/8	Yes	Yes				
	6913T		100	95	4	40-22		6 x 9	3		S	2 3/8	Yes	Yes				
	6513C		100	95	4	50-20		6 1/2	2		F	2 1/2	Yes	Yes				
MAJESTIC ELECTRONICS	MS2TS	39.95	40	91.5	4	350-20		T			S			No				
	MS69300DC	179.95	300		4	50-22		6 x 9	3		F			No				
	MS5800	139.95	80		4	30-20		4	3		S			No				
MARANTZ	MZS-350	44.00	20		4	150-18		3 1/2	2		S							
	MZS-412	90.00	90		4	80-20		4 x 10	2		S							
	MZS-410	40.00	20		4	120-14		4			S							
	MZS-420	60.00	50		4	120-18		4	2		S							
	MZS-620	90.00	50		4	120-18		5 1/4	2		S							
	MZS-630	120.00	100		4	100-18		5 1/4	3		S							
	MZS-692	100.00	100		4	60-18		6 x 9	2		S							
	MZS-693	140.00	100		4	50-20		6 x 9	3		S							

SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to KHz, \pm dB	DRIVERS										Notes
								Subwoofer Only (W) (1)	Tweeter Only (T) (1)	Midrange Only (M)	Woofer Size, Inches	Woofer (W), 2-Way 3-Way (3), 4-Way (4)	Angled Drivers (A)	Pointable Drivers (P)	Flux Mount (F) Surface Mount (S)	Max. Required Mounting Depth, Inches	Weatherproof?	
MITSUBISHI	SX-20	109.95	30	88	4	90-20 \pm 3		4	2		S		No	Yes				
	SG-69TB	139.95	100	90	4	70-14		6 x 9	3		F		No	Yes				
	SG-13CD	79.95	30	90	4	115-18		5 1/4	2		F		Yes	Yes				
	SG-13WD	59.95	30	88	4	120-12		5 1/4	W		F		Yes	Yes				
	SG-10CE	64.95	30	89	4	120-18		4	2		F		Yes	Yes				
	SG-10WE	49.95	30	89	4	120-17		4	W		F		Yes	Yes				
	SR-35WA	34.95	20	88	4	180-12		4			F		No	Yes				
	SB-2SA	39.95	20	89	4	5k-20k	T				P	S		No	Yes			
MONOLITHIC SOUND	S-500	120.00	70	90	8	100-20 \pm 3		4 1/2	2	A	C	2	Yes		For mid and high biamping.			
	S-600	200.00	80	90	8	60-20 \pm 3	S	5 1/2	2		C	2 1/2	Yes					
	W-700		120	87	8	35-2		7			S	4 1/2	Yes					
MOREL ACOUSTIC	Integra 1	156.00	100	91	4	45-25 \pm 3		6	2		F	2 1/8	Yes	No	Adapted for biamp. As above.			
	Integra 2	168.00	120	92	4	35-25 \pm 3		8	2		F	2 1/8	Yes	No				
	Coax 160	118.00	100	93	4	45-20 \pm 3		6	2		F	2 1/8	Yes	No				
	Coax 220	128.00	120	93	4	35-20 \pm 3		8	2		F	2 1/8	Yes	No				
	MCW 160	110.00	150	90	4	45-5 \pm 3	S	6			F	2 1/8	Yes	No				
	MCW 220	118.00	150	91	4	35-5 \pm 3	S	8			F	2 1/8	Yes	No				
	MDT-101	84.00	100	91	4	1.2k-25k \pm 3	T				F	1 1/8	Yes	No				
	CR-6	168.00	100	93	4	75-20 \pm 3	T		2		C		Yes	No				
MTX	Polyplex 4.5	119.00	60	90	4	90-20 \pm 3		4 1/2	2	P	F	1 3/4	Yes	Yes				
	Polyplex 5.3	129.00	60	93	4	75-20 \pm 3		5 1/4	2	P	F	1 1/8	Yes	Yes				
	Polyplex 6.5	149.00	60	93	4	60-20 \pm 3		6 1/2	2	P	F	2 1/2	Yes	Yes				
	Polyplex 6.9	149.00	60	92	4	55-20 \pm 3		6 x 9	2	P	F	3	Yes	Yes				
	Polyplex 7.0	199.00	100	88	4	45-20 \pm 3		6 x 9	2	P	F	3 1/4	Yes	Yes				
	8X-31	349.00	200	89	4	30-2 \pm 3	S	(4) 6 1/2		A	S		Yes	Yes				
8X-41	349.00	200	89	4		S	(4) 6 1/2		P	S		Yes	Yes					
8X-41S	349.00	200	89	4		S	(4) 6 1/2		P	S		Yes	Yes					
NAKAMICHI	SP-400	390.00	80	85	4	50-22		5 1/4	3		F	1 1/4	No	No	External crossover inc.			
PANASONIC	EAB-69A	89.95	25	93	4	45-20		6 x 9	3	P	S		Yes	Yes				
	EAB-06A	79.95	25	91	4	50-20		5 1/4	3	P	S		Yes	Yes				
	EAB-T-50	49.95	25	89	4	50-16		5	2	P	S		Yes	Yes				
	EAB-T-60	59.95	25	91	4	15-30		6 1/2	2	P	S		Yes	Yes				
	EAB-T-65	79.95	25	92	4	15-30		6 1/2		P	S		Yes	Yes				
	EAB-043	49.95	25	92	4	10-20		5 1/4		P	S		Yes	Yes				
	EAB-064	54.95	25	92	4	40-20		6 1/2	2	P	S		Yes	Yes				
	EAB-045	64.95	30	92	4	50-20		4		P	S		Yes	Yes				
	EAB-065	74.95	30	92	4	35-22		6 1/2		P	S		Yes	Yes				
	EAB-G40	69.95	60	92	4	150-25		4		A	S		Yes	Yes				
	EAB-W60	99.95	75	92	4	35-10		8	4	P	S		Yes	Yes				
	EAB-697	119.95	100	94.5	4	30-22		6 x 9		P	S		Yes	Yes				
	EAB-W80	159.95	75	93	4	20-10		6 x 9		P	S		Yes	Yes				
	EAB-030	29.95	20	90	4	100-20		3 1/2		P	S		Yes	Yes				
	EAB-049	69.95	30	92	4	50-25		4		P	S		Yes	Yes				
	EAB-061	59.95	25	92	4	45-20		6 1/2		P	S		Yes	Yes				
	EAB-062	74.95	25	92	4	10-25		6 1/2	2	P	S		Yes	Yes				
	EAB-063	84.95	25	93	4	40-25		6 1/2	2	P	S		Yes	Yes				
	EAB-411	64.95	25	92	4	60-20		4 x 10		P	S		Yes	Yes				
	EAB-415	74.95	40	91	4	45-22		4 x 10		P	S		Yes	Yes				
EAB-694	59.95	50	93	4	40-20		6 x 9	2	P	S		Yes	Yes					
EAB-695	89.95	80	94.5	4	30-22		6 x 9		P	S		Yes	Yes					
EAB-911	39.95	20	92	4	50-15		5		P	F		Yes	Yes					
EAB-915	39.95	10	91	4	60-15		4		P	F		Yes	Yes					
PARASOUND	SX40	44.50	40	88	4	80-20 \pm 4		4			F	1 1/2			Fits 6 x 9-inch cutouts.			
	SCX50	69.95	50	90	4	75-20 \pm 3		5 1/4	2		F	1 1/2						
	SCX65	89.95	50	92	4	70-22 \pm 3		6 1/2	2		F	1						
	STM96	129.95	60	94	4	60-22 \pm 3		6 x 9	3		F	3						
	CMs250	149.95	60	90	4	65-22 \pm 3		4	2		C	1 1/2	Yes	Yes				
	SW80	129.95	100	92	4	35-600 Hz \pm 3	S	8			F	4		Yes				
PEERLESS AUDIO	PHT-19	15.00	75	89	8	2.5k-20k	T				F	1 3/4	Yes	No	Biamp capable.			
	KD10	19.50	100	91	4, 8	1.5k-20k	T				F	1 1/8	Yes	No				
	TX255F	43.00	100	88	4, 8	30-3.5		10			F	4 3/4	Yes	No				
	TD255F	52.00	150	90	8	30-2.5		10			F	5	Yes	No				
	TA305F	62.50	200	89.5	8	30-2		12			F	5 3/8	Yes	No				
	Lemans		40	92	4	50-20		6 x 9	2		F	3 3/4	No	No				
	TP165F	33.00	80	89	4, 8	50-4.5		6 1/2		F	3 1/4	Yes	No					
	TX205F	37.00	80	90.5	4, 8	40-4		8		F	3 3/4	Yes	No					
	TD125F	26.00	50	87	4, 8	55-5		5		F	2 5/8	Yes	No					
	TD115F	24.00	50	88	4	60-5		4 1/2		F	2 1/2	Yes	No					
	LK10	18.00	100	90	4, 8	1.5k-18k	T				F	1	Yes	No				
	PHILIPS AUTO AUDIO	8895	399.95	200	90	4	20-22 \pm 3		2 x 5	4	P	F	1 1/8	Yes		No	Biamp capable. As above.	
8869		199.95	200	92	4	35-22 \pm 3		6 x 9	3		F	3 1/4	Yes	No				
8769		149.95	200	90	4	40-20 \pm 3		6 x 9	2		F	3 1/4	Yes	No				
8749		129.95	100	93	4	40-20 \pm 3		6 x 9	2		F	2 3/4	Yes	No				
8810		139.95	100	91	4	65-20 \pm 3		4 x 10	2		F	3	Yes	No				
8885		179.95	120	90	4	25-22 \pm 3		6 1/2	3		F	2 1/8	Yes	No				
8855		119.95	100	88	4	35-20 \pm 3		5 1/4	2		F	2 1/8	Yes	No				
8845		89.95	80	90	4	60-22 \pm 3		4	2		F	1 3/4	Yes	No				
8741		69.95	80	88	4	60-20 \pm 3		4	W		F	1 3/4	Yes	No				

SPEAKERS

MANUFACTURER	Model	Price \$		Recommended Max. Power (1 Watt/1 Meter)	Sensitivity, dB SPL	Impedance, Ohms	Frequency Response, Hz to KHz, ±dB	DRIVERS										Notes
		(If Sold Individually)	(If Sold in Pairs)					Supersonic Drive Tweeter Only (1)	Midrange Only (M)	Woofer Size, Inches	Woofer (W) 2-Way (2) 3-Way (3)	Applied Drivers (A) = A, P	Pointable Drivers (P) = P	Fish Mouth (F) Superse Motor (S)	MFR. Required	Mounting Depth, Inches	Weatherproofed?	
PHILIPS AUTO AUDIO (Continued)	8641	39.95	30	90	4	75-15 ±3		4	W		F	1 1/2	Yes	No	With 4 x 6-inch plate for dash mounting. Rear deck. Kit. As above. For hatchbacks. Triamplified.			
	8864	79.95	30	90	4	35-20 ±3		6 1/2	2		F	1 1/2	Yes	No				
	8853	69.95	25	90	4	55-20 ±3		5	2		F	1 1/2	Yes	No				
	8751	59.95	25	88	4	80-15 ±3		5	W		F	1 1/2	Yes	No				
	8846	89.95	60	90	4	100-22 ±3		3 1/2	2		F	1 1/2	Yes	No				
	8235	129.95	60	90	4	200-22 ±3		3 1/2	2	A, P	S	1	Yes	No				
	8320	69.95	100	90	4	2.7k-22k ±3	T				C	3/4	Yes	No				
	8335	49.95	100	90	4	2.7k-22k ±3	T				F	3/4	Yes	No				
	8340	49.95	100	90	4	2.7k-22k ±3	T				F	3/4	Yes	No				
	8346	59.95	100	90	4	2.7k-22k ±3	T				F	3/4	Yes	No				
	6500	119.95	150	94	4	60-5 ±3	S	6 1/2			F	2 1/4	Yes	No				
	6900	149.95	200	94	4	48-4 ±3	S	6 x 9			F	3 1/4	Yes	No				
	8000	149.95	200	94	4	43-3 ±3	S	8			F	3 3/8	Yes	No				
	8241	99.95	60	90	4	80-20 ±3	S	4	2		F	2 1/2	Yes	No				
	8900	599.95	50	90	4	20-22 ±3	S	2 x 5	4		F	2 1/2	Yes	No				
	PIONEER	TS-1011	34.95	30	90	4	50-16		4	W		F	1 3/4	No		Yes	Motional feedback, built-in 44-watt mono amp with controller.	
TS-1044K		69.95	30	90	4	50-20		4	2		F	1 3/4	Yes	Yes				
TS-1200K		89.95	30	91	4	50-20		5 1/2	2	P	F	1 3/8	Yes	Yes				
TS-1611		39.95	30	92	4	40-20		6 1/2	W		F	2	No	Yes				
TS-1633K		69.95	60	92	4	30-20		6 1/2	2		F	1 3/4	Yes	Yes				
TS-1655K		124.95	90	90	4	30-20		6 1/2	3		F	2 1/8	Yes	Yes				
TS-1690K		149.95	90	91	4	40-24		6 1/2	4	P	F	2 1/8	Yes	Yes				
TS-87		29.95	20	87	4	100-18		3 1/2			F	1 1/2	No	Yes				
TS-462		49.95	20	89	4	60-20		4 x 6	W		F	1 1/2	No	Yes				
TS-411		69.95	20	90.5	4	50-20		4 x 10	2		F	2 1/4	No	Yes				
TS-6903		54.95	40	93	4	40-19		6 x 9	W		F	3 1/4	No	Yes				
TS-6904		84.95	80	94	4	35-20		6 x 9	2		F	3 3/4	No	Yes				
TS-6905		119.95	80	94	4	30-20		6 x 9	3		F	4	No	Yes				
TS-6906		149.95	100	95	4	35-22		6 x 9	3		F	4	No	Yes				
TS-6907		169.95	100	95	4	30-22		6 x 9	4		F	4	No	Yes				
TS-W203		149.95	60	93	4	28-10		8			F	3 1/4	No	Yes				
TS-205		199.95	60	92	4	30-22		8	3		F	3 1/4	No	Yes				
TS-55	37.95	40	90	4	180-13		5 1/8			S		No	Yes					
TS-X7	99.95	60	88	4	70-20		4	2		S		No	Yes					
TS-X8	149.95	80	86.5	4	55-20		4 1/8	3		S		No	Yes					
GTS-X80	399.95	100	90	4	50-150 Hz	S	6 1/2			S		No	Yes					
POLK AUDIO	Mobile Monitor I	79.90	50	93.3	4	80-15		4	W		S	1						
	Mobile Monitor III	159.90	100	92	4	40-20.5		5 1/4	2		S	1 3/4	Yes	Yes				
	Mobile Monitor IV	220.00	100	91	4	40-20.5		5 1/4	2		S	1 1/2	Yes	Yes				
	Mobile Monitor V	279.00	100	92	4	40-20.5		5 1/4	2		S	1 3/4	Yes	Yes				
POLYDAX	EZ 302		250.00	30	86	4	50-20		4	2	A		No	No				
	HIF 17 JS	29.95		30	86	4	30-3.5	S	6 1/2			3	No	Yes				
	HIF 13 J	27.95		30	86	4	40-5		5 1/4			2 1/8	No	Yes				
PROSOUND PRODUCTS	PRD-40	104.95	40		4	150-8	M				F	1 1/8	Yes					
	PRD-50	104.95	65		4	100-8	M				F	1 1/8	Yes					
	PRD-60	124.95	70		4	50-5	S	6			F	2 1/8	Yes					
	PRD-69	124.95	85		4	60-7	S	6 x 9			F	2 1/8	Yes					
	PRD-80	149.95	70		4	40-4.5	S	8			F	2 1/8	Yes					
	PRD-605	159.95	50		4	70-22	S	6			F	2 1/8	Yes					
	PRD-695	164.95	50		4	70-22	S	6 x 9	2		F	3 1/8	Yes					
PROTON	280 290	125.00	50	90	4	2k-20k ±5	T				S	2 1/4	Yes	No				
	295	50.00	80	88	4	80-6 ±5	S	5 1/4			F	4	Yes	No				
	296	90.00	60	90	4	50-2 ±5	S	6 1/2			F	4 1/4	Yes	No				
	297	100.00	80	93	4	30-400 Hz ±5	S	8			F	4 3/4	Yes	Yes				
	298		120	94	4	25-400 Hz ±5	S	10			F	4 3/8	Yes	Yes				
	299		150	95	4	20-400 Hz ±5	S	12			F	4 3/8	Yes	Yes				
	283	80.00	40	91	4	60-20 ±5			2		A	2	Yes	No				
	284	90.00	60	90	4	55-20 ±5		5 1/4		A	P	2 1/4	Yes	No				
	285	170.00	80	90	4	50-20 ±5		5 1/4		A	P	2 1/4	Yes	No				
	286	120.00	60	89	4	60-20 ±5		4 1/2			C	2	Yes	No				
	287	100.00	60	90	4	70-20 ±5		6			C	2	Yes	No				
	289	100.00	80	92	4	60-20 ±5		6 x 9	2		A	F	2	Yes		No		
	PYLE INDUSTRIES	P-HS100A	229.95	80	90	4	50-20 ±3		4	2		S		Yes			Blamp capable. As above.	
		P-HS150P	219.95	80	90	4	50-20 ±3		4	2		S		Yes				
P-HP523A		189.95	80	92	4	45-20 ±3		5 1/4	2		F	1 1/8	Yes					
P-HP43A		159.95	80	91	4	100-20 ±3		4	2		F	3/4	Yes					
FP69C200-FCD		67.95	164.95	120	95	4	40-20 ±3		6 x 9	2		F	3 1/2	Yes				
FS69C100-FCD		54.95	135.95	70	92	4	50-20 ±3		6 x 9	2		F	3 1/2	Yes				
F69C160-FCD		59.95	149.95	100	96	4	40-20 ±3		6 x 9	2		F	3 3/4	Yes				
F69C200-FCD		65.95	159.95	120	96	4	40-20 ±3		6 x 9	2		F	3 3/8	Yes				
F69C290-FCD		75.95	185.95	140	97	4	40-20 ±3		6 x 9	2		F	4	Yes				
F69C100-FT		49.95	129.95	80	95	4	45-20 ±3		6 x 9	2		F	3 3/8	Yes				
F69C200-FT		57.95	149.95	120	96	4	40-20 ±3		6 x 9	2		F	3 3/8	Yes				
F69C290-FT		69.95	175.95	140	97	4	40-20 ±3		6 x 9	2		F	4	Yes				
F69C180-WF		32.95	89.95	80	96	4	50-18 ±3		6 x 9	W		F	3 1/2	Yes				
F69C100-WF		27.95	83.95	80	94	4	55-18 ±3		6 x 9	W		F	3	Yes				
F410C160-FCD		54.95	135.95	70	95	4	55-20 ±3		4 x 10	2		F	3 1/8	Yes				
F410C100-FP		42.95	115.95	60	94	4	55-20 ±3		4 x 10	2		F	3 3/8	Yes				
F410C100-WF		27.50	84.95	60	93	4	55-18 ±3		4 x 10	W		F	2 1/8	Yes				
(Continued)																		

SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Max. Power Watts	Sensitivity dB SPL (1 Watt/1 Meter)	Impedance Ohms	Frequency Response Hz to kHz ±dB	DRIVERS									
								Subwoofer Only (S) Tweeter Only (T)	Woolfer Size, Inches	Woolfer (W), 2-Way (2) 3-Way (3), 4-Way (4)	Applied Drivers = A Pointable Drivers = P	Flush Mount (F) Surface Mount (S)	Max. Required Mounting Depth, Inches	Weatherproofed?	Application Guide Available?	Notes	
PYLE INDUSTRIES (Continued)	FP65C100-FR	48.95	124.95	50	91	4	65-20 ±3		6½	2		F	1½	Yes	Yes		
	FS65C100-FR	49.95	128.95	50	91	4	65-20 ±3		6½	2		F	1½	Yes	Yes		
	F65C120-CD	49.95	129.95	70	95	4	55-20 ±3		6½	2		F	2¼	Yes	Yes		
	F65C120-WCR	29.95	89.95	70	95	4	55-20 ±3		6½	W		F	2¼	Yes	Yes		
	F52C160-FCD	54.95	135.95	60	94	4	55-20 ±3		5¼	2		F	2¾	Yes	Yes		
	F52C100-FP	39.95	110.95	60	93	4	60-20 ±3		5¼	2		F	2	Yes	Yes		
	F52C100-WF	25.95	79.95	60	92	4	60-18 ±3		5¼	W		F	2	Yes	Yes		
	F57C100-WF	26.95		60	93	4	60-18 ±3		5 x 7	W		F	2¾	Yes	Yes		
	F5C100-CR	25.50		60	92	4	50-18 ±3		5			F	1¾	Yes	Yes		
	FP45C99-FR	44.95	112.95	50	92	4	60-20 ±3		4½	2		F	1¾	Yes	Yes		
	F45C99-FR	43.95	109.95	50	92	4	60-20 ±3		4½	2		F	1¾	Yes	Yes		
	F45C99-F	24.50	74.95	50	92	4	60-18 ±3		4½			F	1¾	Yes	Yes		
	F4C99-F	23.95	70.95	50	92	4	70-18 ±3		4			F	1¾	Yes	Yes		
	F46C75-FR	41.95	99.95	50	92	4	70-20 ±3		4 x 6	2		F	2	Yes	Yes		
	F46C55-WF	22.95	60.95	50	92	4	80-18 ±3		4 x 6	W		F	1½	Yes	Yes		
	FM46C55-WF	23.95	61.95	50	92	4	80-18 ±3		4 x 6	W		F	1½	Yes	Yes		
	F35C55-WF	22.50	59.95	40	92	4	90-18 ±3		3½	W		F	1½	Yes	Yes		
	F35C30-WF	20.95		40	90	4	100-18 ±3		3½	W		F	1½	Yes	Yes		
	W4C55-F4S	26.95		60	89	4	55-4 ±3	S	4			F	1½	Yes	Yes		
	WP52C100-F4	28.50		70	93	4	55-8 ±3	S	5¼			F	2¾	Yes	Yes		
	W52C165-F4S	34.95		90	90	4	30-3 ±3	S	5¼			F	2½	Yes	Yes		
	W52C165-F	30.95		90	92	8	50-7 ±3	S	5¼			F	2¾	Yes	Yes		
	WP65C200-F4	39.50		120	93	4	40-6 ±3	S	6½			F	3¼	Yes	Yes		
	W65C170-F4S	38.95		130	91	4	25-2.5 ±3	S	6½			F	3¼	Yes	Yes		
	W65C200-F	35.95		120	93	8	40-6.5 ±3	S	6½			F	3¼	Yes	Yes		
	W65C200-F4	36.95		120	93	4	40-6 ±3	S	6½			F	3¼	Yes	Yes		
	W65C200-F4D	42.95		120	91	4	35-4 ±3	S	6½			F	3¼	Yes	Yes		
	WP8C200-F4	43.50		140	95	4	30-5.5 ±3	S	8			F	3½	Yes	Yes		
	W8C200-F4S	40.95		140	93	4	20-1.5 ±3	S	8			F	3½	Yes	Yes		
	W8C200-F	38.95		140	95	8	30-6 ±3	S	8			F	3½	Yes	Yes		
	W8C200-F4	39.95		140	95	4	30-5.5 ±3	S	8			F	3½	Yes	Yes		
	W8C290-F4D	50.95		150	94	4	25-3.5 ±3	S	8			F	4½	Yes	Yes		
	W8C300-F	50.95		160	95	8	25-3.5 ±3	S	8			F	4½	Yes	Yes		
	W8C300-F4	51.95		160	95	4	25-3 ±3	S	8			F	4½	Yes	Yes		
	WP10C200-F4	47.50		150	96	4	25-5 ±3	S	10			F	4¾	Yes	Yes		
	W10C200-F4S	47.95		150	94	4	20-1	S	10			F	4¾	Yes	Yes		
	W10C200-F	42.95		150	96	8	25-5.5 ±3	S	10			F	4¾	Yes	Yes		
	W10C200-F4	43.95		150	96	4	25-5 ±3	S	10			F	4¾	Yes	Yes		
	W10C300-F	55.95		170	96	8	20-3.5 ±3	S	10			F	4¾	Yes	Yes		
	WP69C200-F4	44.50		130	94	4	40-5.5 ±3	S	6 x 9			F	3½	Yes	Yes		
	W69C200-F4S	41.95		130	92	4	25-1.5 ±3	S	6 x 9			F	3½	Yes	Yes		
	W69C290-F	47.95		140	95	8	35-6	S	6 x 9			F	3½	Yes	Yes		
	W69C290-F4	48.95		140	95	4	35-5.5 ±3	S	6 x 9			F	3½	Yes	Yes		
	W69C290-F4D	52.95		140	94	4	30-3.5 ±3	S	6 x 9			F	3½	Yes	Yes		
	W410C160-F	30.95		80	93	8	40-7 ±3	S	4 x 10			F	1½	Yes	Yes		
	M5C99-F	24.95		80	94	8	700-14 ±3	M				F	3½	Yes	Yes		
	M5C160-F	29.50		100	94	8	50-10 ±3	M				F	2	Yes	Yes		
	M5C160-CR	30.50		100	94	8	500-14 ±3	M				F	2	Yes	Yes		
	P-R3415		49.95	100	87	8	4k-20k ±3	T				C		Yes	Yes		
	P-R4580		99.95	120	90	8	4k-20k ±3	T				C	1	Yes	Yes		
	P-CD2C10-X		34.95	60	88	8	4k-20k ±3	T				F	½	Yes	Yes		
	P-CD4C80-X		49.95	80	92	8	4k-20k ±3	T				F	1¾	Yes	Yes		
	P-CD54C80-X		66.50	80	89	8	4k-20k ±3	T				F	1¾	Yes	Yes		
	P-T17C55-X		48.95	60	91	8	4k-20k ±3	T				F	1½	Yes	Yes		
P-T3C24-X		37.95	90	94	8	4k-20k ±3	T				F	1¼	Yes	Yes			
P-T3PA		22.95	140	89		3k-20k ±3	T				F	¾	Yes	Yes			
P-T3PAS		30.95	140	89		3k-20k ±3	T				F	1½	Yes	Yes			
ROYAL SOUND	RS 500N		30.00	50	89	4	80-15 ±15		5¾	W	P	C	1¾	Yes	Yes		
	RS 510N		40.00	50	88	4	60-17 ±15		5¾	2	P	C	1¾	Yes	Yes		
	RS 520N		60.00	50	86	4	60-18 ±15		5¾	3	P	C	1¾	Yes	Yes		
	RS 530		60.00	75	93	4	90-17 ±10		6	3	P	C	2½	Yes	Yes		
	RS 900		60.00	100	95	4	60-20 ±10		6 x 9	3	P	C	3½	Yes	Yes		
	SANSUI	SB-165		99.00	60	90	4	40-21		6½	2	P	C	2¼	No	Yes	
SB-160			89.00	30	90	4	40-20		6½	2	P	C	1¾	Yes	Yes		
SB-135			89.00	40	90	4	48-21		5¼	3	P	C	1¾	Yes	Yes		
SB-105			69.00	30	90	4	50-20		4		P	C	1½	Yes	Yes		
SB-100			59.00	25	90	4	50-20		4	W		C	1½	Yes	Yes		
SB-X907			449.00	110	88	4	43-22		5	3	A	S		No	Yes		
SB-X903			239.00	80	88	4	55-21		5	3	A	S		No	Yes		
SB-F707			269.00	100	93	4	28-22		8	3	A	S	3½	No	Yes		
SB-F703			199.00	80	92	4	38-22		6½	3	A	S	2¾	No	Yes		
SB-693			149.00	70	93	4	30-22		6 x 9	3	P	S	3½	No	Yes		
SB-692			119.00	70	93	4	30-20		6 x 9	2	P	S	3½	No	Yes		
SANYO		SP 41		19.95	10		4	80-15 ±3		4	W		F	1¾	Yes	Yes	
		SP 42		34.95	20		4	80-20 ±3		4	2		F	1¾	Yes	Yes	
	SP 47		49.95	30		4	70-20 ±3		4	2		F	Yes	Yes			
	SP 24		39.95	20		4	80-20 ±3		4 x 6	2		F	1¾	Yes	Yes		
	SP 55		29.95	15		4	80-12 ±3		5¼			F	1½	Yes	Yes		
	SP 56		39.95	20		4	70-20 ±3		5¼	2		F	1½	Yes	Yes		
	SP 700		15.95	5		8	100-10 ±3		6½			F	1½	Yes	Yes		
	SP 62		24.95	20		4	70-15 ±3		6½	W		F	1¼	Yes	Yes		
	SP 64		44.95	20		4	60-17 ±3		6½	2		F	1¾	Yes	Yes		
	SP 67		59.95	40		4	60-17 ±3		6½	2		F	2	Yes	Yes		
	SP 75		54.95	30		4	80-17 ±3		5 x 7	2		C	2	Yes	Yes		
	SP 16		59.95	40		4	80-17 ±3		4 x 10	2		F	3	Yes	Yes		
	SP 92		69.95	40		96	4	55-17 ±3		6 x 9	2		F	4	Yes	Yes	
	SP 94		79.95	40		94	4	55-20 ±3		6 x 9	3		F	4	Yes	Yes	
	SP 96		99.95	100		95	4	55-20 ±3		6 x 9	3		F	4	Yes	Yes	

Without grilles, Model SP 245.

SPEAKERS

MANUFACTURER	Model	Price, \$ (if Sold Individually)	Price, \$ (if Sold in Pairs)	Recommended Max. Power, Watts	Sensitivity, dB SPL (1 W/1 m, Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ± dB	DRIVERS									
								Subwoofer Only (S) Woofer Only (W) Tweeter Only (T)	Woofer Size, Inches	Whizzer (W) 3-Way (3) 4-Way (4)	Angular Driver(s) = A	Polarizable Driver(s) = P	Flush Mount (F) Surface Mount (S)	Max. Required Mounting Depth, Inches	Weatherproofed?	Application Guide Available?	Notes
SONY	XS-3		34.45	20	88	4	100-20 ± 10		3 1/2	W	P	F	1 1/2	Yes	Yes		
	XS-101		64.95	20	91	4	50-20 ± 10		4	W	P	F	1 1/4	Yes	Yes		
	XS-102		79.95	20	91	4	50-20 ± 10		4	2	P	F	1 1/4	Yes	Yes		
	XS-301		89.95	20	92	4	47-20 ± 10		5 1/4	2	A	F	1 1/2	Yes	Yes		
	XS-211		59.95	15	91	4	85-12 ± 10		5	W	P	F	1 1/4	Yes	Yes		
	XS-613S		89.95	20	93	4	70-17 ± 10		6 1/2	2	P	F	1 1/4	Yes	Yes		
	XS-606		99.95	30	92	4	45-20 ± 10		6 1/2	2	P	F	2	Yes	Yes		
	XS-690		94.95	30	92	4	35-20 ± 10		6 x 9	2	P	F	4	Yes	Yes		
	XS-691		129.95	60	92	4	30-21 ± 10		6 x 9	3	P	F	4	Yes	Yes		
	XS-880		189.95	60	92	4	30-21 ± 10		8	3	P	F	4 3/4	Yes	Yes		
	XS-410		139.95	40	91	4	65-20 ± 10		8	3	P	F	3 3/8	Yes	Yes		
	XS-H1		129.95	60	94	4	5k-22k ± 10	T	4 x 10	3	P	F	2 3/8	Yes	Yes		
	XS-H2		79.95	40	89	4	5k-40k ± 10	T			P	F	2 3/8	Yes	Yes		
	XS-L16		99.95	40	89	4	50-3.5 ± 10	S	6 1/2		P	F	2 1/8	Yes	Yes		
	XS-L20		169.95	60	91	4	20-5 ± 10	S	8		P	F	3 5/8	Yes	Yes		
	XS-HF2		219.95	40	90	4	75-40 ± 10	S	5 1/4		P	C	2	Yes	Yes		
	XS-1		329.95	100	88	4	90-40 ± 10	S	5		P	S		Yes	Yes		
SPARKOMATIC	SK-6950		99.95	200	92	4	50-20		6 x 9	4		F	4	Yes	Yes		
	SK-6922T		69.95	80	96.6	4	30-17		6 x 9	3		F	3 1/2	Yes	Yes		
	SK-6920C		47.95	50	95.3	4-8	30-15		6 x 9	2		F	3 3/8	Yes	Yes		
	SK-650		74.95	200	92	4	70-20		6	4		F	2 3/8	Yes	Yes		
	SK-622T		54.95	80	96.6	4	50-17		6	3		F	2 3/4	Yes	Yes		
	SK-620C		39.95	50	95	4-8	50-15		6	2		F	2 3/4	Yes	Yes		
	SK-400		28.95	40	86	4-8	90-15		4	W		F	1 1/4	Yes	Yes		
	SK-410		31.95	40	86	4-8	90-15		4	W	A	S		Yes	Yes		
	SK-313		15.95	10	85	4-8	125-8	M			A	S		Yes	Yes		
	SK-355		15.95	10	88	4-8	100-10	M			A	S	1 3/4	Yes	Yes		
	SK-520C		44.95	50	95	4-8	60-15		5 x 7	2	A	P		Yes	Yes		
	SK-415		33.95	40	86	4-8	90-15		4	W		S		Yes	Yes		
	SK-300		19.95	40	86	4-8	90-15		4	W		S	1 1/2	Yes	Yes		
	ASK-4000		199.95	100 inc.	↑	↑	30-20		4	2		S		Yes	Yes	Internally biamped; †† or 2.5 V for full power; ††10 kilohms or 20 ohms. As above.	
	ASK-4010		249.95	100 inc.	↑	↑	30-20		(2) 4	2	A	S		Yes	Yes	As above.	
	ASK-4020		299.95	100 inc.	↑	↑	30-20		6	2	A	S		Yes	Yes	As above.	
	ASK-4030	199.95	68 inc.	↑	↑	↑	30-250 Hz	S	(4) 4			S		Yes	Yes		
SPECO	SK6925TD		133.95	120		4	30-20		6 x 9	3	P	F	4 1/4	Yes		Blamp capable.	
	SK6920Q		79.95	80		4	50-20		6 x 9	4	P	F	3 3/4	Yes			
	SK6920T		69.00	60		4	50-20		6 x 9	3	P	F	3 1/2	Yes			
	SK6920C		59.95	50		8	50-20		6 x 9	2	P	F	3 3/8	Yes			
	SK5120T		65.95	60		8	80-20		5 1/4	3	P	F	2 1/8	Yes			
	SK5120C		52.95	50		8	50-20		5 1/4	2	P	F	2 1/8	Yes			
	SK5110C		49.95	30		8	50-20		5 1/4	2	P	F	2	Yes			
	SK5110A		37.50	30		8	80-15		5 1/4	W	P	F	2	Yes			
	SK4120C		59.95	50		8	50-20		4 x 10	2	P	F	3	Yes			
	SK4C10			40		8	50-20		4	2	P	F	2	Yes			
	SK4A10			30		8	30-17		4	W	P	F	2	Yes			
	DMS-3		110.00	100		4	55-20		4	3	A	P	S		Yes		
	DMS-2		69.95	60		4	60-20		3 1/2	2	A	P	S		Yes		
	WC5110C		53.95	30		8	50-15		5 1/4	2	A	C	F		Yes		
	WC5110A		42.00	30		8	50-12		5 1/4	W	A	C	F		Yes		
	SK5A5SC		44.95	40		8	120-18		5	2	P	F	1 1/4	Yes			
	SK5A5S		35.95	30		8	110-10		5	W	P	F	1 1/4	Yes			
	STILLWATER DESIGNS	Kicker	250.00		100		4	40-20		(2) 6 1/2	2	A	S	6 1/2	No	No	Mounts behind seat in pickups.
		Kicker II	250.00		100		4	40-20		(2) 6 1/2	2	A	S	13 1/2	No	No	Mounts on rear deck in lastbacks.
		Slide-Kicks		270.00	100		4	40-20		6 1/2	2	A	S	6 1/4	No	No	Mounts behind seat in mini-pickups.
TEI ELECTRONICS	Super-Kicks		325.00	150		4	38-20		8	2	A	S	6 1/4	No	No	Mounts behind seat in standard pickups.	
	21-294		66.35	25		4, 8	55-22					S					
	21-295		116.53	30		4, 8	55-22					S					
VISONIK	21-297		126.91	50		4, 8	20-18					S					
	49-250		89.95	25		4, 8	20-180 Hz	S				S				Subwoofer and amp set (see "Amplifiers").	
YAMAHA	05200	98.00	196.00	50		4	60-22 + 3, -8		4	2		F	1 1/2	No	No	Fits 4 x 6-inch cutouts.	
	04200	90.00	180.00	50		4	80-22 + 4, -8		4	2		F	1 1/4	Yes	No		
	05000	138.00	276.00	50		4	50-25 + 4, -8		4	2		S		Yes	No		
	04000	107.00	214.00	50		4	50-22 + 4, -8		4	2		S		Yes	No		
	YCS-800		140.00	200	92	4	50-1	S	8			S	3 1/2	Yes	No		
YCS-691		180.00	120	91	4	40-20		6 x 9		A	S	2 1/8	Yes	No			
YCS-690		140.00	120	91	4	40-20		6 x 9	2	A	S	2 1/8	Yes	No			
YCS-601		160.00	120	89	4	60-20		6 1/2	2	A	S	2 1/8	Yes	No			
YCS-600		100.00	100	90	4	60-20		6 1/2	2	A	S	2 1/8	Yes	No			
YCS-530		200.00	100	86	4	50-20		5	2		S	1 1/4	Yes	No			
YCS-400		60.00	80	88	4	70-20		4	2		S	1 1/8	Yes	No			
YCS-300		90.00	40	90	4	3.5k-20k	T				S	3/4	Yes	No			

COMPANY ADDRESSES

<p>Acoustic Research 10 American Dr. Norwood, Mass. 02062</p> <p>ADS One Progress Way Wilmington, Mass. 01887</p> <p>Alphasonik See Visonik</p> <p>Alpine 19145 Gramercy Pl. Torrance, Cal. 90501</p> <p>Altec Lansing 1250 North Red Gum St. Anaheim, Cal. 92806</p> <p>Anglo-American Audio P.O. Box 653 Buffalo, N.Y. 14240</p> <p>ARA Manufacturing P.O. Box 870 Grand Prairie, Tex. 75050</p> <p>Audia See Clarion</p> <p>AudioMobile 1500 Executive Dr. Elgin, Ill. 60120</p> <p>Audio Pro See Sonic Research</p> <p>AudioSource 1185 Chess Dr. Foster City, Cal. 94404</p> <p>Autotek 1447 North Carolan Ave. Burlingame, Cal. 94010</p> <p>Babb Audio 3230A Towerwood Dallas, Tex. 75234</p> <p>Becker Electronics Route 145 East Durham, N.Y. 12423</p> <p>Beltek 28 East Susquehanna Ave. Towson, Md. 21204</p> <p>Bevada International 8743 Shirley Ave. Northridge, Cal. 91324</p> <p>BGW Systems 13130 South Yukon Ave. Hawthorne, Cal. 90250</p>	<p>Blaupunkt c/o Robert Bosch Sales Corp. 2800 South 25th Ave. Broadview, Ill. 60153</p> <p>Bose 100 The Mountain Rd. Framingham, Mass. 01701</p> <p>Boston Acoustics 247 Lynnfield St. Peabody, Mass. 01960</p> <p>B & W See Anglo-American Audio</p> <p>Canton 254 First Ave. North Minneapolis, Minn. 55401</p> <p>Cerwin-Vega 12250 Montague St. Arleta, Cal. 91331</p> <p>Clarion 5500 Rosecrans Ave. Lawndale, Cal. 90260</p> <p>Concord Systems 6025 Yolanda Ave. Tarzana, Cal. 91356</p> <p>Craig 921 West Artesia Blvd. Compton, Cal. 90220</p> <p>Crown Japan See UCM</p> <p>Cybernet 7 Powder Horn Dr. Warren, N.J. 07060</p> <p>EPI Epicure Products 25 Hale St. Newburyport, Mass. 01950</p> <p>Fujitsu Ten 19281 Pacific Gateway Dr. Torrance, Cal. 90502</p> <p>Fultron Arthur Fulmer Inc. P.O. Box 177 Memphis, Tenn. 38018</p> <p>Genesis Physics Newington Park Newington, N.H. 03801</p> <p>Gold Sound P.O. Box 141 Englewood, Colo. 80110</p>	<p>Harman/Kardon 240 Crossways Park West Woodbury, N.Y. 11797</p> <p>Hi-Comp 150 Marcus Blvd. Hauppauge, N.Y. 11787</p> <p>Hifonics 171 Highwood Ave. Leonia, N.J. 07605</p> <p>Infinity Systems 7930 Deering Ave. Canoga Park, Cal. 91304</p> <p>JBL 8500 Balboa Blvd. Northridge, Cal. 91329</p> <p>Jensen 4136 North United Pkwy. Schiller Park, Ill. 60176</p> <p>Jet Sound Electronics P.O. Box 4567 Carson, Cal. 90749</p> <p>JVC 41 Slater Dr. Elmwood Park, N.J. 07407</p> <p>Kenwood 1315 East Watsoncenter Rd. Carson, Cal. 90745</p> <p>Kraco 505 East Euclid Ave. Compton, Cal. 90224</p> <p>Linear Power 11545 D Ave. Auburn, Cal. 95603</p> <p>Magtone Electronics 20445 Gramercy Suite 204 Torrance, Cal. 90501</p> <p>Majestic Electronics 14614 Lanark St. Panorama City, Cal. 91402</p> <p>Marantz 20525 Nordhoff St. Chatsworth, Cal. 91311</p> <p>Midland International 1690 North Topping Kansas City, Mo. 64120</p> <p>Mitsubishi 799 North Bierman Circle Mt. Prospect, Ill. 60056</p>	<p>Monolithic Sound 15635 Saticoy St. Suite D Van Nuys, Cal. 91406</p> <p>More! Acoustic 414 Harvard St. Brookline, Mass. 02146</p> <p>MTX One Mitek Plaza Winslow, Ill. 61089</p> <p>Nakamichi U.S.A. Corp. 1101 Colorado Ave. Santa Monica, Cal. 90401</p> <p>Panasonic One Panasonic Way Secaucus, N.J. 07094</p> <p>Parasound Wharfside 680 Beach St. San Francisco, Cal. 94109</p> <p>Peerless Audio 40 Jytek Dr. Leominster, Mass. 01453</p> <p>Philips Auto Audio 230 Durfy Ave. Hicksville, N.Y. 11802</p> <p>Pioneer P.O. Box 1720 Long Beach, Cal. 90801</p> <p>Polk Audio 1915 Annapolis Rd. Baltimore, Md. 21230</p> <p>Polydax Two Park Ave. New York, N.Y. 10016</p> <p>Prosound Products See Radio 1</p> <p>Proton 737 West Artesia Blvd. Compton, Cal. 90220</p> <p>Pyle Industries 501 Center St. Huntington, Ind. 46750</p> <p>Radio 1 123 Eastlake Ave. East Seattle, Wash. 98109</p> <p>Rockford Fosgate 613 South Rockford Dr. Tempe, Ariz. 85281</p>	<p>Royal Sound 200 Industrial Way West Eatontown, N.J. 07724</p> <p>Sansui 1250 Valley Brook Ave. Lyndhurst, N.J. 07071</p> <p>Sanyo 1200 West Artesia Compton, Cal. 90220</p> <p>Sherwood 17107 Kingsview Ave. Carson, Cal. 90746</p> <p>Sonic Research 27 Sugar Hollow Rd. Danbury, Conn. 06810</p> <p>Sony Sony Dr. Park Ridge, N.J. 07656</p> <p>Sparkomatic Routes 6 and 209 Milford, Pa. 18337</p> <p>SPECO P.O. Box 624 Lindenhurst, N.J. 11757</p> <p>Stillwater Designs 1212 South Main Stillwater, Okla. 74074</p> <p>Tancredi 2318 East Del Amo Blvd. Compton, Cal. 90220</p> <p>TEI Electronics 570 West 18th St. Hialeah, Fla. 33010</p> <p>UCM 3848 Carson St. Torrance, Cal. 90503</p> <p>Unisef See UCM</p> <p>Vector Research 20600 Nordhoff St. Chatsworth, Cal. 91311</p> <p>Visonik 701 Heinz St. Berkeley, Cal. 94710</p> <p>Yamaha 6600 Orangethorpe Ave. Buena Park, Cal. 90620</p> <p>Zapco 2135 Stone Ave. Modesto, Cal. 95351</p>
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withstand cycles of heat, cold and humidity.

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BRINGING YOU *THE ART OF MUSIC* THROUGH THE SCIENCE OF SOUND.

OLD-TYME HIGH Electronic Cylinder

Re-recording engineer Art Shifrin uses sophisticated

While up-to-date audio buffs eagerly explore the state-of-the-art digital sound of the Compact Disc, a surprisingly large clique of music lovers still explores the birth-of-the-art sounds of the Edison cylinder and Berliner disc.

This early-fi contingent of old phonograph and record collectors is not, however, made up only of oldsters seeking yesteryear's Edisons, Victrolas and Graphophones to revive happy moments associated with their youth. It encompasses as many buffs under 40 years of age as over 40.

These enthusiasts see early phonographic technology as quite sophisticated, and they often view it as a challenge. That challenge is to extract every nuance of sound still contained in the grooves of ancient discs and cylinders. This clique might best be described as "tweakers," kin of those present-day audiophiles who go to extremes to achieve sonic bliss.

Some "old tyme" tweakers attain their goals by acquiring two or more units of a certain cylinder or disc phonograph, tearing them down, then creating a single "new" machine from the best or least-worn parts of both originals. Other enthusiasts will selectively replace an old phonograph's operating elements, using parts from a variety of sources that cater to sound archeologists, to get "mint" equipment whose optimized reproducing capabilities can satisfy their goals.

But the more determined tweaker goes beyond refurbishing or recon-

structing original equipment. He believes that vintage acoustic phono hardware, no matter how good its condition, cannot bring out all of the sounds in cylinder or lateral-cut disc grooves. Instead, he applies modern technology to the old—using a current phono cartridge, for example, instead of a mechanical "sound box" to recreate the original recorded sound. He may also employ a variety of filtering, noise-reduction and equalization devices to further improve the results. He will also re-record the results for posterity (and for convenience) on cassette or reel-to-reel tape.

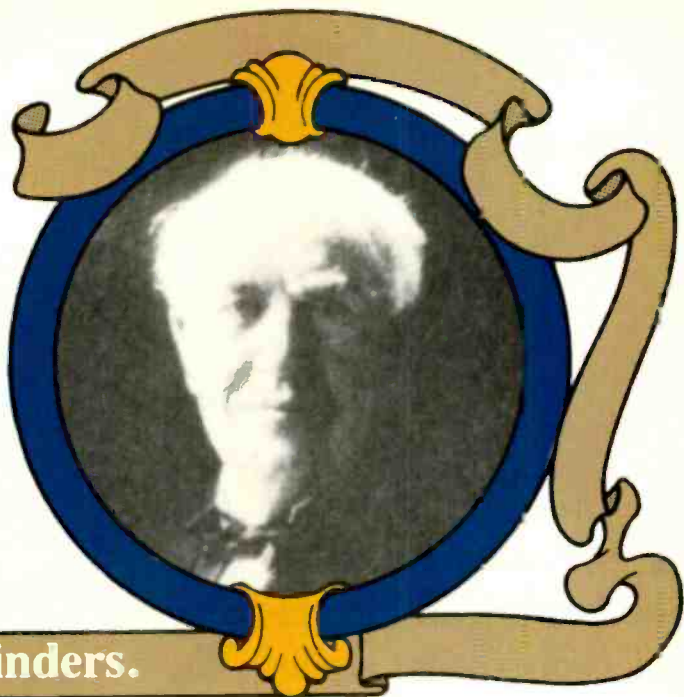
One of the most determined and best-known of early-sound enthusiasts is Arthur Shifrin of Douglaston, New York, a sound technician internationally known for his restorations of early disc, cylinder, film and magnetic recordings. To achieve proper reproduction of cylinders, Shifrin has developed a truly deluxe playback system using sophisticated modern technology and equipment. Shifrin's Electronic Cylinder System, originally created for his own personal and professional use, is now also made to order in a variety of custom configurations for educational institutions, sound archivists, historical record producers and for serious—and well-heeled—hobbyists. Selling for about \$15,000 in its basic version, Shifrin's system is comprised of four handsomely constructed components: A thick, solid hardwood base; a motor and control housing; a drive assembly, and a radial-tracking tonearm.

The arm is a modified Rabco SL8-E which can track cylinders up to 6 inch-

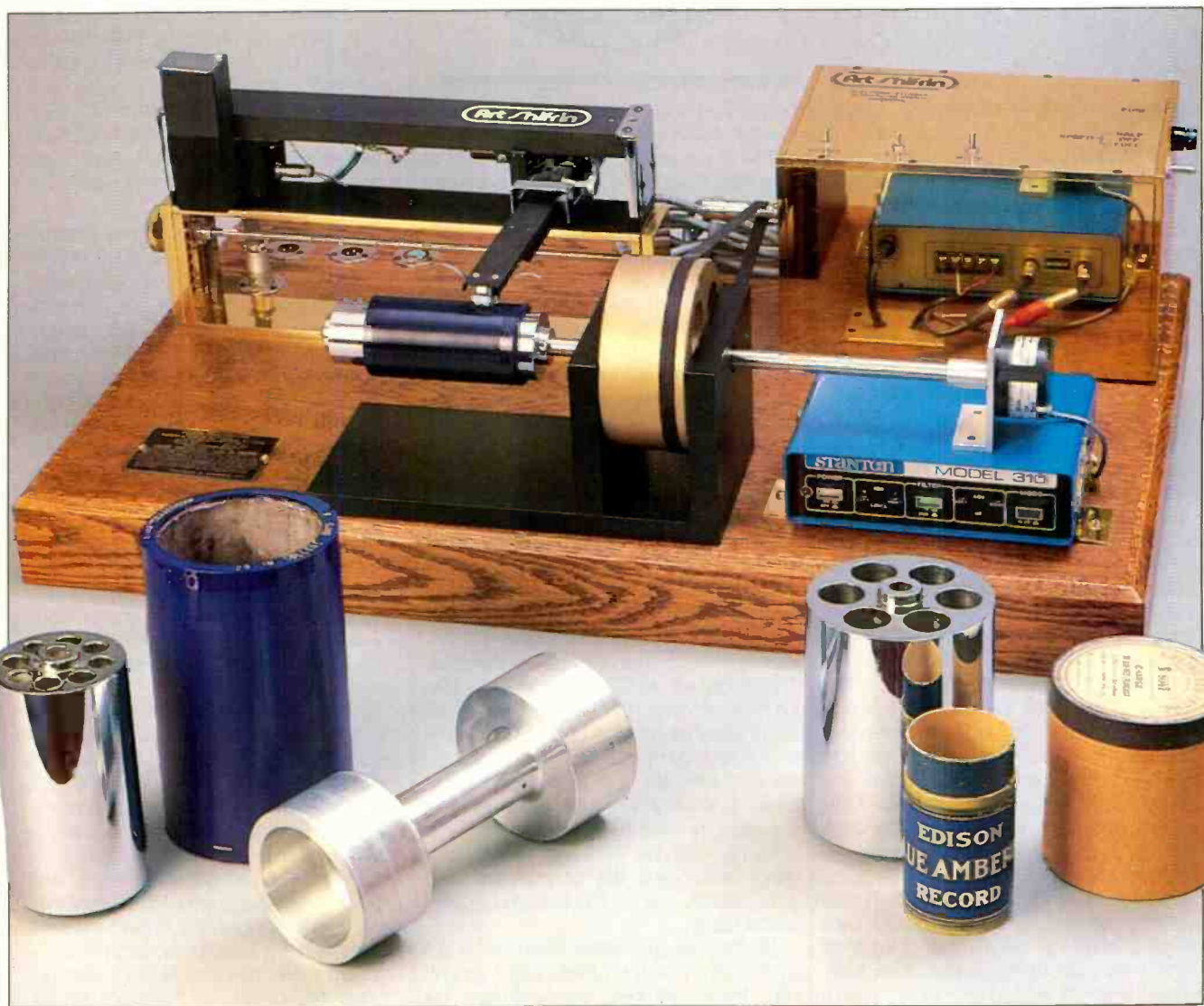
FRED PETRAS

Shown playing a standard wax cylinder (c. 1906), Shifrin's machine uses a variety of changeable mandrels to play standard and non-standard cylinders. In foreground, from left, are a Pathé Salon mandrel, Edison Kinetophone cylinder and mandrel, Concert mandrel, Edison Blue Amberol cylinder tube (c. 1912-1929), and a Salon cylinder tube.

-TECH System



ted methods to play antique cylinders.



Photograph: Robert Lewis

Collectors of early-fi gear are sometimes surprised to find out how sophisticated and good sounding these old recordings were.



es long, of any groove pitch or speed. Drive screws, such as those used in old cylinder phonos, are avoided by this mechanism's design. The arm is modified to accommodate the faster tracking progression needed, since most cylinders have a faster tracking rate than do the LP discs for which the SL8-E was originally designed. Shifrin's unit also features controls for lift, mute, and servo override. The last modification provides an electrical means of riding the stylus past damage-locked grooves.

The motor housing contains the tonearm controls and a heavy-duty hysteresis-synchronous motor. The drive shaft is equipped with a stepped pulley having three diameters, typically for 120-, 144- and 160-rpm speeds. Speeds are manually selected by moving the drive belt to these positions. Shifrin explained that there are many out-of-round cylinders which would ordinarily be considered unplayable because they cause pickups to bounce uncontrollably at normal playing speeds. He has gotten around this problem by using an electrically switched motor which provides half-speed operation for each of the set's standard rpm rates. By tracking the warped recordings at slower speeds, pickup bouncing is eliminated. Tapes of this reproducing procedure are played back at twice the speed at which they were recorded. The half-speed technique also avoids the use of

heavy tracking forces which can harm the old grooves and distort the sound.

The drive assembly is comprised of a precision-ground half-inch-diameter shaft, stanchions, a brass flywheel, and a mandrel. The latter is specially designed to accommodate warped as well as normal cylinders. Access to the mandrel, which revolves on precision ball bearings, is via an open end, so cylinders can be mounted and removed without the impediment of "gates" like those on original Edison players.

Shifrin's system employs a Stanton 310 preamp with any moving-magnet cartridge. Two equalization curves are provided, linear and a modified RIAA roll-off. The latter is generally used for listening applications, while the former is intended for use with additional signal processors.

Options include convertibility for cylinders of other than standard diameter. This requires additional mandrels and an arm elevator mechanism. The standard drive motor can be replaced with a d.c.-servo model for digital speed confirmation and variable speed operation. Specially sized and shaped styli are also available. A cabinet/console housing can be ordered to complement or replace the counter-top version, which has a 2½-inch-thick fine-wood base.

Shifrin recommends that once an optimum stylus for a particular cylinder has been chosen, the cylinder be

promptly taped. He feels that it is prudent to make any further adjustments to the sound from a master tape that has been recorded "flat." "Thus," he explains, "rare recordings won't be jeopardized by repeated playing and handling. This procedure is especially pertinent to wax cylinders, which can be precariously soft or brittle."

Shifrin claims a speed accuracy of 99.8% for his instrument. Its wow and flutter is less than 0.08% for the highest speed, 0.1% for the low speed. It weighs in at around 50 pounds.

When he debuted the first commercial version of his system, Shifrin explained that he had developed it "on the premise that most cylinders were better recorded than most people presume, and certainly better than the caliber of the equipment originally used to play them back. Anyone who has heard such recordings reproduced on my system, with appropriate auxiliary noise-reduction equipment, has been amazed at their clarity and sonic impact."

Shifrin admits that his pricey ensemble does not have "the antique charm of an old external-horn phonograph." But, conversely, he feels early phonographs cannot reproduce old recordings satisfactorily. "Even when functioning optimally, they impart speed fluctuations to the sound. If you tape from their horns through microphones, the mikes pick up unwanted harmonic resonances caused by the horns. Room noises, as well as mechanical sounds made by the phonograph, are also picked up by the mikes and superimposed on the original recorded sounds. The technique of installing a new pickup on an old reproducer does not solve the problem of speed fluctuations. You also need half-speed playing capabilities."

Shifrin also cautions that severe rumble and other sonic disturbances can result from interactions between a modern, sensitive pickup and the old, imprecise, or worn drive mechanisms. "My instrument also has the unique ability to accommodate the multiplicity of diameters, lengths, speeds and groove pitches usually found in cylinders. It is not generally known that the quality of most acoustical recordings—both disc and cylinder types—was finer than the caliber of playback equip-

ment available at the time. My system enables the modern user to extract superior fidelity from cylinders, with less noise and distortion than previously thought possible."

The first production model of the Shifrin Electronic Cylinder System was sold to the Rodgers and Hammerstein Archives of Recorded Sound, New York Public Library at Lincoln Center. It is being used there to transfer a large part of the Archives' collection to tape to preserve irreplaceable historical vocal and musical performances and to make them easily accessible to students and others interested in hearing them. Another of his machines is doing extensive duty at the Swedish Radio Company, in Stockholm, Sweden, optimally processing a "phenomenal" collection of cylinders from the 1890s for preservation on tape. Shifrin's own personal machine has been used in a variety of sonic projects. "The most significant was to reproduce the synchronous film soundtracks recorded by Edison on cylinders [7½ inches long by 4¼ inches in diameter] in 1912 and 1913 called 'Kinetophones,'" he says. Also significant was a project involving home-cut cylinders made by the Mellon family in the mid-1890s. (Andrew Mellon was a noted financier and industrialist, and Secretary of the Treasury from 1921 to 1932.) Says Shifrin, "These cylinders had been kicked around a lot as the family moved here and there. Existing family members wanted to capture the voices of their ancestors and to listen to some of the conversations that had been recorded at various times at family gatherings. Despite the horrendously bad condition of the cylinders, with scratches, cracks, warps and mold-rot, we were able to make them really understandable and to effectively tape them. One of the cylinders contained the sounds of a party at the Mellon home on New Year's Day, 1895." **A**

(Editor's Note: Shifrin's current "hot" interests are the early sound films from Biophon, Kinetophone, Cameraphone, Movietone, Cinephone, Vitaphone, Eugene Lauste, Orlando Kellum, et al. He will appreciate receiving any information or artifacts. We will forward them to him via the magazine: Art Shifrin, c/o Audio, 1515 Broadway, New York, N.Y. 10036.)



Sampler of Sources

If you want to get involved in old phonograph and record collecting, you'll find the pickings fairly substantial, even at this late date. If your discretionary dollars are limited, what you'll need is a lot of time and patience and determination to seek out the hardware and software within the parameters of your budget. If money is no object, you can save a lot of effort in acquiring low-tech "goodies" by merely heading for any one of dozens of sources catering to old phono and record collectors and gratifying your desires on the spot.

Herewith are a very few sources that collectors might find worthy of checking out. (Note: A complete up-to-date list would be impossible, given the ebb and flow of the collector's marketplace.)

Antique Phonograph Monthly (502 East 17th St., Brooklyn, N.Y. 11226). A 16-page magazine containing wide-ranging information on old pho-

nos and records in the form of feature articles, old ad reproductions, book reviews, etc., plus a classified section that lists a variety of goods and services available to collectors. Ten-issue subscription is \$10.

Kastlemusick, Inc. (901 Washington St., Wilmington, Del. 19801). This publisher's most recent directory (1982/1983) contains over 2,500 names and addresses of sources of equipment and records, plus collectors' clubs and associations, among other valuable information. Price, \$12.95 postpaid. Kastlemusick also publishes a monthly bulletin chock full of information of interest to collectors. Sample copy, \$1.00.

Neal's Antiques (23 Waldo Ave., Bloomfield, N.J. 07003). Formerly operated by Al Gerichten, known as the "dean" of Edison phonography, it is now run by his son Neal, who also mans a complete machine shop to make exact replacements of phono parts no longer available. Sells and repairs all types of phonographs, and stocks a selection of records and accessories.

The Antique Phonograph Shop (300 Jericho Turnpike, Floral Park, N.Y. 11001). Carries all makes of phonographs and offers repairs, parts and accessories. Also sells cylinder and disc records.

Charlie Hummel (61 Laurel Dr., Wayne, N.J. 07470, 201/696-3130). Sells and repairs old phonographs and also deals in old records and related phonographia. Shifrin considers him truly expert and completely trustworthy. *F.P.*



1

SOUTHER SLA-3 TONEARM WITH SHURE V15 TYPE V CARTRIDGE

Manufacturer's Specifications Tonearm

Arm Type: Linear, tangential tracking.

Pivot to Stylus Distance: 2 inches.

Maximum Tracking Error: 0°.

Cueing: Vertical and horizontal.

Anti-Skating Adjustment: Not required.

Tracking Force Range: 0.5 to 2.5 grams.

Cartridge Weight Range: 1 to 20 grams.

Vertical Bearing Type: Conical sapphire vee bearings on stainless steel axle.

Lateral Bearing Type: Ball.

Vertical Tracking Angle Adjustment: $\pm 10^\circ$.

Headshell: Integral part of tonearm.

Effective Mass: Variable, 1.68 x to 2.38 x cartridge mass.

Price: \$850.00; additional tonearm tubes, \$30.00.

Company Address: 429 York St., Canton, Mass. 02021.

For literature, circle No. 90

Phono Cartridge

Tracking Force, at Stylus Tip: Optimum, 10 mN (1.0 gram); maximum, 12.5 mN (1.25 grams).

Tracking Force, Total Tonearm Setting with Dynamic Stabilizer: Optimum, 15 mN (1.5 grams); maximum, 17.5 mN (1.75 grams).

Tip Geometry: Hyperelliptical, 5 x 38 microns (0.2 x 1.5 mils), long contact area.

Trackability at 10 mN (1 gram)

Tracking Force: At 400 Hz, 30 cm/S; at 1 kHz, 46 cm/S; at 5 kHz, 80 cm/S; at 10 kHz, 60 cm/S; all figures typical in cm/S peak velocity.

Vertical Tonearm Resonance:

Less than 5-dB rise at 14 Hz in SME Series III arm (without SME damper).

Output Voltage: 3.2 mV rms at 1 kHz at 5 cm/S peak velocity, typical.

Frequency Response: 10 Hz to 28 kHz.

Recommended Load: 47 kilohms in parallel with 250 pF (including tonearm wiring, connecting cables and preamplifier input). Capacitive

loading from 100 to 400 pF will cause negligible change from the recommended 250-pF loading.

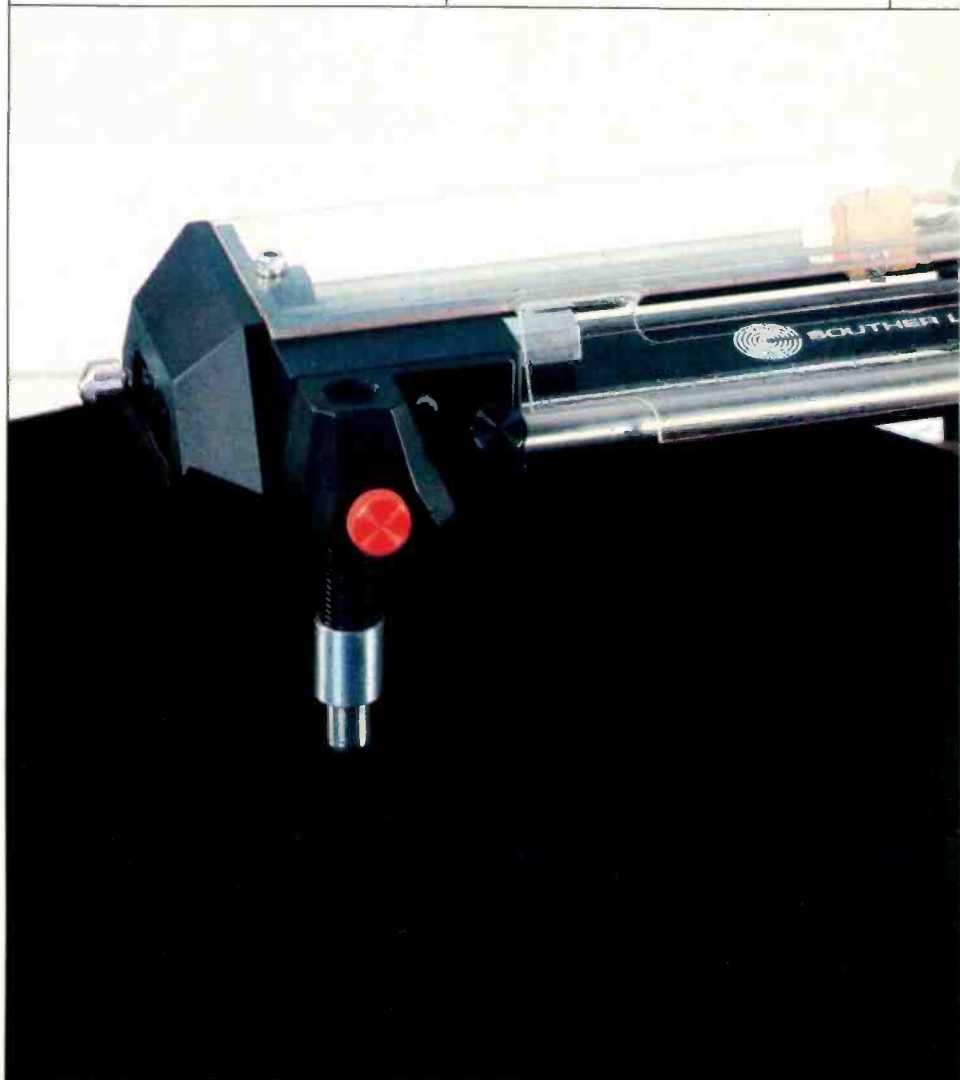
Resistance: 950 ohms d.c., typical.

Inductance: 330 mH at 1 kHz, typical.

Weight: 6.6 grams.

Price: \$220.00; with alignment gauge and Micro-Ridge stylus, \$275.00.

Company Address: 222 Hartrey Ave., Evanston, Ill. 60204.



The SLA-3 is a linear-tracking or tangential tonearm made by Souther Engineering Corp. of Canton, Massachusetts. Most of the currently available linear-tracking tonearms are integral parts of turntables and are often supplied with a phono cartridge installed by the manufacturer. The Souther SLA-3 is one of the very few linear-tracking tonearms which can be purchased separately. It comes without a cartridge and can be mounted on the turntable of your choice.

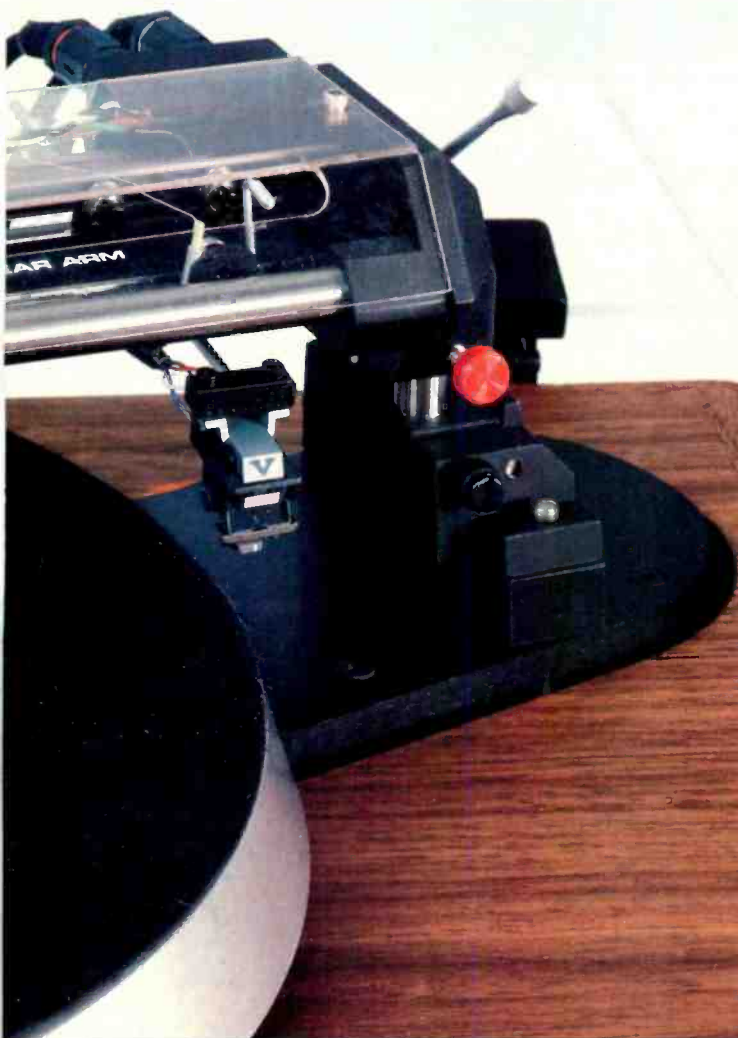
The difference between a linear-tracking tonearm and a pivoted tonearm is the manner in which the cartridge is moved across the record. The more common, pivoted tonearm causes the cartridge to traverse the record in an arc. This means that, if no cartridge offset and overhang were used, the cartridge could be exactly tangent to the record groove at only one spot on the record. The use of offset and overhang, if properly adjusted, allows the cartridge to be exactly tangent at two locations across the record. The reason the cartridge should be tangent to the groove across the entire record is that the cutter heads used to make

records are moved by a precision lathe system in a straight line from the rim toward the center of the record. If cutter heads were moved by a pivoted mechanism, then pivoted tonearms could be made to follow the same arc and would, therefore, trace the groove exactly as it was originally made. If a cartridge doesn't trace the groove exactly as made by the cutter head, distortion results. As it is, it would appear that the linear-tracking or tangential technique is the best way to achieve zero tracking error across the record.

The obvious question is then: Why aren't all tonearms made this way? The answer is too complex to discuss completely in this report, but here is a brief explanation of one of the problems: When the record is being made, the cutter is driven across the record and decides where the groove shall be. When the record is being played, the cartridge must determine where the groove is, and some method must be used to supply the force needed to make the cartridge follow the groove. It sounds simple—until you start to list the imperfections of real records. If they were perfectly concentric, if they had no warps, if the number of grooves per inch were exactly the same for all records, etc.—in other words, if records were perfectly uniform and predictable, then the problems to be solved would be much simpler. As it is, the vast majority of tonearms use the horizontal-pivoting and offset-cartridge technique because, while such tonearms can't be perfect and are hard to design, the problems encountered in designing a linear-tracking tonearm are even greater. Some linear-tracking tonearms use a servo motor to overcome friction and maintain the cartridge tangent to the groove, but they are expensive, and the servo itself can cause problems. Mechanical, non-servo, linear arms were made in the past, however.

Lou Souther decided, in December 1979, to tackle the problems of designing a linear-tracking tonearm. He had spent 26 years with the Department of Defense until he decided to take an early retirement in 1981. He had also worked for manufacturers of radar and communication antenna systems. His experience in the mechanical design of tracking antennas, coupled with his love of audio (his first hi-fi system was assembled in 1953), came together, and he formed Souther Engineering to design and manufacture a high-quality, linear-tracking tonearm. He decided that, if the problem of friction could be overcome, he would not have to use a servo system. This would mean a decided reduction in complexity and, therefore, lower cost and increased reliability. The results of Lou's efforts are embodied in the Souther linear-tracking tonearm and are covered by 24 claims in U.S. Patent No. 4,346,467. In 1982 the Souther tonearm won a Design and Engineering Award at the Consumer Electronics Show. There were earlier versions (the SLA-1 and SLA-2); the tonearm that I tested is the SLA-3.

The intricate detailing of the rigid, polyurethane plastic parts of the SLA-3 was the first thing that I noticed. Most linear-tracking tonearms of the past have not displayed the attention to detailing or finish which Souther has lavished upon the SLA-3. This gave me the immediate impression that the SLA-3 has been carefully engineered and is a serious attempt to overcome the problems that have plagued linear-tracking tonearms of the past. The tiny leads were the next thing I noticed; they are the thinnest, most



Most linear-tracking arms of the past have not displayed the attention to detailing or finish which Souther lavishes on the SLA-3.

flexible that I have ever seen. Because they are so thin and flexible, their contribution to the total friction must be very small. They are reinforced at each end by flexible silicone rubber. The cartridge carrier has three stainless-steel wheels, each with precision bearings, which ride on two round quartz-rod tracks. This serves as the horizontal bearing system. I checked the friction by moving the carrier back and forth along the tracks and it seemed very low, which is a necessity for proper operation of this design. I noticed that, because the cartridge carrier is held on the two tracks by gravity alone, it appears to have more play than might be desirable. I checked the vertical bearings by hand and they had very low friction and no excess play. I counted 12 adjusting screws, not counting those used to mount the cartridge!

The Souther SLA-3 is not difficult to mount to most good turntables. A few turntables, such as the Oracle, may require an adaptor, since the SLA-3 base is rectangular and its longer side is 3½ inches. Adjusting the SLA-3 for proper performance is not an easy task. The instructions which I received were not as clear as I think they should be. A great

deal of adjusting and readjusting was necessary over a long period of time before I was satisfied that the performance was as good as it could be. The listening panel sessions and the technical measurements were repeated a number of times.

It is important that the turntable and the tonearm be close to perfectly level. A bubble level is mounted on the aluminum strip which separates and supports the two quartz-rod tracks. This is used to level the tonearm and turntable after they have been made parallel. The tracking force is adjusted by sliding a counterweight on the thin rod which extends out from the rear of the cartridge-mounting platform. Three counterweights are supplied, to match different cartridge weights. The cartridges that I used weighed about 6 grams, so I used the heaviest counterweight, which was 6.1 grams. The other counterweights supplied are 1.8 and 3.9 grams each. Using the heaviest counterweight possible and keeping it close to the vertical pivot allows the lowest dynamic mass to be achieved. The total weight of the cartridge-mounting platform and the rod is only about 1.25 grams! When a cartridge and counterweight of 6 grams each are

MEASURED DATA

Souther SLA-3 Tonearm		External Lead Length	Supplied by user
Parameter	Measurements/Comments	Structural Resonances	Well damped
Pivot to Stylus	2 in. (5.1 cm)	Base Mounting	3½ in. (8.9 cm) × ¾ in. (1.9 cm) hole plus two screws
Pivot to Rear of Arm	Not applicable		
Height Adjustment Range	2 in. (5.1 cm)		
Tracking Force Adjustment	0 to 3.0 grams		
Tracking Force Calibration	None		
Cartridge Weight Range	2 to 12 grams		
Counterweights	Three (6.1, 3.9 and 1.8 grams)		
Counterweight Mounting	Direct to arm, with thumbscrew		
Sidethrust Correction	Not applicable		
Pivot Damping	None		
Lifting Device	Lever		
Headshell Offset	Not applicable		
Overhang Adjustment	Not applicable		
Bearing Alignment	Very good		
Bearing Friction	Below 40 mg		
Bearing Type	Jewelled vertical and horizontal		
Lead Torque	Very low		
Arm Lead Capacity	Left channel, 65 pF; right channel, 53 pF		
Arm Lead Resistance	3 ohms each channel		
		Shure V15 Type V Cartridge	
		Parameter	Measurements/Comments
		Coil Inductance	355 mH
		Coil Resistance	878 ohms
		Output Voltage	Left, 0.32 mV/cm/S; right, 0.34 mV/cm/S (lateral modulation)
		Tracking Force	1.3 grams without brush, 1.8 grams with brush
		Cartridge Mass	6.6 grams
		Microphony	Very low
		Hum Rejection	Excellent
		High-Frequency Resonance	25 kHz
		Rise-Time	21 μS
		Low-Frequency Resonance	12 Hz
		Low-Frequency Q	1.5
		Recommended Load Resistance	47 kilohms
		Recommended Load Capacitance	250 pF
		Recommended Tracking Force	1.8 grams with brush

A great deal of adjusting and readjusting was needed before I was satisfied that the performance was as good as possible.

added, the total mass is only 13.25 grams, which is extremely low. Calculations supplied by Souther indicate that the effective dynamic mass of the SLA-3, with a cartridge mounted, is only about double the cartridge mass alone! Such low mass will cause the low-frequency resonance produced by the cartridge compliance and tonearm mass to be higher than the desired 10 to 15 Hz for most cartridges, especially low-compliance moving-coil types.

A means is provided to lift the cartridge at the end of a record, by the attraction between the steel cartridge-mounting screws and a small magnet which can be mounted near the end of the track. I did find some recordings which were recorded so close to the label that the magnetic attraction first reduced the tracking force (thus causing distortion) and then lifted the cartridge before the side was finished. This can be eliminated by removing the magnet when playing such long records.

The pivot-to-stylus distance for the SLA-3 is only 2 inches. I checked the SLA-3 for its claimed ability to track warped records, since this is usually a weak point for such a short tonearm. I placed a foam wedge under one side of a record, which caused it to vary in height a little over $\frac{1}{8}$ of an inch each revolution. The SLA-3 tracked the record even when I tapped the side of the turntable base! Of course, the effects of wow could be heard easily. I can't imagine anyone expecting to even be able to play such a badly warped record on most turntables. I also tried off-center records, and the SLA-3 did a decent job on these as well. However, the ability to track high-level passages is reduced alternately in the left and right channels as the stylus is forced back and forth. No stylus force indication is provided, so you will have to use a gauge to set the stylus force. (I use the Arpo 0.5 to 5-gram model to set tracking force, even on tonearms with calibrated adjustments. It is listed in the latest Jensen Tools catalog on page 127 and costs \$74.95.) Since the output cables, which you must supply, plug into the top of the tonearm, they will probably interfere with most turntable covers. For turntables with floating suspension, the cables should be flexible.

Measurements and Listening Tests

As I mentioned earlier, there were a number of listening sessions, and the technical measurements were also repeated a number of times. The listening panel was invaluable in calling attention to subtle details in the sound reproduction, which, by further adjusting the SLA-3, I was able to improve. It is possible that performance might be further improved by additional refinements in the adjustments, but I felt that I had arrived at a point where such improvements would be slight. The Shure V15 Type V cartridge was selected for the main body of the measurement and listening correlations, although other cartridges were also tested in the SLA-3.

Figure 1 shows the amplitude versus frequency response and the interchannel crosstalk of the Shure V15 Type V cartridge in the Souther SLA-3. This is an excellent result, and the listening panel was unanimous in their positive comments about the good stereo effect produced by this combination, which they judged to be as good as the reference system.

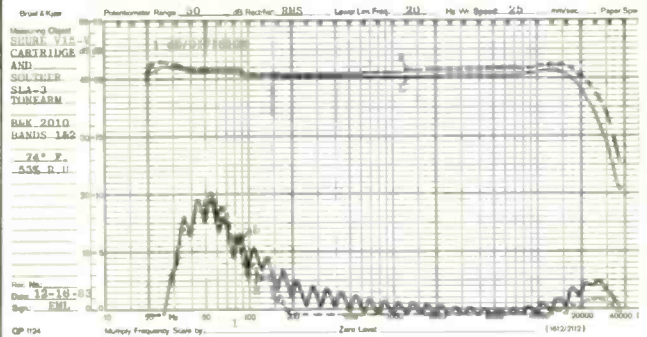


Fig. 1—Frequency response and interchannel crosstalk of

arm and cartridge using B & K 2010 test record.

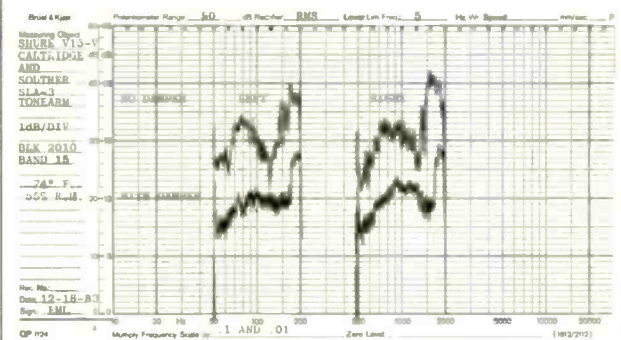


Fig. 2—Low-frequency tonearm/cartridge resonance is at about 18 Hz with a Q of 4. Note the anti-resonance at 12 Hz.

(B & K 2010.) Also note that frequency scale should be multiplied by factors of 0.1 (left) and 0.01 (right).

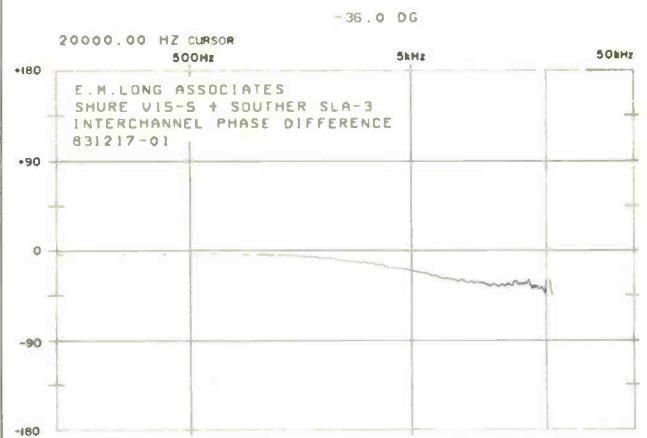


Fig. 3—Interchannel phase of tonearm and cartridge as a function of frequency (B & K 2011,

band 7, pink noise). Maximum phase shift is 36° at 20 kHz, equivalent to $5 \mu\text{s}$.

The Souther/Shure combination will track even the highest level band of the B & K 2010, if the disc is well centered.

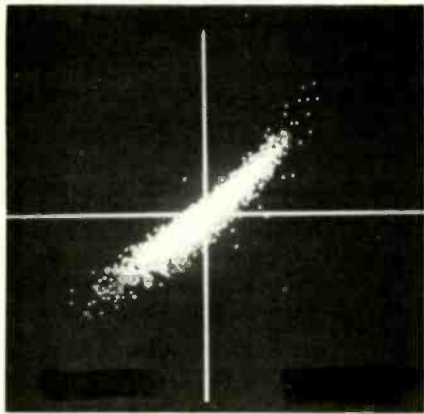


Fig. 4—
Interchannel
phase of arm
and cartridge,
left vs. right
channel
(B & K 2011,
band 7,
pink noise).

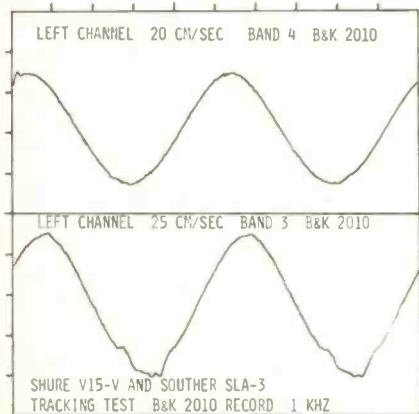


Fig. 5—
Tracking of arm
and cartridge at
1 kHz for 20-
and 25-cm/S
lateral modulation
(B & K 2010);
total tracking
force of 1.8
grams including
brush. Note the
remarkable
tracking on the
lower waveform,
the highest
level on the disc.

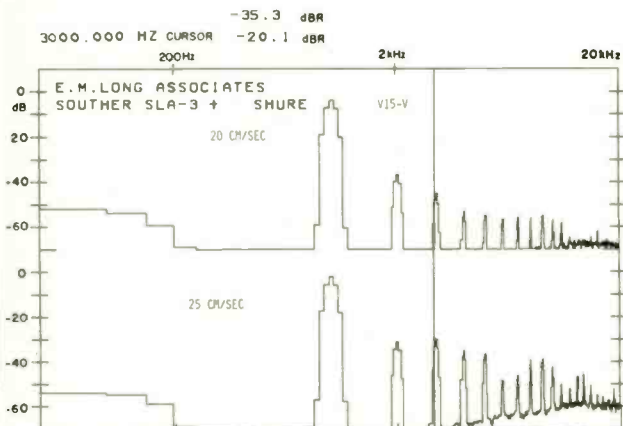


Fig. 6—Spectral
components caused
by slight mistracking
of 1-kHz
signals shown in Fig. 5.
Level of third harmonic

(3 kHz) is 1.8% at 20 cm/S and 10% even at 25 cm/S—which some arm/cartridge combinations cannot even track.

Figure 2 shows the low-frequency response of the Souther/Shure combination, from 5 to 20 Hz. Usually the combination of tonearm mass and cartridge compliance resonates somewhere in this frequency range, which causes a rise in the response. Both the left and right channels are shown; the upper curves are without the Shure V15 Type V's damper, and the bottom curves are with the damper. The low-frequency resonance appears to be about 17 to 18 Hz, with a Q of 4. An anti-resonance at 12 Hz is present without the damper. The listening panel's comments concerning the bass reproduction were very interesting in that some panel members felt that the Souther/Shure combination had less bass than the reference system, while others commented that the bass sounded "tighter and more solid." The present reference system does have a slight rise at about 12 Hz with a Q of about 3. All listening was done with the damper in place, since I found that it also helped to damp out the arm's slight horizontal bearing instability.

The interchannel phase difference is shown in Fig. 3, and I suspect, from this and other measurements, that the interchannel phase difference caused by the original cutting system may possibly account for most of this. A phase difference of 36° at 20 kHz is equivalent to a time difference of only $5 \mu\text{s}$, which should be insignificant. Figure 4 is a photo taken from the display of the Nicolet Explorer III digital storage oscilloscope and shows the left versus right channel output over a period of time. If there were no difference between the channels, the display would show a straight line of dots at a 45° angle. As it is, the small amount of spread indicates excellent performance for the Souther/Shure combination. Certain records produced very stable images, as some members of the panel commented.

The tracking ability of the Souther/Shure combination is very good, with one reservation: The centering of the record is very important. This is true for all tonearm/cartridge combinations, but the Souther/Shure combination will track even the highest-level, 25-cm/S band of the B & K 2010 test record, if it is perfectly centered. Most other tonearm/cartridge combinations have difficulty tracking this band. Figure 5 shows the 1-kHz waveform produced by the left channel of the Souther/Shure combination for the 20- and 25-cm/S bands of the B & K 2010. I caused the record to be slightly off-center to show how it effects the tracking. The distortion varies for each rotation of the record as the tracking force against each groove wall changes. While the photo can only show one instant in time, the shape of the waveform, and therefore the amount of distortion, is actually varying, and I captured the signal when it looked and sounded its worst. The upper trace for the 20-cm/S band is very good and the distortion products are quite low for this high level of groove modulation. Figure 6 shows the spectrum of the distortion as sampled over a period of time. The cursor is at the third harmonic, and the distortion is about 1.8% and 10% for the 20- and 25-cm/S levels respectively. The eighth, ninth, and tenth harmonics are seen to stand out, which could partly account for comments made regarding a mild brightness heard during the listening sessions. The Souther/Shure combination also shows a slightly rising response with increasing frequency, so it is difficult to pinpoint the cause. I think that each effect plays a part.

While the SLA-3 does not solve all the problems of linear-tracking tonearm design, it is the best of its type I have seen.

The Souther/Shure combination gave the best results I have seen to date for the 10.8-kHz tone burst of the Shure TTR-103 test record, which is appropriate enough! Figure 7 shows the waveform of the 10.8-kHz signal for the 15- and 30-cm/S bands of this record. There is no compression evident, even at the 30-cm/S level, which is excellent. Figure 8 shows the spectrum of the distortion components for these levels of modulation. The distortion components are about -50 dB (0.3%) for the 15-cm/S level and about -40 dB (1%) for 30 cm/S, which I consider to be very good. There is an increase in distortion components in the middle register for the 30-cm/S level, which could also have been a cause of some panel members' comments about brightness during high-level passages. A better explanation for these comments might be that these high levels are being compressed less by the Souther/Shure combination than by the reference system.

Figure 9 shows the left- and right-channel responses to the 1-kHz square wave of the CBS STR-112 test record. If you compare this to other square-wave results that I have shown in past reports, I think you will agree that, although the waveform produced by the Souther/Shure combination is not perfect, it is one of the best. I noticed also that both the amplitude versus frequency response, shown in Fig. 1, and the square-wave response indicate that the "sway-back" or depressed upper-midrange response, usually associated with moving-magnet cartridge designs, has been eliminated by Shure in the V15 Type V.

Conclusions

As mentioned above, I tested the Souther SLA-3 with other cartridges besides the Shure V15 Type V, including a lower-compliance, moving-coil type. Performance with the moving-coil cartridge was also good, albeit with different emphasis, being better in some areas and worse in others. The trade-off might be summarized as being between a very subtle delicacy in the sound of low-level passages and material like string quartets with a moving-coil type versus the ability to sound very clear and open, even at the highest levels, for the Shure V15 Type V. The usually lower compliance of moving-coil cartridges means that you will have to choose carefully to get good performance. The damping of mechanical energy from the cartridge is very good with the Shure V15 Type V but could be a problem with other cartridges, depending upon materials and construction. The effects of any reflected energy will also change as the position of the horizontal bearing changes as it moves across the record, so it is important to eliminate this energy as close to the cartridge as possible. The damping brush of the Shure V15 Type V is also a very large factor in the level of performance that I was able to achieve, and, of course, other cartridges don't have this.

The Souther SLA-3 is capable of excellent performance; however, making it produce these results will require a good deal of patient adjusting and readjusting by the user. Even without knowing all of the economic factors involved, I would say that the price of the Souther SLA-3 makes it a reasonable value. Lou Souther may not have overcome all of the problems of linear-tracking tonearm design, but the SLA-3 is the best of its type that I have seen. *Edward M. Long*

Fig. 7— Arm/cartridge output at 15 and 30 cm/S, 10.8-kHz pulse test. The jaggedness of the waveform is due to the digital storage oscilloscope.

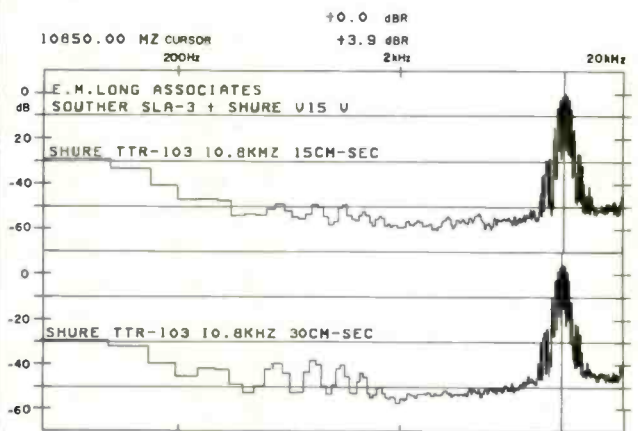
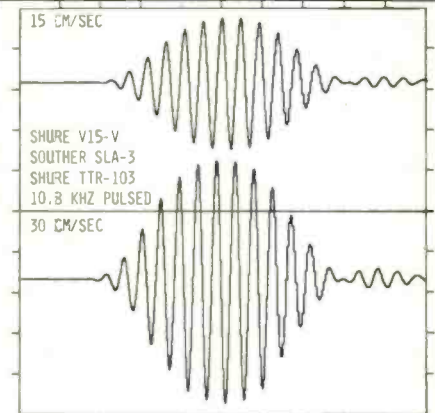
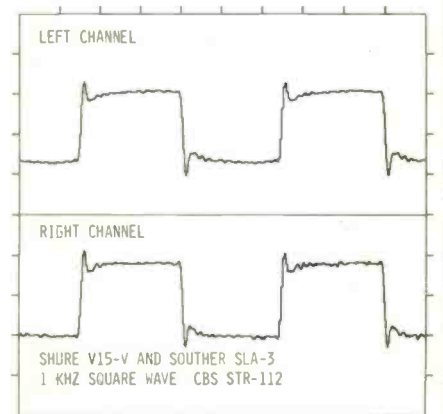


Fig. 8—Spectrum of distortion products for 15- and 30-cm/S signals shown in Fig. 7. Frequencies

above 200 Hz are at least 40 dB down for the 30-cm/S level, which is excellent.

Fig. 9— Arm/cartridge output for 1-kHz square wave (CBS STR-112).



2

HITACHI DA-800
COMPACT DISC
PLAYER**Manufacturer's Specifications****Frequency Response:** 5 Hz to 20 kHz, ± 0.5 dB.**S/N Ratio:** 95 dB.**Dynamic Range:** 95 dB.**Separation:** 94 dB at 1 kHz.**Harmonic Distortion:** 0.003% at 1 kHz.**Output Level:** 2.5 V.**Number of Programmable Selections:** 15.**Power Consumption:** 23 watts.**Dimensions:** 17 $\frac{1}{8}$ in. (43.5 cm) W x 4-5/16 in. (11 cm) H x 10 $\frac{5}{8}$ in. (26.4 cm) D.**Weight:** 13 lbs. (5.9 kg).**Price:** \$1,000.00.**Company Address:** 401 West Artesia Blvd., Compton, Cal. 90220.
For literature, circle No. 91

Let me begin by stating in no uncertain terms that the DA-800 is vastly superior in its performance and features to the first-generation CD player, the DA-1000, offered by Hitachi more than a year ago. The earlier model, one of the first players I tested, proved to be so erratic that I had to ask for a second sample to obtain satisfactory readings and reliable performance. Clearly, Hitachi has learned a great deal about CD players since that first attempt. The DA-800, selling for no more than the earlier model, is a completely redesigned and reconfigured machine which performed perfectly during all my bench and listening tests. Furthermore, its special features, and the ease with which even a novice can make it perform all of its various functions, make it a CD player well worth considering.

The DA-800 allows you to select disc tracks you wish to hear and to play them in any random order. You can, of

course, also begin play at any track number or even at a specific index point within a program track, if the particular disc is divided into indexed sections. Repeat play of a track, the entire disc, or even a given portion or musical phrase is easily accomplished. Up to 15 tracks can be pre-programmed for random sequence playing, and access time from track to track is extremely fast, usually no more than 2 or 3 seconds.

Control Layout

The front panel is finished in black. Discs are loaded into a motorized sliding drawer which opens smoothly when the "Open/Close" button is touched. A power button is located at the lower left of the unit, below the disc drawer. A display area to the right of the drawer indicates the number of tracks contained on a disc and its total playing time, after the disc

has been inserted in the drawer and a brief scan of the contents has taken place. During play, the display shows track and index numbers, as well as time from the beginning of a track. Touch buttons below this display are "FB" (fast reverse), "Play," "FF" (fast forward), "Pause," and "Stop/Clear." If either of the fast-motion buttons is depressed along with "Play," the laser pickup moves either to the next track or to the beginning of the track currently being played. If either fast-motion button is pressed by itself, accelerated laser-pickup scanning of the disc (in jumps of about 8 to 10 seconds worth of playing time) occurs.

To the right of the track and time displays is a display which tells the status of repeat-play functions. By touching the "Repeat" button below this display, you mark the beginning of a musical phrase you want repeated. Touching the "Repeat" button a second time marks the end of the phrase to be repeated, and repeat-play starts. It will continue until you touch the "Repeat" button a third time, thereby canceling the preceding commands. "Repeat" is flanked by a "Program" button (to enter your track and index selections during programming) and by a "Call" button which allows you to review your programming sequence by calling up the selected track and index numbers in the main display. Ten small square buttons numbered from 0 to 9 are arranged in a horizontal row below the "Program," "Repeat" and "Call" buttons and are used to punch in desired program numbers. A stereo headphone jack and an output-level control are located at the extreme right end of the front panel. The output-level control alters signal levels at main output jacks as well as at the headphone output.

In addition to the usual left and right output jacks found on the rear panel, there is a slide switch labelled "Anti-Shock." The owner's manual explains that this switch should be placed in the on position when the player is located where it may be subjected to large amounts of vibration. The manual points out, however, that when this switch is on, sound "skipping" or muting may occur more frequently if a scratched or damaged disc is played.

Measurements

Figure 1 is a plot of frequency response for both channels of the Hitachi DA-800 player. At 20 kHz, left-channel output was down by 0.3 dB, while right-channel output remained absolutely flat. This minor difference in response is probably attributable to tolerance variations in the analog low-pass filters which follow digital-to-analog conversion.

Figure 2 shows three plots of harmonic distortion versus frequency, at levels corresponding to maximum output (0 dB), -24 dB below maximum, and -30 dB below maximum. THD for maximum output, at mid-frequencies, was 0.0035%, rising to a still insignificant 0.013% at 20 kHz and 0.0045% at 41 Hz, the lowest frequency available for checking THD on my Philips test disc. SMPTE-IM distortion measured 0.003% at maximum output level, rising to 0.025% at a -20 dB output level.

Output linearity was accurate to within 0.2 dB from maximum output level all the way down to -80 dB. Below that point, my instrumentation is not accurate enough to verify precise linearity discrepancies, if any did indeed exist. Signal-to-noise ratio measured 96 dB, unweighted, increasing

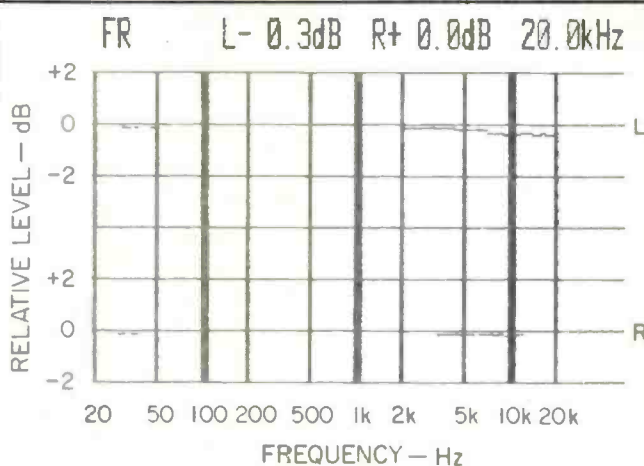


Fig. 1—Frequency response, left (top) and right channels, at 0-dB level.

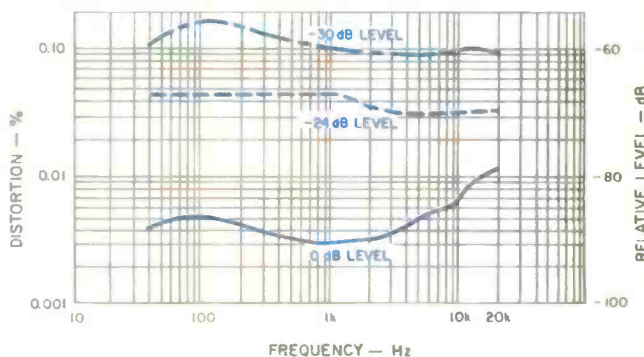


Fig. 2—THD vs. frequency at levels of (from top to bottom) -30, -24, and 0 dB.

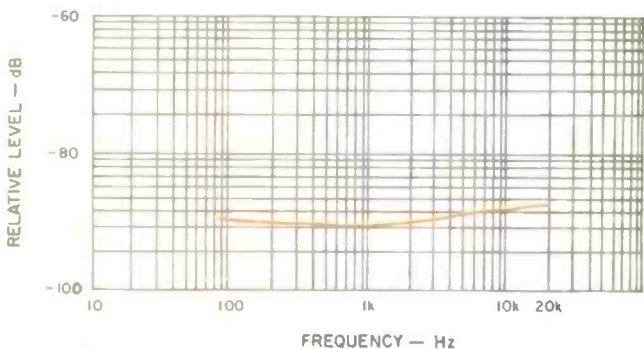


Fig. 3—Separation vs. frequency (both channels identical).

The New York Times

Reviews the New Ohm Walsh 4

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NEW YORK, SUNDAY, JANUARY 29, 1984

SOUND

HANS FANTEL

Another classic reappearing in new guise is the radically unconventional loudspeaker designed about a decade back by the late Lincoln Walsh, a California physicist who had done pioneering work in sound reproduction. His patents were acquired by Ohm Acoustics Corporation of Brooklyn, N.Y., resulting in the Ohm Walsh 2 loudspeaker, which at \$750 per pair remains one of the best buys among omnidirectional models.

In its effort to make a speaker affordable for the majority of listeners, Ohm had stopped short of producing what might be called the ultimate design based on the Walsh principle. It has now at last gone all the way with the new Ohm Walsh 4, which boasts all the notable virtues of the earlier model but extends the bass to 32 Hertz. This allows it to conjure up with almost tactile impact the deep shudder of a low C played on an organ pedal or the wallop of a bass drum. With a stupendous power capacity of 500 watts, the Ohm Walsh 4 accommodates with apparent ease even the most hair-raising sonic peaks contained on the new laser disks. It is doubtful whether such generous power limits will ever be reached in normal listening. The point is that full concert volume can be reached comfortably by this speaker even in the most spacious setting, assuming of course that it is driven by a sufficiently strong-muscled amplifier.

The basic notion of Lincoln Walsh utilized in this design involved an upright, pyramidal cone open to all sides that radiates sound in all directions and upward toward the ceiling. As is the case with other omnidirectional speakers, this creates a remarkably open and spacious sound. At the same time, the unique pattern of wave propagation along the surface of the cone maintains crucial phase relationships throughout the audible spectrum, accounting for the remarkable clarity of sound. Thanks to an auxiliary directional tweeter, very precise stereo imaging is obtained despite the omnidirectional sound spread. In effect, this speaker reconciles the usually contradictory aspects of frontal radiation and omnidirectional sound, yielding an uncommon degree of musical truthfulness. And the price of \$1,500 per pair might not deter listeners who recognize a classic."



"The Ohm Walsh 4 accommodates with apparent ease even the most hair-raising sonic peaks contained on the new laser disks."

MANUFACTURERS SPECIFICATIONS

	Ohm Walsh 2	Ohm Walsh 4
Frequency Response	45Hz to 16kHz ± 4dB	32Hz to 17kHz ± 4dB
Size	32½" tall x 9¼" x 9¼" at top, 11½" x 11½" at bottom	40" tall x 12½" x 12½" at top, 15½" x 15½" at bottom
Weight	29 lbs.	63 lbs.
Sensitivity	87dB at 1 meter with a 2.83 volt input and all controls at maximum	87dB at 1 meter with a 2.83 volt input and all controls at maximum
Finish	Genuine wood veneer, walnut and oak standard. Scandinavian rosewood and black or white lacquer on oak finishes available on special order.	Genuine wood veneer, walnut and oak standard. Scandinavian rosewood and black or white lacquer on oak finishes available on special order.
Inputs	Press connectors accepting "banana plugs" or bare wire up to 12 gauge	Press connectors accepting "banana plugs" or bare wire up to 12 gauge
Controls	2 — low and high frequency each with 3 positions	3 — low, high and perspective each with 3 positions
Power requirement on Music	30 watts minimum/150 watts maximum	50 watts minimum/500 watts maximum
Impedance	4 ohms	8 ohms
Price per Pair	Under \$995 Depending on finish	Under \$1895 Depending on finish

To get details on buying directly from Ohm, call today toll free.
800-221-6984
Or write,
Ohm Acoustics Corp.
241 Taaffe Place, Brooklyn, New York 11205

We make loudspeakers correctly.

Clearly, Hitachi has learned a great deal about CD players. This model performed perfectly, with features even a novice can use.

to 102 dB when an A-weighting network was introduced in the measurement path.

Channel separation, plotted in Fig. 3, measured 90 dB at mid-frequencies, decreasing to 87.5 dB at the high end of the spectrum. Separation was identical whether measured from left to right channel or in the reverse direction.

Examination of a reproduced 1-kHz square wave (Fig. 4) reveals that the Hitachi DA-800 CD player uses post-D/A, sharp cutoff filtering similar to that employed by Sony (and several other manufacturers), as opposed to the digital filtering and oversampling techniques used by Philips (and several other makers of CD players). The appearance of the recovered unit-pulse signal (Fig. 5) confirms that this circuit approach has been used. As has been true with all CD players that employ this filtering technique, some phase nonlinearity can be seen in the reproduced two-tone test signal shown in Fig. 6. Ideally, the lower frequency sine-wave signal (2 kHz) should cross the zero axis in a positive-going direction at the same instant of time that the higher frequency signal (20 kHz) crosses the zero axis in a positive direction. As you can see from examining Fig. 5, that is not quite the case for the Hitachi player. The error seems very minor at first—almost unmeasurable in terms of microseconds of time delay. Most of the players that utilize multi-pole, brick-wall analog filtering show greater phase errors on this test. But, as I have come to realize since making my tests for this report, this "improvement" may be an illusion, and the actual phase error could well be closer to some multiple of 360° than it apparently is to 0°.

The Philips test disc containing musical selections and simulated scratches, dust specks, and fingerprint smudges was used to evaluate error-correction capabilities of the DA-800. In contrast to the poor tracking characteristics of the earlier Hitachi model checked a year ago, the DA-800 exhibited one of the best error-correction systems I have tested to date. Quite simply, the player was able to "track" all levels of the impairments deliberately applied to this disc: It was able to successfully correct missing data up to 900 microns wide in the case of the simulated scratch and up to 700 microns wide in the case of simulated dirt or dust particles on the surface of the test disc. No difficulty was encountered in playing through the simulated fingerprint smudge, either.

Use and Listening Tests

The Hitachi DA-800 has been performing perfectly in my lab for the past month. All of its operating features, including the various programming features, are easy to implement and work well. I have always favored the drawer-loading approach to disc insertion, if only for the reason that you can grasp the disc by its edges, never touching any portion of its surface. That's sometimes impossible to do with the swing-out or swing-down door system used on some other players.

Another feature of this player that particularly appeals to me is the front-panel level control. Only a few players I have tested have any sort of output-level control, and those are usually found on the rear panel, making them all but inaccessible if the player is installed in a shelf or cabinet. I find (and you will too) that voltage levels delivered by CD play-

Fig. 4—
Response to
1-kHz
square wave.

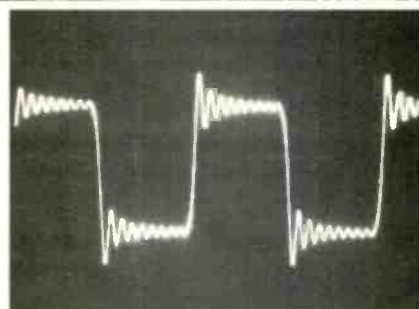


Fig. 5—
Single-pulse
reproduction.

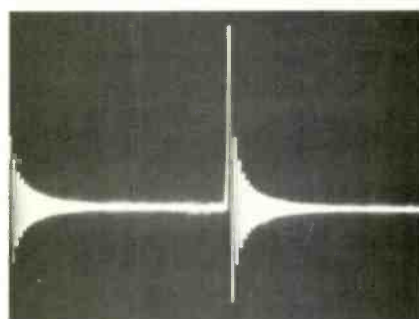
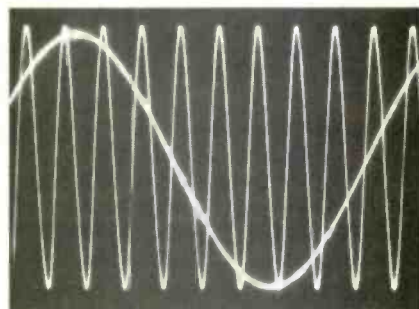


Fig. 6—
Two-tone phase
check
(2 kHz left,
20 kHz right).



ers are well above those normally produced by tuners, tape decks, or phono cartridges (after preamplification). Without a level control, this means that when you switch from one of these other program sources to CD, you have to reach for your amplifier's master gain control. Usually, that control ends up at so low a setting that it is difficult to get fine gradations of volume-level adjustment. With a handy, front-panel output-level control, such as the DA-800's, you can set up output level so that loudness levels remain the same when you switch back and forth between CDs and other program sources.

The best aspect of this newest Hitachi CD entry was its sound quality. Here is a CD player that uses filtration which some critics claim "must" sound brittle and strident, and yet I heard no such sound. Rather, playing some of my most recently acquired discs, I was totally delighted with the sound quality delivered by the DA-800. I could listen to it for hours on end, thoroughly immersed in the music and completely oblivious of any of the so-called defects that some claim are inherent in the CD system. As far as I am concerned, Hitachi has come up with a real winner of a CD player this time.

Leonard Feldman

3

ALLSOP 3 CASSETTE DECK CLEANING SYSTEM

Price: \$9.95.

Company Address: P.O. Box 23,
Bellingham, Wash. 98227.
For literature, circle No. 92

Most cassette deck users are well aware of the need for regular cleaning along the tape path to maintain the

recorder's best performance. I suspect that many are as reluctant as I am to do the job regularly. The Allsop 3 cassette deck cleaner, contained within a cassette shell made for drop-in-and-play cleaning, should appeal to them.

Each of the Allsop's hubs has an external gear which mates with a second gear which, in turn, drives a cam to which is attached a springy arm with a felt pad at its end. When either hub is driven, in either direction of play, the pad is driven back and forth across the head(s) in the cassette shell's center opening.

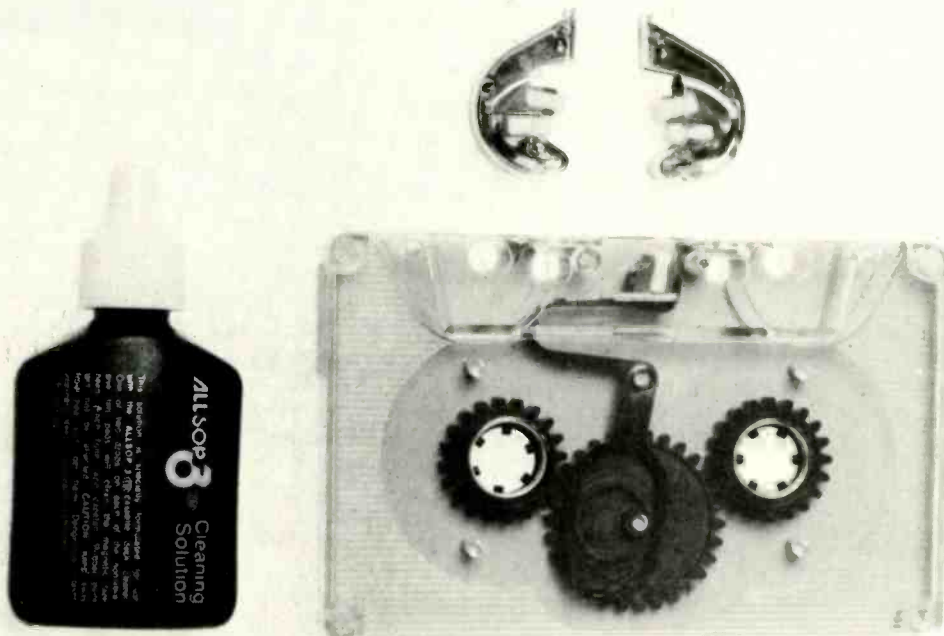
The Allsop 3 shell also holds two snap-in cartridges, each with two felt pads which are positioned to clean the capstans and associated pinch rollers. The arrangement can be matched to single-capstan decks (by snapping in only one cartridge) and dual-capstan decks with auto reverse. But for some single-direction, dual-capstan decks, the left pinch-roller felt is in the wrong position. On such decks, a tape guide would prevent the felt from cleaning the second pinch roller (though it would still clean the second capstan).

A bottle of cleaning solution is also included, and just one or two drops are applied to each felt, as needed, for cleaning. Thus, in play mode, the head structure is wiped by the oscillating felt

at the same time that the two felts in the cartridge are bearing against the rotating capstan and roller. The felt against the roller is also on a springy arm, ensuring contact with any size roller.

With most decks tried, the Allsop 3 worked very well in removing even small deposits. I liked the felt-pad approach for capstan-and-roller cleaning, as cotton swabs can have fibers pulled off, particularly in play. With one very dirty head, two little ridges were deposited at the end of pad travel, an undesirable result. My conclusion is that the Allsop 3 is certainly best used regularly to forestall such a result—and to maintain good performance in any event. The Allsop 3 was especially attractive as the means to clean car units which give substantially no access to the tape head.

The brief instructions tell what to do, including the replacement of center felts and cartridges, and being able to do that is a definite plus for the device. Instructions on cleaning the felts would be a welcome addition. Other tape-head cleaners can be used on the felts, but only a couple of drops are in order, whatever choice is made. The Allsop 3 I evaluated came in a blister pack, but there is another model, at higher cost, which includes a handy carrying case. *Howard A. Roberson*



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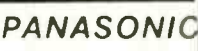
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4

DISCWASHER D'MAG CASSETTE DECK DEMAGNETIZER

Manufacturer's Specifications

Form: In cassette shell.

Power Required: None.

Demagnetization: By permanent magnets.

Price: \$19.95.

Company Address: P.O. Box 6021,
Columbia, Mo. 65205.

For literature, circle No. 93

At first glance, Discwasher's D'Mag is both interesting and puzzling. Certainly, it is handy to have a cassette deck demagnetizer in the form of a cassette, but the use of permanent magnets seemed wrong. Therefore, I removed the five shell screws carefully and lifted off the A side.

Resting on the B side were the two hubs, grooved on the outer diameter for a connecting rubber drive belt. Resting against the outer edge was a round, flat, plastic container with small pinions on each face. The container was translucent enough to show a magnet structure with six outer poles. The pinions were made to run within matching tracks in the A and B sides. Teeth on the outer edge of the tracks made the magnet container spin at the same time that it was propelled along the track by the drive belt. The track is a large oval around the hubs, making the spinning magnets pass close to the locations for heads and capstans. The track is not a complete oval, for there is a break at the back of the shell. At the very end of the grooves, there are no

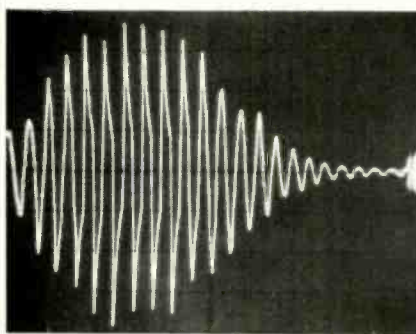


Fig. 1—Output of D'Mag obtained from Nakamichi 582 deck in fast-wind/cue mode. Horizontal scale: 0.2 S/division; vertical, 0.5 V/division.

teeth along the track edge, which prevents possible damage to pinion or track teeth at the end of the normal use cycle. That consists of inserting D'Mag, fast winding for 5 S, and then rewinding for the same length of time. Basically, that is the time required to spin the magnet assembly from one end to the other at normal winding speeds. From this examination of the internal mechanism, we can understand how D'Mag can use permanent magnets to generate an alternating flux for demagnetization.

Travel along the track also provides the desirable characteristic of decaying flux at the end of the process. Figure 1 shows the output voltage from a Nakamichi 582 deck with the use of D'Mag for a 2-S period after sweep triggering, with the deck in "Cue" to increase the magnetic coupling from

the rotating magnets to the heads. The alternating nature and the smooth decay of the waveform are obvious.

The playback head and the capstan shaft of an Aiwa AD-M700 deck were magnetized using a permanent magnet. D'Mag reduced the magnetization to satisfactory levels for both the head and the capstan, actually matching one battery-powered hand-held unit. D'Mag was definitely better than a battery-powered, in-cassette unit for reducing play-head demagnetization, and the battery-powered demagnetizer had absolutely no detectable effect on the capstan magnetization. After a few uses of D'Mag, it was easy to tell when the whirling magnets had completed their trip along the track. I concluded it was important to make certain that winding times were sufficient to get from one end position to the other, to be ready for the next use. A change in the character of the sound indicated when that had occurred and that winding should be stopped.

For difficult demagnetization, a heavy-duty a.c.-operated unit is required. For day-in, day-out use by most audiophiles, the Discwasher D'Mag will be quite sufficient for demagnetizing the entire tape path, which other in-cassette units cannot do. D'Mag is recommended in particular for car stereo recorder/players where access is close to nonexistent. The Discwasher device comes with a shielded storage clip which could prevent inadvertent erasures and perhaps help to keep the magnets at full strength. *Howard A. Roberson*



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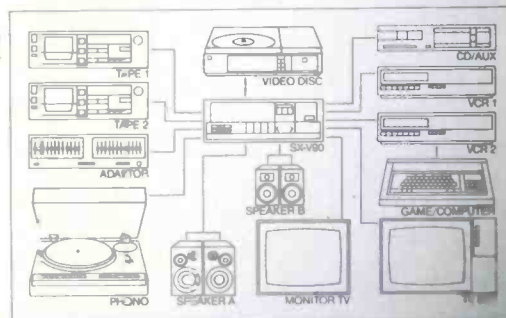
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5

TEAC Z-7000 CASSETTE DECK

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz; to 21 kHz with CrO₂ tape; to 22 kHz with metal tape.

Signal/Noise Ratio: At 1 kHz, 82 dB with Dolby C NR; 92 dB with dbx NR.

Input Sensitivity: Mike, 0.25 mV; line, 60 mV.

Output Level: Line, 300 mV; head-
phone, 100 mW at 8 ohms.

Flutter: 0.019% wtd. rms.

Fast-Forward and Rewind Times: 80 S with C-60 cassette.

Dimensions: 17 in. (432 mm) W x 6-7/16 in. (163 mm) H x 17-13/16 in. (437 mm) D.

Weight: 39.4 lbs. (17.9 kg).

Price: \$1,800.00.

Company Address: 7733 Telegraph Rd., Montebello, Cal. 90640.
For literature, circle No. 94



Teac calls the Z-7000 a "master cassette deck," and its size alone is impressive. Hefting its 40 pounds and contemplating all its front-panel buttons is certain to give pause to many.

As the button count implies, the deck is full of features: Three types of noise reduction (Dolby B and C and dbx), pitch control in recording and in playback, automatic fade-in and fade-out, a real-time tape counter, and automatic tape-parameter setting with a degree of manual override, to name just some of the less usual ones. As with many units full of microprocessor-controlled functions, a period of familiarization is in order, to give the user confidence and to ensure that all of the features are used as much as possible.

The center of the front panel is dominated by the cassette compartment on the left and the meter/display panel on the right. The controls are in three main areas, in a "U" surrounding these dominant features.

The cassette compartment has a carrier which moves out and tilts down for tape ejection. Loading and unloading are easy and smooth, and maintenance access is good, especially so with the clear door cover snapped off.

The main operating controls lie horizontally, slightly recessed below the tape well and display. Logically, the transport controls are just below the transport, with "Record," "Rec Mute" and "Pause" just to their right, all equipped with indicator LEDs (green for playback functions, red for the three record ones). The Z-7000's "Rec Mute" is unusual in that the period of time before the transport goes into pause mode can be set for anywhere from 2 to 10 S by using the "Auto Space" control at the upper left. Even longer mute times can be obtained by holding down "Play" while pushing "Rec Mute," then releasing "Play" at the end of the desired mute time.

Pots next to "Auto Space" control "Fade In" and "Fade Out" times, which can be independently set anywhere from 0 (normal on/off recording) to 10 S for the change between full level and off. Fading in will occur at any time that recording is started, but a fade-out requires the use of "Rec Mute." Automatic fading is a nice feature to have, particularly as record level-set controls do not have to be changed. All three pots have small-diameter, spring-loaded knobs which lock in flush with the front panel but remain operative even when pushed in.

Below the three knobs are three rows of four pushbuttons with status LEDs, plus one row of three buttons without. The top row is for monitor selection: "Source," "Cal," "Tape" and "Sync." "Cal" is the normal mode for most three-head decks where the playback level shown on the meters is *not* affected by the setting of the output-level pot. In "Tape" mode, the level on the meters does vary with the setting of the output-level control, possibly useful where level matching is needed. The "Sync" position has automatic switching, so that the meters display input levels when the transport is stopped (including record/pause) or in a wind mode and show playback level when the deck is in play or record/play mode. This feature would be a great convenience when doing a lot of copying or editing of short selections.

The four buttons in the second row are for noise-reduction control: "Out," "dbx," "Dolby B" and "Dolby C." Annunciators in the meter/display panel remind the user what has

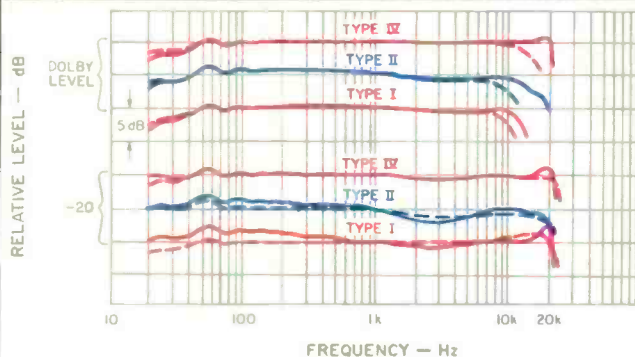


Fig. 1—Swept-frequency responses with (solid line) and without (dashed line) Dolby C NR, at Dolby level and -20 dB for Maxell MX (Type IV), UD-XL II (Type II) and UD-XL I (Type I) tapes.

been selected, a real need for any serious user. The third row is primarily for input selection: "Line," "Mic" and "dbx disc," plus the "MPX Fil" switch for use with the Dolby modes to reject above-band energy, such as from FM pilot tones. The remaining three buttons control the timer "Out," "Play" and "Rec" functions.

The "Power" and "Eject" buttons are recessed below the above panel. The "Power" switch has a nice, orange designation, but it is push-on/push-off and too close to the "Eject" button, in my view. Below is the headphone jack with its own level control, always a nice feature. Next to it is a similar push-in/push-out "Pitch Cont," which must be latched in to be off. When the knob is out, tape speed is controlled ($\pm 10\%$) both in play *and* record modes. The range is very good, being about a full tone in either direction, but because there is no center detent in the out/operating position, I would have liked a "Speed Off" annunciator on the display.

The peak-responding meter display is very bright and easy to read under any lighting conditions. There are 30 segments in each channel, blue-white from "-40" to "-1" and orange from "0" to "+10." In addition, there are 1-dB steps from "-10" to "+10," which provides outstanding resolution in this important level range. In normal mode, the topmost segment is held for about 2 S after being turned on by a music peak. With "Peak Hold" selected (from a group of buttons at the panel's top right), the highest level indication will be held indefinitely, and a "Peak Hold" reminder illuminates on the display panel.

Also appearing on the display panel are the following: The NR system selected (as mentioned earlier), the tape type (determined by sensing holes in the cassette shell), the tape length (entered by the user), the elapsed playing time corresponding to the length of the tape in use, and the "CPS" (programming) number. As tape type is sensed automatically, it is obvious that some older Type II tapes could indicate "Norm," and even some current Type IV cassettes would show "CrO₂." The elapsed-time indicator does not calibrate itself to the actual position on the tape, nor does it

As the button count implies, the Z-7000 deck is full of features. A period of familiarization is thus in order.

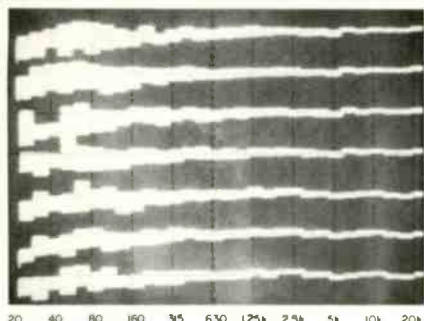


Fig. 2—Pink-noise response using dbx NR. From top to bottom: At +10 dB with Maxell MX (Type IV) tape, at 0 dB with MX, at 0 dB with

Maxell UD-XL II (Type II), at 0 dB with UD-XL I (Type I), and at -20 dB with MX, UD-XL II and UD-XL I.

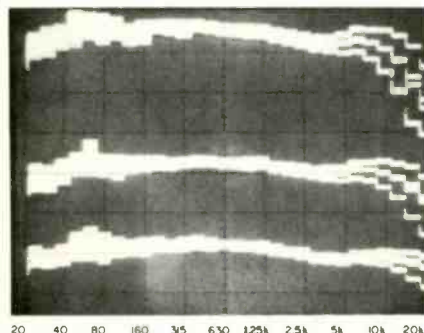


Fig. 3—Effects of MOL balance, "Hi-Extend" and Dolby C NR on frequency response. All curves are with Maxell UD-XL II tape at +5 dB; major curves are (top to bottom) with low, standard and high MOL balance settings. High-frequency ends of

each curve show effects of (top to bottom) Dolby C NR and "Hi-Extend" together, Dolby C NR alone, "Hi-Extend" alone, and response with neither Dolby C NR nor "Hi-Extend." Vertical scale: 5 dB/division.

reset upon insertion of a tape or rewind the tape to the beginning to set zero. Actually, I do prefer that counters *not* reset with cassette removal or insertion, and the Teac time counter keeps track of real time relative to tape position even in the fast-wind modes, which is good. The Computomatic Program System ("CPS") fast-winds to a desired selection, skipping a programmed number of selections (up to 19) en route.

Below the meter/display panel (another logical control placement) are the horizontal "Rec Preset Level" sliders for each channel and a "Master" slider with nearly 3 inches of travel. The "Master" control has a good-sized, square knob

with a clear window and index line in its center, making settings very easy to read. The channel-slider knobs are small but easy to use; I was made a bit dubious, however, by the springiness of the arms connecting these knobs to their internal controls. Just to the right is the output-level slider, of the same mechanical design. Below it are the left and right microphone jacks and the socket for the RC-200 wired remote control (supplied).

Above, on the right side of the front panel, are rows of pushbuttons, most with indicators. The top row includes "STZ" (search to zero), "Cue," "STC" (search to cue) and "STR" (search to record). The "STZ" fast-winds the deck to the position where the counter reads zero. "Cue" sets into memory whatever counter reading is displayed at the time; "STC" will then fast-wind the Z-7000 to that position. "STR" functions only in the record mode and will fast-wind the deck to the beginning of the last recording. In the next row of buttons are "SES" (spot-erase system), "Position," "Repeat" and "Intro Check." "SES" is used in conjunction with "Position" to pinpoint a section to be erased (as little as 0.3 S) and then to have the erasure made automatically. It includes a check run to verify the accuracy of the position choices before actual erasure. This is a good use of micro-processor capability. "Repeat" will initiate repeated playback between counter zero and the selected cue point. "Intro Check" makes the deck play the first 10 S of each selection on the tape.

The third row of buttons consists of "Counter Clear" to zero the counter, "CPS" to enter the number of selections to be skipped, and "Peak Hold" to get that metering mode. The next row is for setting tape length: "C-46," "C-46L" (large hub), "C-60" or "C-90." It is necessary to input this information to ensure accurate elapsed-time indications for the cassette in use.

The next group of buttons and readouts are all part of the Z-7000's tape-calibration system. When a cassette is loaded, the tape type ("Norm," "CrO₂" or "Metal") lights up, as does a button labelled "Reference" and one designated "Std." This tells the user that the tape will be recorded with reference bias, equalization, and record sensitivity with "standard" MOL (maximum output-level) balance. "Low" MOL balance would get lower low-frequency distortion but less high-frequency headroom, and "High" MOL balance would favor better high-frequency headroom with higher distortion at the low end.

For any tape not meeting the reference criteria, the user pushes "Auto Cal," and the three MOL-balance button LEDs will flash, calling for that decision. Once made, "Record" flashes and the actual calibration takes place. At the end, an "OK" appears, at which time the settings can be entered into any one of the three memories. The versatility of the system is further enhanced by the fact that each memory will store settings for each of the tape types, a total of nine calibrations stored—quite impressive. "Hi-Extend" can be used with Type II or IV tapes for further improvement in high-frequency headroom. The setting of this function is included in the stored information for recall later.

On the back panel are gold-plated line-in/out stereo pairs and a jack for the supplied 5-V power supply which ensures that the memories are fed constant power even if the deck is

The counter keeps track of elapsed time relative to tape position, even in the fast-wind modes, which is helpful.

turned off. I was unsure of the functions of a number of screws holding on the top/side cover, so the normal disassembly was not made. A peek in from the bottom after taking off that cover showed many p.c. boards, with all parts identified and excellent soldering.

Measurements

The playback responses were very close to standard, within a dB for both equalizations, except for fringing effects at the lowest frequencies. The Z-7000 auto-calibration system produced at least very good responses for all tapes tried, with the exception of low-bias, non-premium Type I and II cassettes, which were rolled off. Test data supplied with the deck had been taken with Maxell UD-XL I, UD-XL II and MX tapes, and they were used for the detailed tests. Figure 1 shows the swept-frequency responses for these three tapes, with and without Dolby C NR. The results are quite good to excellent, with MX responses most notable. The -3 dB points are listed in Table I.

Figure 2 shows the pink-noise responses with dbx NR for all three tapes. There are small differences at the lowest frequencies, but overall the responses are excellent and very consistent. The three families of overlapping curves in Figure 3 show the results of recording pink noise at +5 dB on UD-XL II at the three MOL balance settings. The different responses above 5 kHz or so in each curve family show the effects of NR and "Hi-Extend." In each case, response was poorest when neither was used; using "Hi-Extend" alone produced a noticeable improvement, and using Dolby C NR by itself produced a slightly greater one. When both "Hi-Extend" and Dolby C NR were used, the responses were flattest of all—and distortion was slightly reduced, as well.

Tape play speed was only about 0.2% high, and a standard level tape played about 1 dB low. Table II lists a number of measured recorder characteristics; these results were good to excellent, save that phase error was just average.

Table III lists the distortion values measured at levels from 10 dB below Dolby level to the 3% distortion limit for the three tapes in both Dolby C and dbx NR modes. Note that UD-XL I used standard MOL balance, while UD-XL II and MX used high MOL balance. There are three interesting facets to the data: The higher distortion of the Type II and Type IV tapes, the much higher maximum levels with dbx NR, and the converging and limiting lower distortion limit around -10 dB. Additional checks were made to determine the effect on 400-Hz distortion with changes of MOL balance. At 0 dB with Dolby C NR, the figures for UD-XL I tape were 0.42%, 0.71% and 1.26% for low, standard and high MOL balance, respectively. Results for UD-XL II tape were 1.41%, 2.2% and 3.4%, while with MX tape results were 0.73%, 1.19% and 2.5% respectively. With dbx NR, distortion also increased with higher MOL balance, but the actual distortion figures were much lower, and the spread between the figures was less. Using "Hi-Extend" increased mid-band distortion slightly, but also reduced distortion at 6 kHz to half what it was when this circuit was not used.

Table IV has the signal-to-noise ratios for the same conditions as for Table III, with the addition of test results for MX tape with standard MOL balance. Note the sizable in-

Table I—Record/playback responses (-3 dB limits).

Tape Type	With Dolby C NR				Without NR			
	Dolby Lvl		-20 dB		Dolby Lvl		-20 dB	
	Hz	kHz	Hz	kHz	Hz	kHz	Hz	kHz
Maxell UD-XL I	15.7	12.5	11.7	21.2	11.2	10.1	10.6	22.6
Maxell UD-XL II	17.7	12.7	12.7	22.1	12.9	9.0	10.4	23.3
Maxell MX	20	21.6	12.2	23.2	12.5	14.3	10.2	24.3

Table II—Miscellaneous record/playback characteristics.

Erasure At 100 Hz	Sep. At 1 kHz	Crosstalk At 1 kHz	10-kHz A/B Phase		MPX Filter At 19.00 kHz
			Error	Jitter	
61 dB	44 dB	-80 dB	50°	10°	-30.3 dB

Table III—400-Hz HDL₃ (%) vs. record level (0 dB = 200 nWb/m).

Tape Type	NR	Record Level						HDL ₃ = 3%
		-10	-8	-4	0	+4	+8	
Maxell UD-XL I*	Dolby C	0.15	0.18	0.29	0.71	2.2		+ 4.8 dB
	dbx	0.13	0.16	0.17	0.22	0.47	0.77	+13.8 dB
Maxell UD-XL II**	Dolby C	0.32	0.56	1.3	3.4			- 0.4 dB
	dbx	0.40	0.47	0.77	1.2	1.8	2.6	+ 8.4 dB
Maxell MX**	Dolby C	0.32	0.45	1.2	2.5			+ 0.7 dB
	dbx	0.36	0.42	0.60	0.95	1.5	2.0	+11.3 dB

*Std. MOL Balance
**High MOL Balance

Table IV—Signal/noise ratios with IEC A and CCIR/ARM weightings.

Tape Type	IEC A Wtd. (dBA)				CCIR/ARM (dB)			
	W/Dolby C NR		With dbx NR		W/Dolby C NR		With dbx NR	
	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%	@ DL	HD=3%
Maxell UD-XL I*	69.1	73.8	74.4	88.2	67.2	71.9	70.6	83.8
Maxell UD-XL II**	70.7	70.4	74.3	81.7	68.4	68.1	70.3	77.7
Maxell MX**	70.4	70.9	72.9	82.5	68.6	69.1	70.7	80.3
Maxell MX*	70.5	75.1	73.9	87.9	68.7	73.3	71.2	85.2

*Std. MOL Balance
**High MOL Balance

Table V—HDL₃ (%) vs. frequency at 10 dB below Dolby level.

Tape Type	NR	MOL Bal.	Frequency (Hz)							
			50	100	400	1k	2k	4k	5k	
			Maxell UD-XL II	Dolby C	Low	0.24	0.32	0.22	0.22	0.07
		High	0.47	0.50	0.40	0.40	0.15	0.16	0.36	

Table VI—Input and output characteristics at 1 kHz.

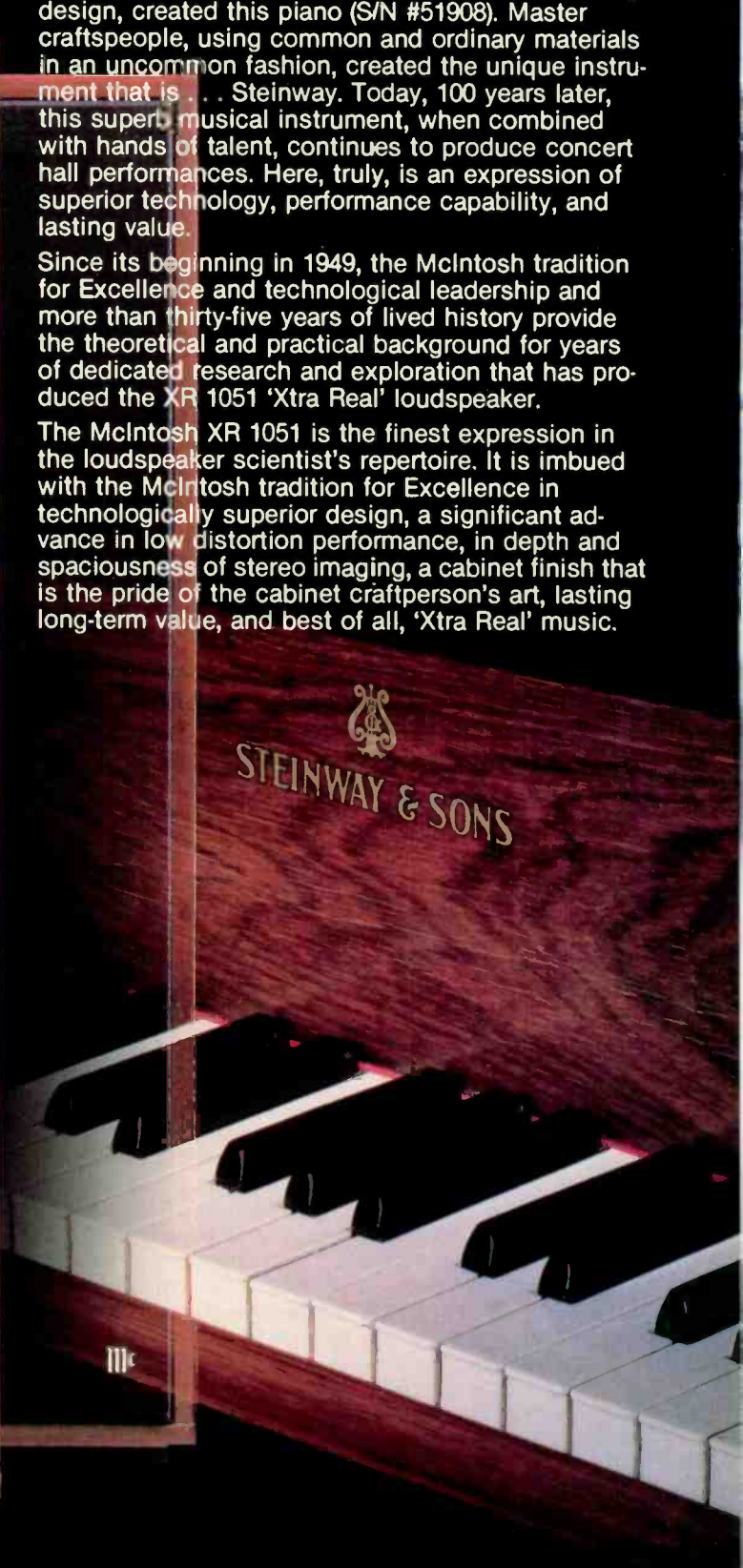
Input	Level		Imp., Kilohms	Output	Level		Imp., Ohms	Clip (Re: Meter 0)
	Sens.	Overload			Open Ckt.	Loaded		
Line	36 mV	10.4 V	84	Line	906 mV	895 mV	11	+12.9 dB
Mike	0.33 mV	224 mV	9.1	Hdphn.	113 mV	105 mV	3.5	

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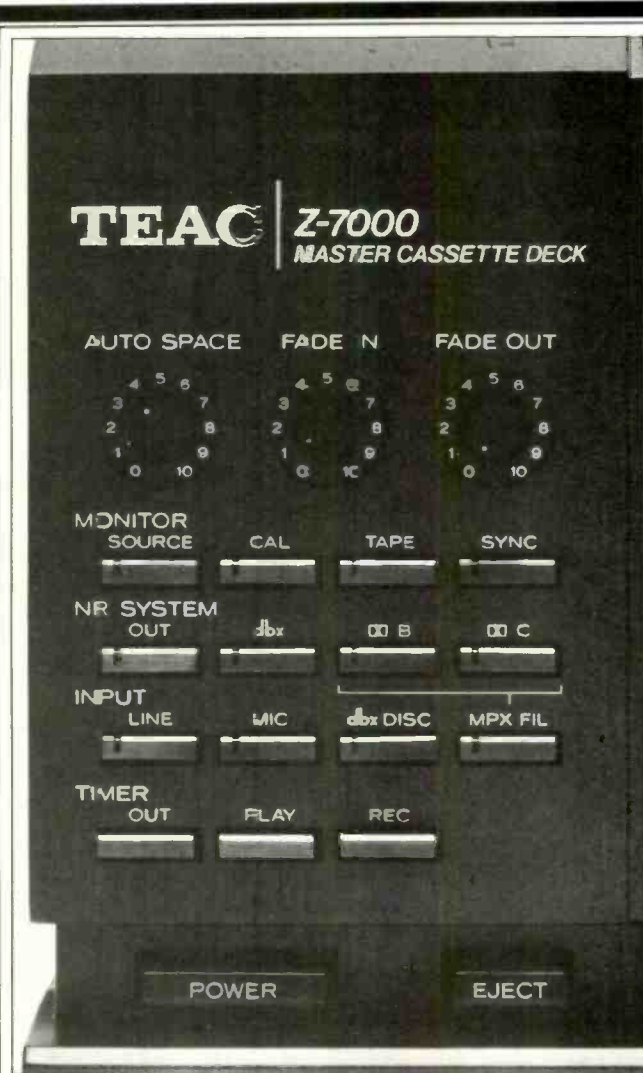


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I judged that the Z-7000 cassette deck delivered the best dbx NR sound I have heard to date.



The three knobs and the "Sync" button on this, one of the Z-7000's two multi-button panels, control some of its more uncommon features.

creases in the ratios because of the higher distortion limits. Table V shows that the lower MOL balance gained lower distortion except for the very highest test frequency.

Various input and output properties are shown in Table VI. The output impedances are very low, quite superior to many other decks. The sections of the master input-level pot tracked within 1 dB over a 45-dB range, which is quite good. The output-level pot sections and those of the headphone control tracked very well, within 1 dB for 55 dB. A very high level was delivered to any of the headphones tried, easily moderated with the pot. The polarity of the output matched that of the input in "Source" or any of the

playback monitor positions. The action of the auto-fade controls was very smooth, with gain changing by a full 60 dB in anywhere from an instant to about 9 S. The auto-space range appeared to be from 2 to 10 S.

The meters in the Teac Z-7000 deck were truly peak-responding, reaching very close to zero with a 10-mS burst. Decay time was slightly fast, at 800 mS. There were momentary peak holds of about 2 S; this characteristic, and the selectable "Peak Hold," were operative even down at -35 dB. This is far superior to many such devices which hold peaks only above zero. The thresholds were very accurate over the entire range of the metering, also superior to most other bar-graph meters.

The measured flutter was 0.023% wtd. rms, which is a very low figure, albeit slightly higher than the specified 0.019%. On a weighted peak basis, the result was $\pm 0.044\%$, also excellent. Any observed speed deviations, including those from voltage changes, were less than 0.02%. Average wind times for a C-60 cassette were 78 S. The pitch control range was from -11.2% to +13.3%, substantially a full tone in both directions, about twice the range of most pitch controls. All logic-transport mode changes took less than 1 S.

Use and Listening Tests

The five-language owner's manual presents lots of detail in its 74 pages, and there certainly are a lot of features to discuss. The illustrations are good, and the full collection of schematics supplied gave quite an indication that I had missed seeing a lot when I did not get the unit's cover off. I did feel that there should have been more discussion of what auto-cal actually did, and also of the expected effects for selecting a particular MOL balance. Considering the good performance of auto-cal, I found it puzzling that the manual recommended that the owner have the "bias circuitry of this deck adjusted" to match his favorite tapes.

All of the controls and switches were convenient in use and completely reliable, including the remote control. The white designations on the dark front panel were easy to read, whatever the lighting. Record, pause and stop clicks were well down in noise, even with Dolby C NR. Metering was outstanding in use, and "Peak Hold" was a big help in checking for maximum levels without having to stare at the meters continually. The spot-erase system worked very well, and it's definitely a nice extra. I used auto-cal and the three memories to store the three MOL balance settings for all three tape types. This made it possible to record and change MOL balance without even stopping the tape.

In general, I preferred the results with Dolby C NR with the MOL balance on standard or low. If I recorded at an extra high level, I always preferred the low MOL setting. I must add that for such levels, dbx NR was preferable. I also judged that, in general, the Z-7000 delivered the best dbx NR sound I have heard to date.

The Teac Z-7000 is a sophisticated deck with many features and generally excellent performance. As is true with other microprocessor-controlled decks in this higher price range, evaluation and rating of the numerous conveniences is in order to assess the value of the required investment.

Howard A. Roberson

WINNING WYNTON

Think of One: Wynton Marsalis
CBS/Sony 35DP 75.

Performance: A+ Recording: B+
 Source: Digital

This is just a musically marvelous record. The ensemble, which consists of Wynton on trumpet, Branford Marsalis (Wynton's brother) on soprano and tenor saxes, Kenny Kirkland on piano, Jeffrey Watts on drums, and Phil Bowler and Ray Drummond on bass (in different selections), is really a joy to listen to—not just because they play to each other, but because they can get the listener into it as well. This quintet is, to my mind and at this point in time, unique. They just feel each other and the music to such an extent that they're almost a throwback—in spite of the performers' youth. The attraction in this record, of course, is Wynton. Both this recording and his *Trumpet Concertos* are at the top of the charts. He's a recent multiple-Grammy winner—correctly so, too, for Wynton's playing is as impeccable as his attire.

The recording is a multi-mike job done in the standard pop fashion, i.e., with isolation of instruments and very little natural ambience. However, it

must be said that no excesses were used here, and the natural quality of the instruments has not been "aided" by marvelous electronic "enhancements." Aside from a slight edge to the trumpet (microphone peak), a lack of extreme top, a slight brightness on the cymbals (mike peak again), and a little clanging jazz piano, air and atmosphere are the most noticeably lacking desirabilities; would that this disc had been made just like M & K's *Darn That Dream*. On the positive side, the gutty sound of the acoustic bass is just thrilling—and listen to the wonderful muted trumpet in "Melancholia." Branford Marsalis on soprano and tenor saxes is also outstanding.

This CD, a Japanese purchase, is short on English notes (13 pages of Japanese to five of English), and there are many goofy misspellings, at that. Considering how much CDs sell for, someone should pay more attention to graphics in their production. In addition, the record runs only 44:31—standard for an LP, but rather short for a format that can hold 72:00.

C. Victor Campos

Trumpet Concertos. The National Philharmonic Orchestra, Raymond Leppard; Wynton Marsalis, trumpet.
CBS MK 37846.

This CD recording contains the Haydn, Leopold Mozart and Hummel trumpet concertos, certainly among the most popular in the repertoire of trumpet virtuosos.

Wynton Marsalis, a young trumpeter with roots in New Orleans jazz, is simply sensational in his playing of these works. He has solid, assured fingering and a very clean touch. His tonal resources are endless, offering a big, resonant sound that is very full and richly expressive. He has complete

mastery of technique, and his pyrotechnical display of trumpet virtuosity in the finale of the Hummel concerto is simply a marvel. Raymond Leppard and the National Philharmonic Orchestra furnish a most sympathetic accompaniment.

On this recording, made in England, Michael Gray and Stuart Eltham (two of EMI's most prestigious recording engineers) have given us a superbly clean, beautifully balanced sound. The Marsalis trumpet is properly brazen, with a lot of weight, but it is never coarse or overly aggressive. It is balanced just the proper distance in front of the orchestra; the sound of the trumpet never swamps the orchestra, and vice versa. The orchestral sound is equally well balanced and very clean. The overall sound is made more realistic by being recorded with a particularly warm, spacious ambience. An outstanding recording.

Bert Whyte

Haydn: Trumpet Concerto in E Flat Major; L. Mozart: Trumpet Concerto in D Major; Hummel: Trumpet Concerto in E Flat Major. The National Philharmonic Orchestra, Raymond Leppard; Wynton Marsalis, trumpet.
CBS/Sony 38DC 70.

Performance: A Recording: B+
 Source: Digital

This is another success in the attempts of CBS's Joe Dash to promote crossover artists (this recording tops the sales charts). Wynton Marsalis, a recent Grammy winner, bears careful watching and listening to, too. A mere 22 years old, he is destined to become the foremost trumpeter of this century and much of the next. Born in New Orleans, trained at Juilliard and the Berkshire Music Center, his formal education is in classical music, his heritage in jazz.

His performance here is virtuosic to a point where it can hardly be faulted. True, his maturity, particularly with this type of music, can only grow, but this in no way diminishes the musical acumen shown here. Some of the playing is simply fantastic—listen, for example, to the tonguing at the finale of the third movement of the Haydn. The Mozart and the Hummel are also played out-

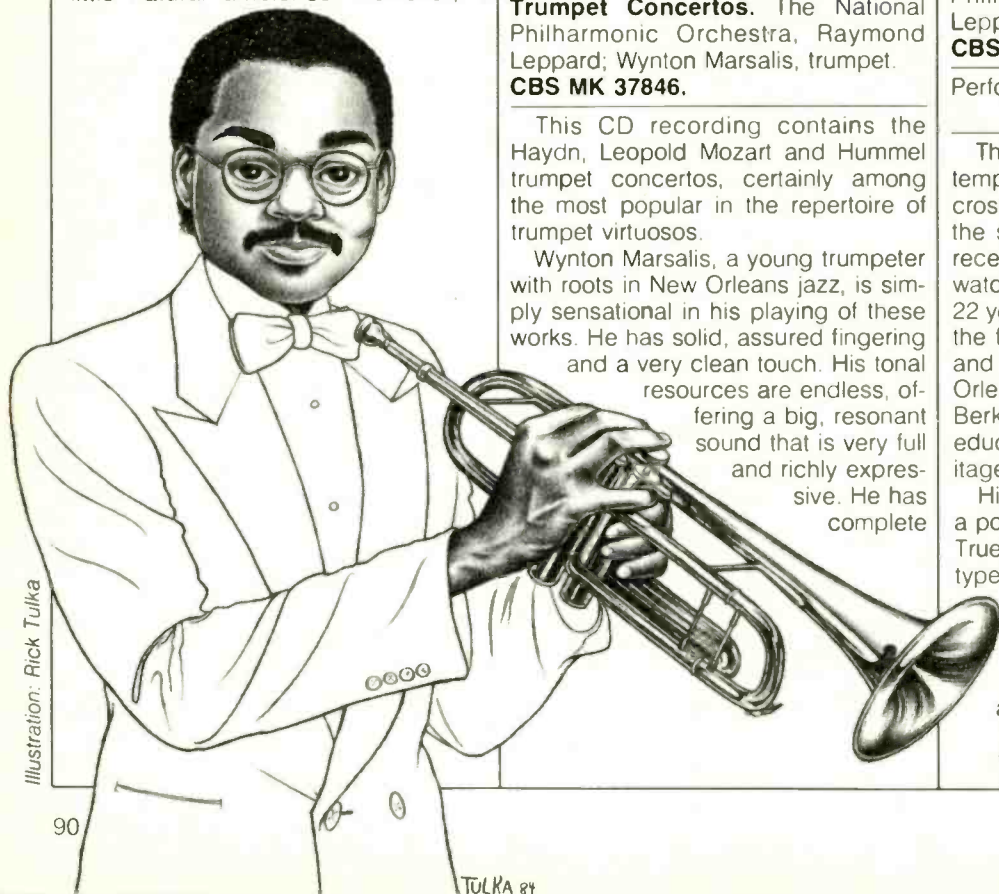
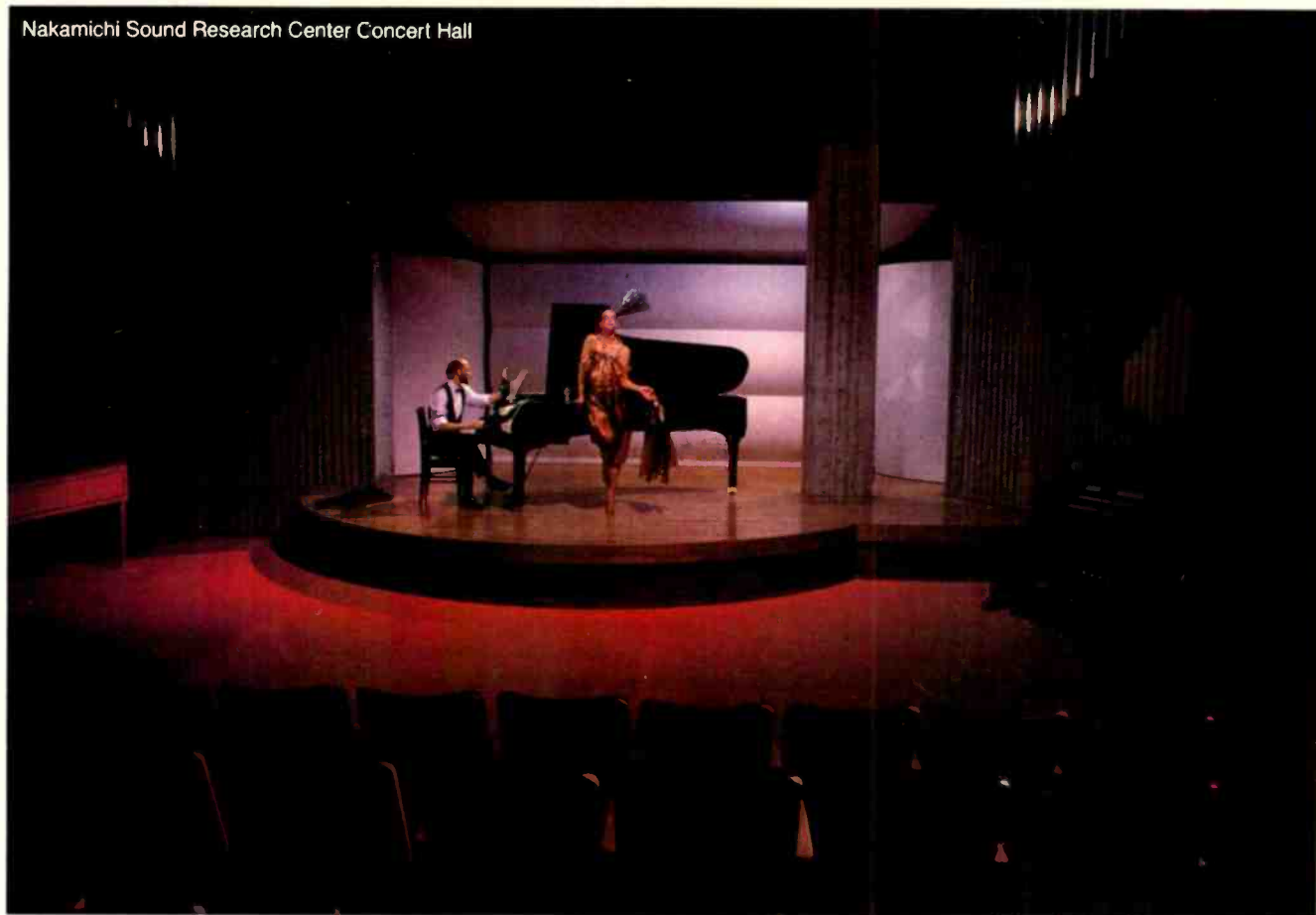


Illustration: Rick Tulka



Nakamichi—Commitment to Innovation

Innovation—not a word to use lightly! Innovation demands a fresh look—a break with the past—a new solution to an existing problem. Innovation begins with an idea born of free thought, unfettered by tradition, unshackled by preconceived notions of what is possible. Technological innovation is akin to artistic inspiration. An idea originates in the creative soul of one person; the R&D lab—technology's "orchestra"—converts that idea into reality.

Consider the Nakamichi Dragon—an innovative cassette deck in the true sense of the word! Why? Not because Dragon plays both sides of a cassette automatically, but because it is the first to do it *perfectly*—the first to solve the "bi-directional playback problem" that has plagued every auto-reverse cassette deck ever made!

The "bi-directional playback problem" is caused by cassette tolerances which allow tape to follow a different path when played in reverse than it did when recorded. This produces "azimuth error" which results in lost overtones. Instruments no longer sound true to life and the music is dead!

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orders by using special test tones on each cassette. This technique cannot be used when *playing* tapes that were recorded *without* the tones. A practical *playback* azimuth-alignment system must utilize *music itself* as a test signal, but how can an electronic circuit know what music should sound like?

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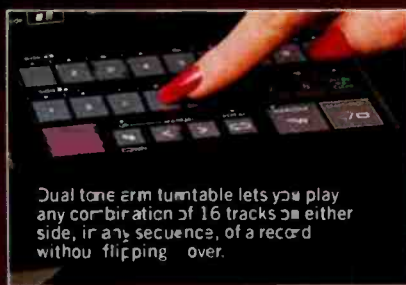
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A shipload of special effects makes *I Robot* a prime choice for digital remastering.

standingly well. Raymond Leppard, as we've come to expect and take for granted, conducts an outstanding accompaniment. It did almost throw me, though, to find that the notes, almost all in Japanese, refer to Hummel, through-out, as "Fummel." (*Editor's Note:* This CD sample was purchased in Japan, hence the Japanese notes; Bert Whyte's, above, was not.)

This CD, from a digital original, is a step in the right direction for CBS, without the problems that have occasioned complaints about other CDs from the label.

The overall pickup appears to be three main, very flat microphones and two more for ambience. The recording, made at EMI's Abbey Road Studios, suffers from that studio's acoustics. Abbey Road is not the best studio, but at least it doesn't impart too many of its poor qualities, aside from an indistinct and almost one-note bass reinforcement which is tubby enough at times to overwhelm the lower strings. There is also a gritty quality to the string sound that is more the string sections of the National Philharmonic (read here: pickup) Orchestra showing their poor ensemble than the quality of the recording itself. It may also be partly the result of large numbers of digital permutations en route from the recording session to CD.

My most serious complaint, however, is the trumpet pickup; it's just too loud. When the orchestra plays softer than mezzo-forte, the trumpet tends to overwhelm it. The trumpet was spot-miked, and the mike used has an upper midrange peak of a magnitude that's impossible to ignore. The high notes, particularly, tend to be painful, and the instrument's timbre changes drastically in the upper registers. These complaints are really minor in view of how much better this recording is than the usual CBS efforts. A really worthwhile CD, recommended for any embryonic digital collection.

C. Victor Campos

**I Robot: Alan Parsons Project
Mobile Fidelity Sound Lab MFCD
804.**

Mobile Fidelity Sound Lab glides into Compact Disc waters with the release of four titles, among them the Alan Par-

sons Project's synthesizer-powered vessel, *I Robot*. This initial Mobile Fidelity Original Master Recording release features both accurate sound, taken from the original analog master tapes and digitalized, and the kind of packaging audiophiles and music lovers crave, with complete liner notes and full credits.

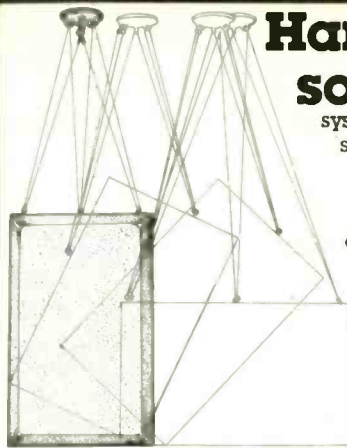
I Robot, originally released on the Arista label in 1977, is a prime choice for digital remastering. It is a concept album featuring a shipload of special effects, from synthesizer gimmickry to spectacular massed voices united in eerie moans and hosannahs. The production is by Alan Parsons with partner Eric Woolfson in the executive spot, and it is splendid.

There is a palpable sense of depth in this CD, from the heavily synthesized title number which opens the disc and introduces the album's theme, to the final cut, "Genesis," with its uplifting choral conclusion. Parsons is fond of moving sound in great swells from back- to foreground and vice versa. "I Robot" opens with synthesizers noodling in the distance which gradually swell into the foreground with great power. A single soprano voice becomes one with this great wave of sound, drowning in it, while rumbling, synthesized bass notes sink into the listener's consciousness, stirring up sympathetic ripples in the bloodstream. "I Wouldn't Want to Be Like You," which follows directly, offers a magical aural experience as an electric piano shimmers slightly from left to right channels, almost below the level of awareness, so that the effect seems not so much heard as felt.

Unfortunately, all this electronic expertise is lavished on some fairly mediocre material. Songs like "The Voice" and "Day After Day" are dragged to the bottom by uninspired melodies and tedious repetition. The concept of the album—the rise of the machine and the decline of man—gets only intermittent support from the material, although the choral effects of "Total Eclipse" and "Genesis" are amusingly reminiscent of the soundtrack of *2001: A Space Odyssey*.

Get this one to show off your CD player; it's a trip, but not a satisfying voyage into pop entertainment.

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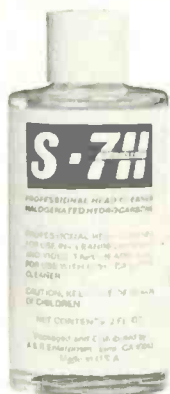
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The CD version of *An Innocent Man* is even better than the original: An overall sense of clarity emerges, adding an extra dimension.

An Innocent Man: Billy Joel CBS CK 38837.

If you are at all cognizant of current pop music and haven't been living in the bush in New Guinea, you probably know that *An Innocent Man* is Billy Joel's valentine to an earlier, more innocent age, the '50s. In keeping with the tone of the music contained within, this album sports deceptively simple production values. The instrumentation is mostly acoustic, with a refreshing splash of saxophone throughout. Producer *extraordinaire* Phil Ramone keeps the vocals and instrumentals largely clustered in the phantom center channel, but he knows how to emphasize a bit of honky-tonk piano ("Christie Lee") or add verb to a finger snap ("An Innocent Man") for just the right effect. The alternation from left to right channels of the doo-wop background vocals in "The Longest Time," for instance, is subtly masterful.

Although the original analog recording is quite good, with a real sense of depth and good instrumental placement, CBS's CD version is even better. It is as though a light veil has been lifted: An overall sense of clarity emerges, adding an extra dimension to what was a perfectly acceptable recording. Nuances of sound and quiet details that may have been missed in the original disc come to light on this CD. The delicate violin accents on "This Night" (with chorus compliments of Ludwig von Beethoven, no less) gain substance without losing their fragility. The great, blating tenor-sax touches on "Easy Money" and "Careless Talk" gain presence, as does Toots Thielemans' honey-rich harmonica on "Leave a Tender Moment Alone." The horns used so generously throughout gain crispness and definition, most notably in the sharp alto punctuation and squeals on "Easy Money." The CD also totally eliminates the distortion that shows up on some sibilants on the analog disc.

An Innocent Man is not a showcase of digital magic, though; it is a good clean-up job, an example of the subtle but discernible difference modern technology can bring to the music you already value. If you are among the millions of Billy Joel fans worldwide—even if you do live in the mosquito-



infested wilds of New Guinea—it might be worth it to own a clean copy of *An Innocent Man* that will last long after Joel's references to things of the past have become totally obscure.

Paulette Weiss

Rumours: Fleetwood Mac Warner Bros. 03010-2.

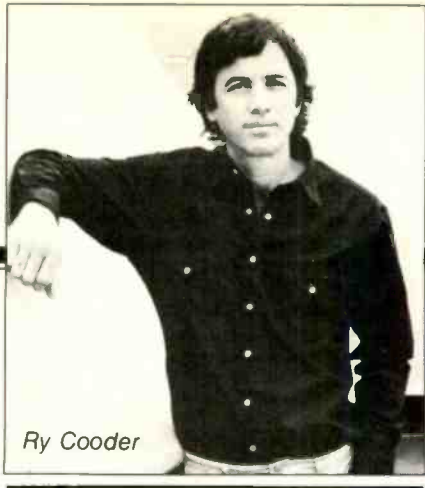
Performance: A Recording: A – Source: Analog

This CD is absolutely recommended. *Rumours*, released when Fleetwood Mac was at its peak, has always been a great recording and, particularly when it was originally available, found its way into many stores as a favorite demo. While the analog version left some things to be desired, specifically poor pressings and some distortion in loud passages, this is not true of the CD. For example, in the LP, the bass guitar in "Chain" always sounded bloated and fuzzy. On this CD, the bass is a pleasure to hear, even though absolute dynamics just make 25 dB. But the entire recording, even through headphones, is absolutely clean; you can even hear the switching in of the left track at the beginning of "Second Hand News."

Although the original was multi-mike, multi-track and overdubbed, the mixing is superbly accomplished, and all the effects are very tastefully done, with no distortion as a result—nothing obnoxious here. This is what good multi-track is all about, and hopefully this CD will start the vindication of the digital audio disc. Crummy music, lousy recording and obnoxious effects buttered up with distortion is what we've come to expect—CD or analog—and that's no way to vindicate a new, potentially crystal-clear medium.

Played back on the Dual CD-120, compressed and equalized as the original is, I don't care. This is one great experience, and I had to listen again and again. This CD I don't want to lose.

C. Victor Campos



Ry Cooder

Bop Till You Drop: Ry Cooder
Warner Bros. 03358-2.

Performance: C- Recording: B+
Source: Digital

This is not one of Ry Cooder's best. It seems more an effort to make up an album than a desire to do it right.

Although the recording is much better than an analog, in that the presentation is very clean and there is no distortion as we describe the word, there are some points at which the microphones pop due to proximity. Some of the vocals sound disturbingly hollow, and a few of the bands have clearly evident overcompression. In "Look at Granny Run Run" and "Don't Mess up a Good Thing," the equalization changes and the sibilants on the vocals and cymbals become intolerable—especially on a CD, where it is just unnecessary.

The best part of this album is the last song, "I Can't Win," a spiritual-inspired composition with Bobby King as the lead singer. The real star, given no credit, is Chaka Khan, who delivers a whomper.

At 39:50, this CD doesn't justify its cost on the basis of time ... or anything else. C. Victor Campos

Cargo: Men At Work
CBS CK 38660.

I admit to a slight psychological bent toward the vastly improved sound in every CD I hear. Even with this bias, I must confess that occasionally the discernible improvement in sound is minor and not worth the significantly higher cost of CD over LP. Men At Work's *Cargo* is such a case.

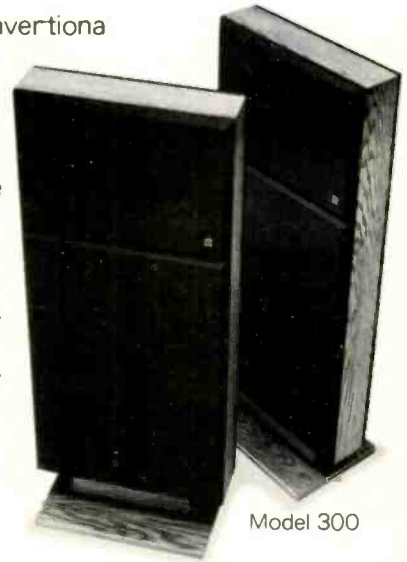
Although the lack of surface noise is an improvement and there is a minor extension in dynamic range, this album has not been packaged to deliver the full range of clear sound that makes digital reproduction worthwhile. Whether it was the decision of producer/engineer Peter McIan, or of the group, or—

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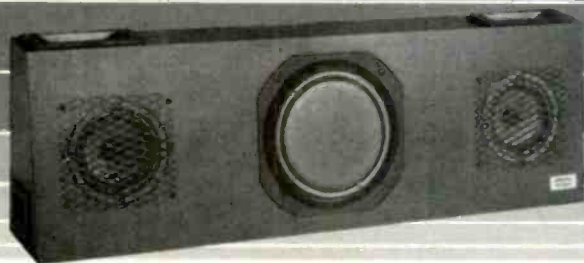
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Men At Work



more likely—of the two jointly, the production values of this disc are often murky. This seems not to be a matter of production or engineering skills, but one of aesthetic choice. When an instrument or special effect is allowed to stand clear (the sharply etched electric-piano intro of "It's a Mistake" and the rising wind and distant church-bell opening of "Dr. Heckyll & Mr. Jive"), the reproduction is flawless. The ability to create clear instrumental presences is obviously within the producer's grasp, as is his ability to create a sense of both spatial movement and

depth; choice was definitely the factor here.

Colin Hayes' distinctive vocals are often double-tracked, reverbed, or homogenized into the backup vocals, and almost always squashed into a mass of indistinct instrumentation. He's like the strawberry in strawberry preserves: More substantial than the surrounding goop, but buried in and a part of it nonetheless. For song after song, drummer Jerry Speiser is permitted to overuse his cymbals in a repetitive pattern that lends a smeared quality to the overall sound. Even the

flutes on "No Restrictions," the final cut, are recorded so that their special, silvery tonal quality is lost, and they are wasted in the mix. The outcome is a performance that is not much improved or clarified by digitalization.

Paulette Weiss

Warren Bernhardt Trio '83,
Digital Music Products CD 441,
 \$20.00. (Digital Music Products, Inc.,
 Rockefeller Center Station, P.O. Box
 2317, New York, N.Y. 10185.)

This CD recording is of a simple piano trio—piano, acoustic bass, and percussion—but it is one of the most stunningly accurate recordings I have ever heard.

The recording engineer, Tom Jung, was with Sound 80 Studio in Minneapolis, and he thus had early access to the 3M digital recorder. He certainly qualifies as one of the most experienced digital recording engineers in the business. Now Tom has founded his own label, Digital Music Products,

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Sonny Stitt's *Moonlight in Vermont* started superbly, and then the sax came in at such a level it ruined the whole record for me.



Sonny Stitt

which, uniquely, will issue recordings only in CD format and in chrome, real-time-duplicated cassettes.

Warren Bernhardt may not be a major musical talent, but he has nice technique, and his touch is very clean and articulate. With Eddie Gomez on bass and Peter Erskine on drums, a varied program of mostly original material is offered.

The sound of the piano is just breathtaking in its realism: Utterly clean, with a sparkling, crystalline sound and superb transient attack. The harmonic structure is clearly revealed; every tonal nuance and shading is perfectly delineated. Simply put, it is the cleanest, most natural piano sound I have ever heard. The acoustic bass and the percussion are equally well recorded. On several cuts, the bass is played arco, at times in an extremely high register. Cut eight, "Four Part Improvisation," has some percussion that will knock your socks off. Again, super-clean, sharp, explosive, weighty sound.

Tom tells me he used a pair of the new Shure condenser microphones on the fairly close-up piano pickup. "A real sleeper," he says about these mikes, and he used a Mitsubishi X-80 digital recorder.

The sound on this CD is so good, it is just great for testing preamplifiers, amplifiers, and—especially—loudspeakers. Tom Jung has several other recordings in his catalog and more in the works. Obviously, this label will bear watching.

Don't miss this one! Bert Whyte

**Moonlight in Vermont: Sonny Stitt
Denon 38C38-7046.**

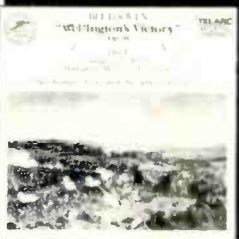
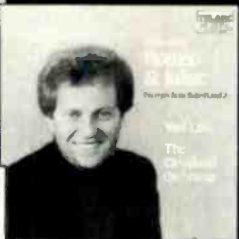
Performance: ? Recording: D –
Source: Digital

This recording started superbly, with real-sounding drums. I mean, they were just about perfect—and then the sax came in at such a level it ruined the whole record for me (soloist's ego?). Plus, the transitions were not only audi-

ble but disconcerting. Sometimes I think soloists should play alone (in recordings) and leave music-making to others, or learn the Bach Partitas or Sonatas for Solo Saxophone or What-Have-You.

If it weren't for this, I'd have loved this record. But the transitions: Slider up, slider down—now he's here, now he isn't! It annoyed me to the point I was not able to listen all the way through. Sorry about that. Ball's in your court.
C. Victor Campos

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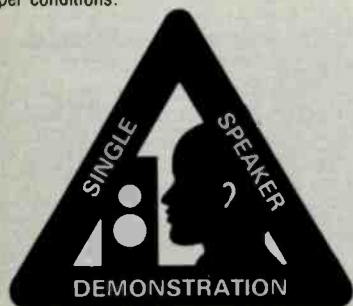
Great Lies of Hi-Fi

#3

"Trust Me, I'm An Expert"

Ever notice how many "experts" you suddenly run into as soon as you decide to buy a hi-fi or improve your existing system? Every "underground" magazine has found the single component that is better than all the rest. Every "slick" magazine has found all the components that represent good value and are worth considering. Every salesman has the perfect component for you and can spend hours telling you about it. Even your friends offer "expert" advice (because they've read the magazines and talked to all the salesmen.)

If they're all "experts", why do they all disagree? The truth is that it takes more than enthusiasm and the ability to pontificate to make one an expert. Most self-proclaimed experts lack any consistent method of evaluating equipment on a musical basis (you know the type, "The bass is a little better on this speaker, but if you really want highs..."). But, more disturbingly, they lack a basic understanding of the hierarchy of a hi-fi system and proper system set-up. In short, their evaluations are based on faulty observations of equipment used under improper conditions.



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RAVELATIONS



Ravel: *Boléro, La Valse, Rapsodie espagnole, Alborada del gracioso.*

Orchestre National de France, Lorin Maazel.

CBS IM 37289, digital.

Ravel: *Daphnis et Chloé Suite No. 2, La Valse, Pavane pour une infante défunte.* The Houston Symphony Orchestra, Sergiu Comissiona. The Houston Symphony Chorale.

Vanguard VA 25022, digital, \$8.98.

These two digital LPs cry for comparison and indeed are worth acquiring together for the interesting contrasts and differing values they offer. Ravel was not only one of the finest orchestrators we have ever seen and heard, but, even more, his music uniquely combines the big sound of the older Romantic symphony orchestra with a special sharp color and detail that comes through well via recording. No wonder his records seem to please.

The common item here is the nightmarish evocation of the Viennese waltz, composed just after WW I had destroyed the very source, old-time Imperial Vienna. That is what we hear, and it is the daemonic sound of the waltz in total disintegration that we must record—some job! Climax after climax, each more intense than the last. Even more difficult: A beginning that deliberately is "in the mud" or, as Ravel put it, in a fog. At the concert hall, the first notes invariably blend with

coughs and rustlings, not to mention distant buses and taxi horns. (The famed "Boléro," a similar tour de force, is not very different.) On records, on LP, the opening notes blend straight out of surface noise and hall sound; the two necessarily sound together! (On Compact Disc the problem is different. Hall noise alone but a groping for level, the beginnings almost inaudible. Beware! The endings are enormous.)

Vanguard's LP waltz begins ingeniously: Faint, slightly bass-inclined surface sound blending quickly into similar hall sound only slightly louder, in which, as expected, the opening notes of the music are barely differentiated. Very nicely done. CBS's begins more briskly; there is more hiss and less fuss about getting off and away. You still cannot hear the first notes. Should you?

As far as sound ambience goes, I like the Vanguard better. The French recording has a curiously mono-like sound, rather dry and not expansive. Vanguard's Houston church gives us a large, relaxed sense of space, adding to the impact of the sharp Ravel orchestral colors. No overblurring, as often occurs in church recordings. In the same way, Vanguard's big bass drum is startlingly real; in Paris it is thinner and harder, though not unacceptable.

Now we get into performance—it has much to do with the sound, after all. On CBS we have a major national

Illustration: Rick Tulka



orchestra in a country that prides itself on exactitude in musical technique. In Houston there is a less rigorous playing group, not yet perhaps of first-line quality but not far below. And we have two of those youngish traveling jet-conductors who operate all over the world, almost simultaneously. They are very different, and would be audibly different, I think, even if they switched orchestras.

The Paris players are unmistakably French, highly disciplined, perfectly blended, somehow a bit chilly in the traditional French manner. The winds, also traditionally, allow themselves to play out of tune. They always do. The strings are so perfectly matched you cannot believe it. But on the shrill side, i.e., lots of highs.

In Houston, the players are a bit more rotund, shall I say. Not lumpy but not taut either. Our Romanian maestro (with one "m," Comissiona—strange name) has some trouble whipping them up, but he does it well except for the final climaxes of the waltz and "Daphnis," which lack the ultimate tension. The playing wears well. I liked it better a second time.

Comissiona understands the music better. He knows the European tradition, is a master of the ups and downs, the changing tempos and moods, vital to the waltz but also to all Ravel. Maa-zel, as always, is chill and tends to whip up climaxes and exaggerate the passages where tensions relax. Too

self-conscious, not instinctively (and by training) correct. But if you want the true daemonic endings, "Boléro" and "La Valse," you have to try him.

Both discs will probably end up on CD—better not wait.

Vaughan Williams: The Lark Ascending, Fantasia on a Theme of Thomas Tallis; Elgar: Serenade for Strings Op. 20; Tippett: Fantasia Concertante on a Theme of Corelli.
The Academy of St. Martin-in-the-Fields, Neville Marriner.
Vanguard VA 25020, \$8.98.

This one is a Vanguard digital import, out of a British company called Academy Sound and Vision Ltd., recorded in the EMI studios with JVC equipment. Imports were the stuff of early LP, notably after Nonesuch opened up a wide market, and we have to remember that in the classical field the electric 78 shellac was very largely an import business, either direct or by reissue. Now the game is open to all, with small and large U.S. companies competing on equal terms, publicity and distribution aside. It's an interesting contest! Still, to my way of thinking, the smaller outfits turn out the better product, if my employer will take that statement as a challenge. Not always better! But often enough to be noticeable.

The impact of this disc, however, is

Neville Marriner



A Few Good Dealers

Here is a list of a few good dealers that won't try to TALK you into believing that they are "experts". They can, and will, actually demonstrate the differences in components under conditions that will allow you to make a sensible decision.

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Audio Distinctions, Corpus Christi
Audio Concepts, Houston
Concert Sound, San Antonio

VIRGINIA

Listener's Shop, McLean

WASHINGTON

Definitive Audio, Seattle

We know this is a pretty meager list considering the thousands of hi-fi dealers across the country. But the truth is that most dealers are more interested in doing things the easy way rather than the right way. On the bright side, this list is growing from month to month. There are some good dealers out there and from time to time we find them, or they find us. It was only a few years ago that we would have been hard pressed to come up with five dealers that we could have included in this list.

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Neville Marriner, here with his home players, has a perfect understanding of the British expression; the music flows beautifully.

more a matter of the music, well played by a home orchestra and a conductor in his own bailiwick. English music! Rather neatly summing up a period.

You have to like it to appreciate it. For strange and abstruse reasons, this music does not go well with the American ear and taste, nor ever has. (More recent British music veers towards internationalism.) Myself, I find it passably dull to very nearly distasteful, though the brain says no and the training agrees. It *ought* to be good, it is good, the English think it is good.... Mostly I get twisty and itchy when I listen. If I listen *hard*, do my duty, I can then hear how good it actually is.

The works are largely for strings alone, with occasional violin solo (as in the "Lark") or group of string solos (as in the Tallis piece and the Tippett). From the earliest, Elgar, to the latest (1953), Tippett, this string sound is rich and mellifluous, not in the modern manner forcing the strings into new feats of strenuous difficulty. It all flows

beautifully, and Neville Marriner, here with his home players, has a perfect understanding of the British expression. (You see—I really do like the stuff when I finally get tuned in to it.)

The early Elgar "Serenade" is outrageously, unctuously Victorian, full of the typical Elgar harmonies; the two early Vaughan Williams items are much concerned with the then-startling "modal" harmonies, supposedly suggesting "ancient" music (Elizabethan) and the music of the Folk, English style. It's old-hat now but still has appeal as a kind of British Impressionism. As for Tippett, he is a thorough modern who, being British, manages to sound right out of the same tradition, which is a considerable feat. His music suggests a much-layered-over Corelli Baroque—more Impressionistic than the Baroque of either Stravinsky or Bartok, who also tried this game.

I think that the seamless continuity of this sound, straight from 1892 to 1953, is its most impressive aspect. Digital is

good for strings, too; it helps sharpen up their brilliant overtone content, always difficult to record without traces (or more) of edgy distortion in the louder parts.

Pillin: Concerto for Strings and Percussion; Reicha: Woodwind Quintet No. 2. The Pasadena Chamber Orchestra and Soloists, Robert Duerr. **WIM WIMR-22**, \$8.98. (Available from Crystal Records, 2235 Wilida Lane, Sedro Wooley, Wash. 98284.)

The West Coast, especially down south, is a hive of cross-culture music-making these days—everything goes and all mixed up, from super classical to super pop, with TV and film mystique mixed in. Is this a classical record? A real question, and in a positive sense too. Boris Pillin, for instance, is outwardly a 100% "classical" contemporary composer, but the Concerto on this record, dating from 1981, has been used for the soundtrack of the

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I liked Pillin's Concerto more the second time I played it, but it is still too big and not well baked.

Omstar production, "The Sky Is Falling," with narration by Oscar-winner Cliff Robertson. The solo percussionist here is also a composer and arranger of TV/film music, writes jingles, and plays at the Playboy Club in Los Angeles. It's a giddy world. And here it comes into your living room.

Well, does it? The usual question. Will it help your enjoyment to know about all those Hollywood-style multi-awards in the background? If so, enjoy, enjoy! But most of us still want to listen, or at least use the stuff for background.

Okay, it goes this way. Mr. Pillin's Concerto is *not* intended as background music. It is very portentous, hinting darkly of all sorts of soulful and ominous agonies, with screeching, dissonant strings and mystic harp tones—rather too big for its boots as I hear it. Especially since it is almost embarrassingly derived from Bela Bartok, who wrote *his* music for a similar combination of sound producers a half-



Percussionist Martin Jabara, composer Boris Pillin and conductor Robert Duerr

century ago. An honest tribute, if you want, and skillfully composed too, but Bartok, in comparison, is all lean muscle where this music runs to adiposity. Dissonant or no, it is basically derivative—which is perfectly okay as long as you keep things within reasonable bounds.

Just to be sure, I played the whole thing twice through. (So you think record reviewers play only the first half-inch?) I liked it more the second time—good sign. But it is still too big and not well baked. Cut down by a third, it would be a third better. Oddly, one casual little segment, near the end, I

thought the most original thing in the piece, quite delightful—a bit of dance-like whimsy, a sort of cross between an addled Irish jig and a slow tango. That's worth the whole record side.

As for Reicha, back in Napoleonic days, out of Prague, Paris and points between, his works are the quintessence of popular music in that era, beautifully written, never pretentious in the slightest degree, and *never* profound—that wasn't the idea. Goes rather nicely with Pillin's big modern work on the other side, and maybe might point some lessons for the 1980s in Pasadena.

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The Columbine Players are all of them superb musicians, which (strangely enough!) makes listening wonderfully easy.

Xenakis: Charisma; Kasinskas: Phoenix Wind; Effinger: Piano Sonata No. 3; Toensing: Music for Christmas Night; Eakin: Capriccio for Harp and Piano Pizzicato. Columbine Players.

Owl 26, \$8.98. (Owl Records, P.O. Box 4536, Boulder, Colo. 80306.)

For a long time I have championed the small record labels for their undoubted pioneering in quality music and audio sound. It is good to find this nonprofit label still operating, based in Colorado, still turning out really fine quality sound and interesting music—in the last analysis—for anyone with an ear for sonics. The music is "contemporary," the list of titles looks forbidding (above). But if you will be brave enough simply to listen, with an occasional glance at the printed explanations, you will be intrigued and pleased—unless, of course, you are looking for background music. This is anything but that.

Can't describe each piece, but all are variously interesting, from the academic but unusual sound of Eakin's work for harp and pizzicato piano (meaning that the pianist gets inside and plucks the strings, along with those of the very similar harp) to an extraordinary piece for solo clarinet accompanied by two of itself, prerecorded, "Phoenix Wind," by Joseph Kasinskas. Cecil Effinger's improvisational, dissonant-Romantic piano sonata is superbly recorded and ever so per-

suasively played; Richard Toensing's "Music for Christmas Night" is full of slow squeaks and color tones, intriguingly mixed with a Bach chorale. The biggest, most original work, "Charisma," is by Iannis Xenakis, with extraordinarily strong and harsh sounds from a clarinet and a cello. The Columbine Players are all of them superb musicians, which (strangely enough!) makes the listening wonderfully easy. Music, after all, does "speak" and needs good "speakers."

The recording is impeccably fine throughout—no one is likely to do better. Some rhythmic rumble in the bass, at 33⅓. Cutting lathe?

Brahms: Ballades, Op. 10; Rhapsodies, Op. 79. Glenn Gould, piano. CBS IM 37800, digital.

This isn't the place to get into the Glenn Gould controversy, which could go on for volumes. I have always been sympathetic to his extraordinary decision to resort to recordings alone, putting aside the concert world. It was epoch making, if only as an extreme, and still brings the fighting musical blood to a boil—but it is a crucial and vital argument for us who deal in any way in recordings because it gets down to stark elementals. What is the nature of a recording?

It seems to me now unarguable that this Gould was one of the great geniuses of the modern piano, both in terms of incredible technique and in the as-

tonishing penetration and intensity—for better or worse—of his musical interpretations. But he chose the (recording) hermit's life and he was probably right. Horowitz could be called just as eccentric in his own way, but he went in the opposite direction and *cannot* make a pure recording, minus concert audience. If records mean anything at all in music (I think they do!), then we must entertain both extremes and learn what we can from both.

I can say all this because I did not enjoy this record of Brahms. It is strong, as usual, but it is also *wrong*. Brahms is not Bach, of another age, nor even Beethoven, whose music is still wide open to varying interpretations, including Gould's. The aural, actual tradition of Brahms playing goes straight back to the composer and his time. What Gould plays is not part of this tradition. Either he put it aside, deliberately, or—more likely—simply does not know it, in his isolation. The music to me is painful to hear because it misses the whole idea! The wonderful, loosely flowing accompaniments are played like so much harpsichord music, loud and clear and pointy, never subordinated. The gorgeously rich Brahms melody, on the other hand (literally), is just notes, one by one, without the long shape. Strong playing but really incomprehensible, even as a re-interpretation of the man. I liked the early works best; they are more flamboyant and virtuosic and so come through better.



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Floyd Cooley's album of tuba music goes one tiny step too far: The world does *not* revolve around the tuba.

If you really want to hear the Gould genius, move on from the two "Goldberg Variations" recordings to his recent record of Haydn piano sonatas. It was that record which convinced me that this pianist was one of the rare, great geniuses. Unbelievable—especially if you happen to have played some of the Haydn in your own simple-minded way, probably making it sound like an ailing player piano. That's the way mine sounded, compared to Gould.

Floyd Cooley—Tuba. Naomi Cooley, harpsichord and piano. Music of Bach, Brahms, Zindars, Russell. Crystal S120, \$8.98.

The ever-present danger for record labels like Crystal, Golden Crest, WIM and many more, is to forget the larger audience—in favor of the special group. The tuba has indeed gone through a recent renaissance, almost a rebirth, and takes itself now very seriously—no more comedy, please. Okay, okay! I'll even listen to Mozart's "Eine Kleine Nachtmusik" for strings as played by a brace of these wind giants. But this record just goes one tiny step too far. The world does *not* revolve around the tuba, either for you or for me.

I didn't get beyond the first side. Sorry, because at least the second side has music actually composed for tuba, with a tuba overdub and a wind quintet. But a Bach suite? Bach was the greatest arranger ever, but he wouldn't have gotten to the tuba, which—for all the virtuosity available—still sounds thin and honky when it tries to play a melody in an intelligible middle range of pitch. I can think of dozens of instruments that could do the Bach much more effectively. So, except for tuba enthusiasts, why bother?

In the case of Brahms, things are much worse. The "Vier Ernste Gesänge," Four Serious Songs, were composed at the very end of his life and are filled with a somber agony, to texts about death. The words and music, as always in Brahms, are one. To blop them out in tuba format is simply a desecration of a man's last musical testament, like, say, applying an early-type voice synthesizer to the Gettysburg Address. Can't you hear it?

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Ormandy Conducts Sibelius: Symphony No. 1, Valse triste, The Swan of Tuonela. The Philadelphia Symphony Orchestra, Eugene Ormandy. **RCA ARL1 4901, \$9.98.**

Two of these are acknowledged re-releases (in very small print); the Symphony is new, though evidently not a brand-new recording. It ain't digital.

The whole collection, whatever its technical background, is musically priceless. Ormandy was the last of the "old guard" Romantic conductors who knew Sibelius' music, so to speak, from the horse's mouth. He was, in fact, close to the old man and even took the entire Philly orchestra to his Finland home to play, shortly before Sibelius died.

Sonically, the recordings are a bit enigmatic. RCA is coy with its reissues. In Europe they tell you the original date, or copyright date. Not here. All the copyrights are 1984, regardless of original, and there is no mention of dates previous to that, as though it were some deep secret. Why? These are excellent updatings and improvements over the earlier release, so why not give them due credit?

Thus, confusingly, the two re-releases, though at a somewhat lower cutting level than many new recordings on LP, are excellent in every way, with a grand ambience and perfect orchestral balance. The Symphony, presumably newer (but is it?), is distinctly less good in the orchestral ambience. It tends to sound small, restricted in width, minus a big, spread-out sound. As music it is superb, but sonically the others are better. Perhaps the Symphony was withheld and left unreleased at some past date? Could be.

Let no such petty technical consid-

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erations stop you if you want the finest Sibelius recording of our time, far ahead of younger conductors not familiar with the original idiom.

Brahms: Songs and Romances for Chorus. Musica Sacra, Richard Westenburg.

RCA ARC1 4916, digital, \$12.98.

Richard Westenburg, with a base at the vast Cathedral of St. John the Divine in New York, is the Apple's prime professional choral conductor. He is not in competition with many others, especially the leaders of the city's numerous amateur groups, some quite advanced, including my own chorus. Musica Sacra is his most professional group. In this country, do professional singers always do a better job with choral music than the non-pros? I try to be objective and, indeed, have much respect for Mr. Westenburg, though I think some of us with less prestige do as good a job in the music he conducts.

By far the best work on this interesting disc is the Brahms music for women's chorus with piano, or with French horn(s) and harp, as accompaniment. He has an expressive group of women who really feel the music, as does he, their only fault being a typical American lack of blending, not serious in view of the fine musicianship. The instrumental soloists are excellent. Brahms conducted this type of wom-

en's chorus at length, hence his considerable output for that medium and his exquisite understanding of the female voice unsupported by male vocalists.

Here we have four songs for women with harp and horns, an early work (Op. 17); 12 songs and romances with piano (Op. 44), rarely heard, and the very best of Brahms; and an even more unusual item, of all things an "Ave Maria," à la Schubert. The Viennese influence, no doubt.

The six songs of Op. 93A, without accompaniment, voices only, are less convincing. These singers, like most, are accustomed to the fixed reference of an instrumental backing; without it they sometimes sing unevenly, out of tune, and their blend suffers. The loud male voices are particularly unblending in these songs. The transitions, from song to song, are unclear in the pitch, tape editing or no. The sound is coarse and inaccurate, though the dramatic emphasis and diction are more than convincing.

The unaccompanied (a cappella) music is only a small part of the disc. The rest, with instruments, is first-rate, as it surely ought to be from such a professional group. If you want to hear a new side of old Brahms, try the record. It's digital—which helps no end with the easily overloaded sound of chorus voices, full of violent acoustic TIM, more than any orchestra at comparable signal levels. Digital copes!

Richard Westenburg and members of Musica Sacra



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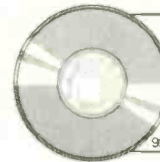
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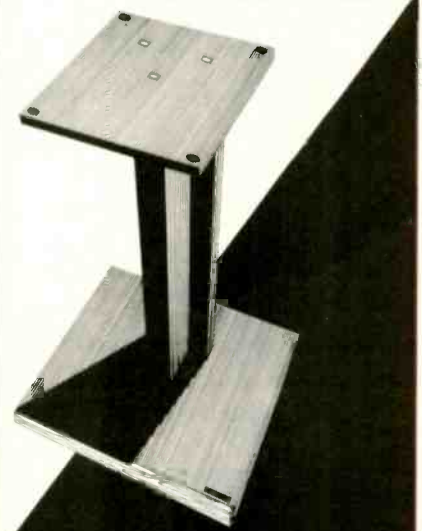
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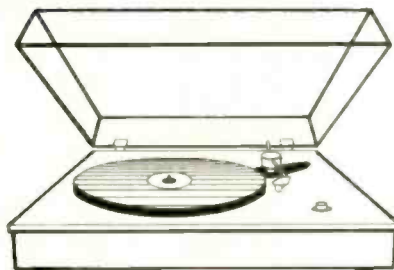
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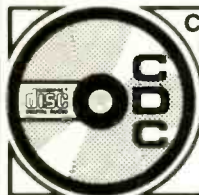
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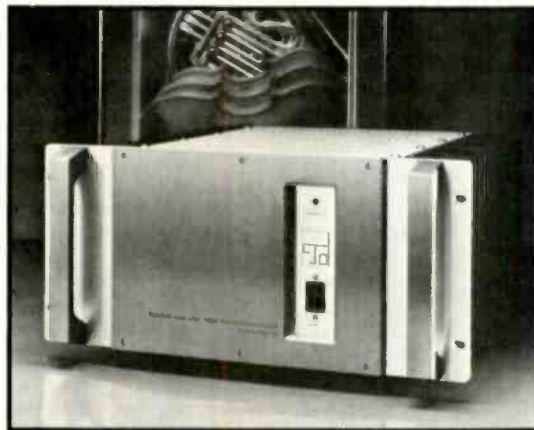


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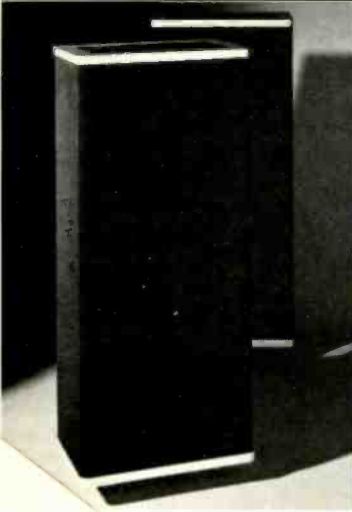
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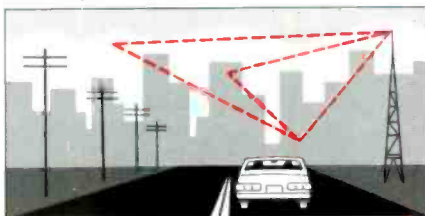
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