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TESTED

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Reference Standard Designer Series

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Infinity.

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Reference Standard Plate System



Reference Standard Amplifier Series



We get you back to what it's all about. Music.



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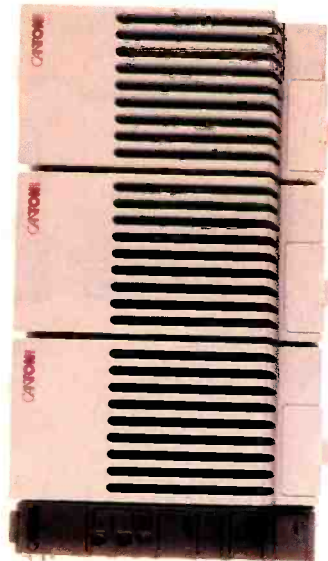
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Excoriated Example

Dear Editor:

I agree with the general theme of Robert DelGavio's letter, "Opening Musical Minds" (November 1988), but I must take issue with the example he used to make his point. In his comments, Mr. DelGavio compares the digital medium to a film negative. I can hardly imagine anything more analog!

The film negative is created by photons of light striking a chemically treated surface (film), thereby altering the chemical composition of that surface. This is very much the same as inscribing an electrical waveform into a physical medium, or "cutting" a phonograph record. Much like the phonograph record's noted fragility, the film negative can warp, yellow, or crack with age.

The digital equivalent of this process is to store the image as an array of computer data, or to "digitize" the desired scene. As with digital audio, the data may then be stored in a variety of media, without fear of degrading the picture quality. Once a scene is digitized, the computer may also modify the data, if desired. The realism and uncanny detail with state-of-the-art computer animation is something we now almost take for granted.

While I appreciate the beauty of the early Disney "analog" animation, I wonder what such an artist could have done with a Cray animation work station. Today's recording engineers and musicians have the same brilliant and exciting opportunity. Let science and art combine to benefit us all!

Tom Larsen
 Electrical Engineering Student
 Oregon State University
 Corvallis, Ore.

Page's Turn

Dear Editor:

Michael Wright's review of Jimmy Page's *Outrider* album ("Rock/Pop Recordings," January) was such a refreshing change from all of the other critiques I've read that I had to write and say thanks. Too many people who definitely know better expected Page to burst forth with the 11th Led Zeppelin album, all by himself. Thank you, Mr. Wright, for stating the truth flat out: Page, without question, branded the Zeppelin sound with his production and playing, but there were three other

guys present and doing their jobs. I only hope that with Page's next solo venture, other critics will stop slamming him for not doing something that is absolutely impossible—achieving the complete Zeppelin sound single-handedly. Other critics should take a good, hard listen to the pure gold pouring from their speakers.

Chelle Krueger
 Austin, Tex.

Sound Proof

Dear Editor:

In the March "Audioclinic," a reader stated that from 1960 to 1965, his Motorola hi-fi sounded "superior to live music" ("Old Is Better?"). He was listening to *euphonic* music. I duplicate this sound every day by playing records produced prior to about 1967, which were made with tube recording equipment. (A new Sheffield record could also be used.) The records must be played back with *all* tube equipment. I have told people that music recorded prior to 1967 sounds better than live music, and sometimes they accuse me of hearing loss. I invite them to my house to listen, and afterwards, some agree that euphonic music really does sound better.

Tony Mauldin
 Lewisville, Tex.

All That Sizzles

Dear Editor:

Gordon Pyzik ("Signals & Noise," March) objected to what he sees as the neglect of rock and pop recordings as viable program sources in *Audio*'s equipment reviews. He's right. A competent loudspeaker reviewer does neglect rock and pop music, with good reason.

We tend to forget that the "fi" in hi-fi stands for fidelity. Hi-fi hardware purports to be accurate. The one component that chronically falls short of the goal is the loudspeaker. A reviewer both measures and listens to a speaker in order to form a judgment of its accuracy—its fidelity to the source. In this context, electric guitars, synthesizers, and a good deal else in pop's armamentarium simply won't do, since much of this stuff cannot exist beyond its own electronics. The reviewer needs to listen to recorded music of the acoustic, rather than electronic,



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realm in order to form an opinion of a speaker's ability to mimic extra-electronic musical life. Further, the great majority of rock and pop recordings are laminations—overdubbed artifacts which, but for the recording studio, would never have come to life. For this reason, they remain of marginal usefulness in a speaker's assessment.

I rather suspect Mr. Pyzik likes his system to sizzle and boom. More power to him. I also suspect that he'd find any speaker I like something of a dis-

appointment. In this, too, I wish him well. The audio world is large enough—and sufficiently motivated—to accommodate both of our aspirations, so long as it remains clear what each of us requires.

Mike Silverton
Brooklyn, N.Y.

Carver's Class

Dear Editor:

I recently purchased a pair of Bob Carver's Amazing Loudspeakers—no

small feat, considering Canadian prices for audio equipment. From the beginning, I had trouble equalizing the speakers, which was traced to a burnt-out capacitor in the crossover. This was taken care of by the place of purchase, where my warranty was honored with same-day service, including pickup and delivery. For six months, I fully enjoyed these excellent speakers—until the ribbons began malfunctioning in the extreme high frequencies. Again, they would have been re-

CODA



IRV DEMSKY

Irv Demsky, well known to CES show-goers as the glib, cigar-chomping, bulk-subscription salesman in the *Audio* booth, died of heart failure early in October of last year at the age of 76. He had had several episodes of heart difficulty during the previous six months.

For more than two decades, he was called "The Last of the Old-Time Roadmen" by associates at the four publishing houses which have owned *Audio* during the period. It was a tribute to his talents and the difficulty of his chosen profession. As an over-the-road, bulk-sales agent, he literally lived in his car, visiting hi-fi store owners throughout the Lower 48 states and Canada, on a 12-month-a-year basis. His job was to find, and attempt to sell subscriptions to, local

hi-fi stores, as well as any other magazine outlets outside the well-known, but narrow regular distribution channels. It was the ultimate in cold calls, the very most difficult form of task for a salesman. He not only had to generate the initial sales lead, but to sell the audio store owner a score or more of issues that were to come each month for a year. At best, magazines about the hobby are tangential for such a store owner, but Demsky had many accounts where the monthly draw was 100 or more and a few of 1,000. He made a living at it, and at one point was credited with nearly 15% of the total issue sales and more than half of the single-copy sales.

At one time, there were many such magazine salesmen, though most usually worked in a local area, sometimes even just in a single town. Students and Scout troops always competed for single-subscription sales, while dealing with most newsstand vendors was a rough-and-tumble adventure. Ultimately, the over-the-road, bulk-subscription salesman faced extinction at the hands of the much more efficient direct-mail subscription agencies, which could essentially put their gasoline money into fancy printing and computerized list keeping.

Used Cars - Whiskey - Manure - Nails - Land
Fly Swatters - Racing Forms - Bongo Drums
Magazines Sold - Bar Mitzvahs

IRVING DEMSKY

Wars Fought
Governments Run
Bridges Destroyed
Uprisings Quelled
Revolutions Started

Tigers Tamed
Saloons Emptied
Orgies Organized
Virgins Converted
Computers Verified

Beyond four grandchildren—Bryan, Alan, Naomi, and Daniel—Demsky doted on vintage automo-



biles; his current heartthrob was a 1965 Imperial, red with big fins. He once called it a cruise ship for the highway. It was equipped with an electronic device which would play any of 22 songs at the touch of a button. There was a plaque on the dash which had engraved on it the Rotary Club's Four-Way Test: 1) Is it the truth? 2) Is it fair to all concerned? 3) Will it build good will and better friendships? 4) Will it be beneficial to all concerned? His oldest grandchild, Bryan, would sometimes go on road trips with Demsky and liked to follow his grandfather's progress on a map of the North American continent. Bryan would put blue-headed pins where he had been with his grandfather, while yellow pins showed the towns from which his grandfather had sent a postcard.

Demsky is remembered by his son, Paul, and daughter, Janis, as a very friendly, gregarious man who loved calling on and getting to know people. Both traits, along with a strong moral fiber and intuitive sense of right and wrong, left a strong impression on those he visited in his job. *E.P.*



Even as the prices of luxury cars go sky-high, Sony brings luxury car stereo down to earth. Introducing the CDX-R77, Sony's most affordable car compact disc player ever. At this price, your CDs at home needn't be home-bound any more. Now you can enjoy their rich, dynamic sound wherever you drive. Sony's stirring CD performance gives the automobile a new type of mobility. Upward mobility.

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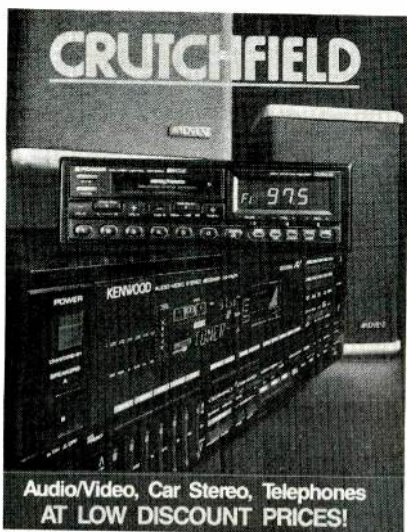
With Sony car CD players at prices like these, it's easier than ever to travel first class. So before you buy your next car stereo, audition the Sony CDX-R77 and CDX-R79. Your ears will convince you: anything less is just pedestrian.

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SIGNALS & NOISE

paired but I wanted them replaced, which prompted me to write the Carver Corporation, explaining my disappointment. I got a prompt reply from Bob Carver himself, stating that he was sorry for my inconvenience and, yes, my speakers would be replaced. He added, however, that he wanted to take several steps beyond what was required by the warranty, and replace my speakers with yet-to-be-released, top-of-the-line models. These boast many improvements and carry a much higher price tag. Since then, at my request, I have received another personal letter from Bob Carver, including specifications, literature, and shipping instructions.

I think the first-class and personal treatment I received from Bob Carver is to be commended. Other audiophiles, like myself, can take heart in knowing companies like this do still exist.

J. J. Hargreaves
Hamilton, Ont
Canada

Platters Matter

Dear Editor:

I am appalled by the cover of the October 1988 Annual Equipment Directory. Because the turntable is still the prevalent source of audio reproduction used in most homes in this country, I find it incomprehensible that a DAT recorder is pictured. How many of your readers own one or plan on purchasing such a unit in the next 12 months?

What is more amazing is that this happened last year too.

Andreas Daniel
Massapequa, N.Y.

Warranty Worth

Dear Editor:

It has occurred to me, and to a sizable number of my audiophile friends, that the matter of transferrability of warranty is an important fact to know. It is apparent that some manufacturers do not always specify this on their warranty card. With the amount of trading, swapping, buying, and selling that goes on in hi-fi, a list of manufacturers who allow this transfer would be extremely useful information. Such a service to your readers, even published on a yearly basis, would endear you to

the hearts of many. I've never seen this data offered by any audio publication. Just an invitation to manufacturers to respond to this question would be welcome.

Richard A. Hathaway
Los Angeles, Cal.

Editor's Note: This suggestion appeals greatly to me, but I think it will be hard to implement. If there are other readers who would like this data, please write. We're also thinking about an owner's survey à la the car magazines. Opinions, please.—E.P.

Rental Case

Dear Editor:

Regarding January's "Behind the Scenes," Bert Whyte mentions that the rental of CDs, not to mention records and audio cassettes, is illegal in the United States. Here in Canada, we are privileged in that CD rentals are legal, and the business is booming.

When video came out, the major studios fought the idea of rentals. The fact that the movie industry was saved by the rental market—not wiped out, as they had predicted—should teach the RIAA something. CD rentals can be directly compared to video rentals. People rarely buy "one-hit wonders," mainly because of the cost of the disc. That is one of the reasons why I started my company, which rents Compact Discs and players. Our emphasis is on "try before you buy." The average person may now rent not only their "one-hit wonders" but also CDs they have never heard of. If they like what they hear, they may buy it; they would never have purchased it otherwise.

People can now eliminate poorly recorded discs and select the version they like best. For example, we have eight versions of Beethoven's Ninth Symphony, and we have found that customers will rent three or four before deciding which to purchase.

If the RIAA cares about all recording artists and not just the top 10, they will let the law expire in 1989. Should this occur, and we hope it does, we will be franchising in the U.S., as we are currently doing in Canada.

Michael Ruge
President, Rent-A-Disc-Inc.
Kitchener, Ont.
Canada

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Include the new Revox Duetto speaker system with the B200-S Series for matching style and elegance. This remarkable new compact speaker is designed to blend easily into your living environment, yet it offers sound quality that will astonish you with its size, depth and clarity.

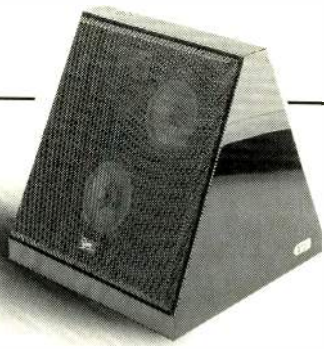
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AUDIOCLINIC

JOSEPH GIOVANELLI

Tuner Leakage

Q. I have a problem that I can't solve. When listening to various program sources (other than my FM tuner), I hear a faint trace of signal as a background. Experiments have proved to me that these signals are produced by my tuner. It strikes me as odd that when I'm listening to my tuner, no other program sources leak into my FM reception. What gives?—Gary Kufchak, Downey, Cal.

A. Did this condition always exist? If so, it may be that the tuner produces so much output signal that some gets into the desired program source. In this case, no leakage would get into your tuner signal because your tuner's output is so much greater than the leakage signals that they are not heard. If this is so, and if your tuner has an output level control, turn that control down a bit and see if the leakage is still present. Aim for a control setting which produces no leakage but still provides sufficient volume when you want to listen to FM.

Another likely explanation is that only your tuner is still on and producing signals when you're listening to something else. Whatever the cause, turning your tuner off will solve the problem.

Usually, an amp is provided with a means by which signal leakage is suppressed. This consists of a set of contacts mounted on the program-selector switch; their purpose is to short-circuit all inputs except the one actually being used. Clean the contacts on the program-selector switch with a suitable cleaner. Unless the switch is just plain worn out, the short on the unused inputs should now have a lower resistance and, hence, do a better job of suppressing leakage. If the short were not present, signals could be coupled capacitively between switch contacts, creating the leakage.

Surge Protectors

Q. What is a surge protector and why do I need one? Or do I?—Jimmy Edwards, Greenville, N.C.

A. A surge protector is a device which is plugged into a wall outlet, with the equipment to be protected then plugged into it. This is the most common form in which these devices are sold, but they are often built into power strips.

Under normal conditions, the protector does nothing. When the power-line voltage rises above some specified value, the device draws current to such an extent that the voltage drops, keeping the line voltage at safe levels. Current continues to flow until the surge of voltage has passed. Because surges are very brief, the protector can draw many amperes without being destroyed. If, on the other hand, the over-voltage continues for any length of time, the protector itself will fail, forming a short-circuit, and blow the house fuse. The protector will be irreversibly damaged, but it will have saved the equipment connected to it.

If this scenario is played out, you would want to measure the power-line voltage to be sure that it is within proper limits before reconnecting your equipment.

These surges do occur quite often as a result of the utility switching generators or rerouting its power load. More and more devices in audio equipment can be damaged by over-voltage. Thus, a surge protector placed on sensitive equipment may well be worth many times its low price.

Overhead power lines are subject to being struck by lightning, which definitely can produce surges. Of course, even a near-miss will be sufficient to damage the protector and the equipment connected to it.

Loudspeaker Destruction

In a previous "Audioclinic," a reader stated that he kept damaging the passive radiators in his speaker systems and asked what the cause of this might be. His problem may have resulted from high listening levels (as you suggested) combined with the lack of a subsonic filter. As I am sure you know, speakers with vents or passive radiators are especially sensitive to subsonic signals. Thus, it is possible that eliminating subsonic signals from his amplifier may prevent premature speaker overload.—Ralph Gonzalez, Philadelphia, Pa.

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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TAPE GUIDE

HERMAN BURSTEIN

Adding HX Pro

Q. Is it possible to have Dolby HX Pro circuitry installed in an existing deck?—Kevin Lloyd, Brooklyn, N.Y.

A. Although not altogether impossible, installation of Dolby HX Pro circuitry, which varies bias supplied by the bias oscillator inversely with the program material's high-frequency content (which also acts as bias), is not feasible in typical situations. It would require someone with a high level of technical knowledge and with access to the special chips employed for HX Pro. It is not a project for the average, or even the above-average, home-electronics service shop.

If you were able to add HX Pro to your deck, I doubt that you would find the results commensurate with the effort and expense. Keep in mind that while a number of superior cassette decks utilize HX Pro, some of the very best do not.

Recording from a Turntable

Q. I recently acquired a cassette deck and a turntable, but I have found that I cannot connect the turntable directly to the deck. Why?—Jaime Nicolas, Cedarhill, Tex.

A. In order to properly reproduce the signal from a magnetic cartridge that is playing a record, a great deal of amplification is required, as well as equalization consisting of bass boost and treble cut. To my knowledge, such amplification and equalization are never provided by a home tape deck. Instead, these are ordinarily provided by the phono section of a preamp. This preamp may be a separate unit or it may be part of a preamp/tuner combination, an integrated amplifier (preamp plus power amp), or a receiver (tuner, preamp, and power amp).

Print-Through Sound

Q. Sometimes on playback of material I have recorded, I hear the sound very faintly before it actually starts fully, and when the tape recording or a section of it is finished, I hear the ending very faintly. I think it is pre- and post-echo. What causes this, and what can be done about it?—Wade Marshall, Chicago, Ill.

A. The echoes you describe are due to print-through—namely the transfer of the signal on one layer of

tape to the next layer. The thinner the tape (and the longer the playing time), the more likely it is for print-through to be audible. Hence, you are more likely to encounter print-through with a C-90 than a C-60 tape. Recording level is a factor, so that reducing the recording level a bit may help. However, such a reduction decreases the S/N ratio. On the other hand, if S/N is quite high to begin with—say, more than 70 dB with Dolby C NR or more than 80 dB with dbx NR—the reduction in S/N may not be noticeable or objectionable. Some brands of tape may be less susceptible to print-through than other brands. Going from Type I cassettes to Type II or IV may help.

Automatic Level Control

Q. My question concerns cassette recorders which contain a.l.c. circuits but no manual control of recording level. Why are such circuits built into most portable and some home decks? I can understand the reasoning if the deck is to be used for speech or dictation, but if the recorder is to be used for high-quality taping, this makes no sense to me. Is this merely an economic move to avoid the cost of a recording level control? Would the cost of installing a manual recording level control be prohibitive, if possible?—Todd Michael Spencer, New Orleans, La.

A. I think that you already recognize the reasons for a.l.c. circuits in lower-grade equipment—economy and user convenience. While some circuits work better than others, they are generally not recommended for high-quality recording. I suppose one could, with considerable effort, install a manual record level control, but I don't think this is worthwhile, considering the overall quality of the deck in question. You would not only have to install a suitable control (potentiometer) but also a record level indicator and circuitry to drive the indicator properly, providing fast, accurate response on sharp transients and slow decay so that the eye can follow. 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.

G & S A LA CARTE

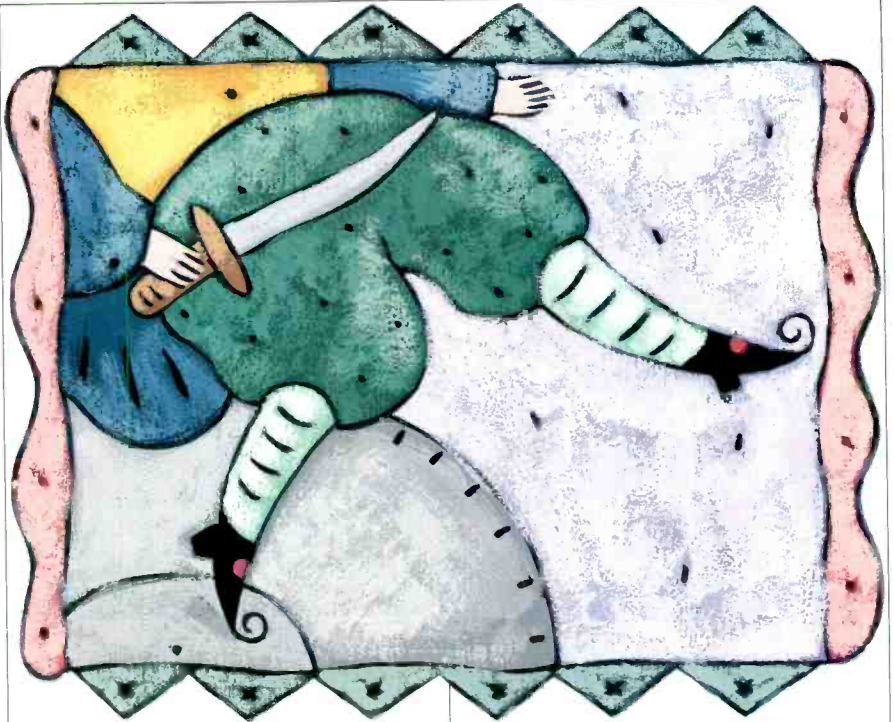
The G & S bug—neither virus, fungus, parasite, nor bacterium—is utterly endemic after a century in the English-speaking countries, and maybe elsewhere, too. If you can speak English, you can catch it. The ultimate means of exposure, the only real exposure, is via audio. *Records*, if you insist. Audio is the sole source today for authentic G & S, and now it is on CD! A first-rate example of audio history.

Like the flu virus, most of the earlier variants of the G & S tradition still persist in a wealth of recordings, and they return, newly potent, with each new audio medium—for new generations of speakers of English to be exposed. The catching of the G & S bug, on CD via Arabesque, was never so easy.

What? In this day of the alphabet galore, you do not know what G & S means? *Gilbert and Sullivan!*

G & S is that series of comic operettas—a dozen or so from the 1870s into the 1890s—in which were combined, in London, England, the work of three wildly diverse talents to create what no one of them could possibly have managed by himself. Those talents were: Sir William Schwenk Gilbert, an imposing versifier of sing-song satirical poetry (*Bab Ballads*) and satire; Sir Arthur Sullivan, dignified composer of much unctuous church and ceremonial music and even a monumental grand opera, and Richard D'Oyly Carte, an English producer (in spite of the name) who made G & S into the equivalent of a long-lasting Broadway show and even built a theater for it, the Savoy (hence the nickname "Savoyards" for G & S fans).

For a century, the D'Oyly Carte Opera Company tried—and failed—to keep its G & S property exclusive, both the scores and its theatrical productions, by copyright or any other means available. But legalities leaked and the bug got loose; it was carried away by unscrupulous promoters, especially in America, until the barriers were mostly demolished and G & S was everywhere, authorized or not. The D'Oyly Carte interests would not give up. Their authorized productions went on, generation after generation, along with more and more extensive recordings. The company died, at least in its staged productions, as recently as the



early 1980s, just yesterday. No new recordings can now carry that famous old name.

Please note the astonishing parallel between D'Oyly Carte and Richard Wagner at Bayreuth during the very same century (see this column, February and March). Wagner too, his own promoter, built a permanent theater and tried hard to keep his music exclusive for the Bayreuth Festival. After his death, the business was carried on by his second wife, his son, and then by two grandsons. D'Oyly Carte's company was carried on after his death by *his* second wife, and in turn by two sons. The grim difference is that the Wagner enterprise still flourishes. D'Oyly Carte is gone—so recently.

There is nothing quite like the true G & S sound. After so long, its ever-so-precise styling in voice and word is unlike any other existing opera sound today—light or heavy, pop or classical (it is neither). That styling, which so titillated the Victorian audiences, is so much a part of the operas as to be almost the sense of the whole—it is the style, even before the content, which first hits the susceptible, today or yesterday. Audio preserves it, as the printed music and texts cannot. Audio is the prime source for all of us.

I caught the G & S bug early. It is the very young who fall hardest for this delightful, preposterous, tuneful satire. At age 10, most of us discover that words and ideas can be juggled for fun. We scream with laughter over "jokes" by the bookful ("When is a door not a door?" "When it's ajar." *Ha, ha, ha, ha!*) And thus is born sophistication. G & S picks right up, perhaps five or six years later if the bug strikes opportunely. Was anything ever so marvelously funny? At 15 or so, we positively roll with joy and excitement, especially if we are *participating*. So sophisticated! So arch, so full of double meanings and pretty conceits, so *veddy* British, withal! The patter songs, at high speed! We all tried them. ("I am the very model of a model Major General . . ."). The sentimental love songs, the laments and dire plottings—of *Little Buttercup* or *Jane*—they are the same in every opera. Such floods of precision words without so much as a breath, such rapturous musical sighing of innocent maidens (me reacting at 15!), such splendid choruses. . . .

I sang in the chorus. It was an all-school cast, students and faculty (who took the lead parts, in tune or out), and it almost killed me with joy. I was a Juror. In *Pinafore*, I was a doughty sail-

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The D'Oyly styling of Gilbert and Sullivan hits the susceptible before content. Audio preserves this as nothing else can.

or. A production such as you'd never believe—or so we thought. Rehearsals went on for weeks, to the disruption of schoolwork, and then on a climactic evening came the performance. Oh, to be an adolescent again.

But before all that, there were hours of preliminary buildup—the records of

the music we would sing. Where else do you think we could get our inspiration, virgin-pure? Our wonderful music teacher, Ernest Kitson, who carried on with school-age G & S for long years after, had bought a batch of the operas in the old reddish-brown 78 Victor albums. (They must have been originally

HMV in England, the outfit that has evolved into the present EMI.) Each album contained five or six or more glistening Red Seal 12-inch shellacs, and these we played in Kitson's school music room or in his study off-hours, on the latest Orthophonic phonographs, of which the school (thanks to him) owned several. These recordings were, needless to say, D'Oyly Carte, and they were brand-new. One of them, I now discover, was recorded just a year before our first G & S show. Yes, this was a long time ago. These albums were electrically recorded, right at the beginning years. The earliest on Arabesque, I see, was done in 1926.

Can you imagine it? I am now listening to those very same sounds—all, of course, seamlessly joined together and immensely improved for the CD format. There's room for an opera and a half, or equivalent, on each two-disc release. It's hard to believe! I was *there*, in audio terms, just 60 years ago. Now I am *here*. Though my acute case of G & S didn't last very long, every measure of the music today makes me acutely sensible of the way I then felt about it. Call it personal audio history.

To be sure, there were certain other G & S events in my life. Even earlier, as a small boy en route from home to a school in French Switzerland, I stopped off in New York, with my family. We went to *The Pirates of Penzance* (D'Oyly Carte, of course), as noted in my childhood diary which, luckily, had not yet lapsed into unintelligible French, as it did when I got to my new school. That was on February 4, 1927, and the temperature that day varied from 24° to 45°. My diary was mainly concerned with meals, hotels, and the weather, and my comment on *The Pirates* was simple: "It was wonderful." The seed was sown; the bug was at hand. I had heard the real thing in the actual flesh.

As you may guess, with increasing old age—I mean late-teens and on into the 20s—G & S began to fade for me under my growing sophistication, or so I felt. It was childhood stuff and I was newly adult, what with college studies and a new life. Soon, my phono was playing Handel Concerti Grossi and the Bach B Minor Mass, and G & S



HARVARD UNIVERSITY

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671 Holyoke Center
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(617) 495-2371

January 11, 1989

The Family of Edward T. Canby
Box 154
Town St
West Cornwall CT 06796

To the Family of Edward T. Canby

We were saddened to learn from The Class Report Office of the reported death of Edward T. Canby, AB 1934. Ma. 1936.

In order that his record in our permanent files be updated properly, we would appreciate receiving from you—at your convenience—the information specified below. Would you be so kind as to then mail this letter back to us in the enclosed stamped envelope?

We are most grateful for your time and consideration in this matter.

Sincerely,


Gwenette I. Kangis
Manager, Alumni Records Office

Dear Harvard,

Like Mark Twain, I must report that the news of my death is exaggerated. I am still here.

I am also saddened to learn that you do not know of my second degree, M.A. in Music, which I received after two years of work and a year of residence at Harvard in June of 1936.

Please include this information in your next death notice.

Edward Tatnall Canby
January 19, 1989

Date of Death: _____
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Place of Death: _____
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Next of Kin: Courtlandt Canby, '36

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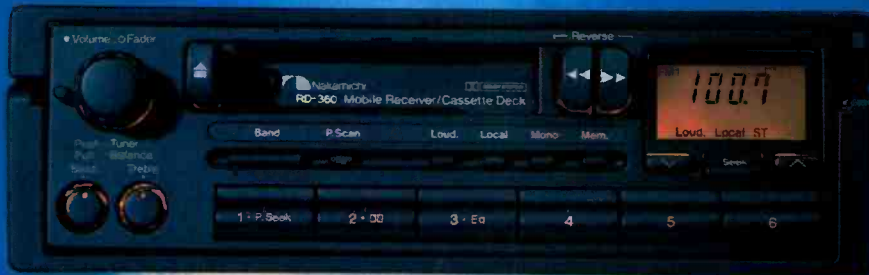
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With increasing old age—I mean late-teens and on into my 20s—G & S began to fade for me under my growing sophistication, or so I felt.

was definitely unthinkable. So, a hiatus. A total blank, for years, while I continued to get even more sophisticated. Or so I felt. In my three seasons of teaching music at Princeton, I remember not a single note of G & S. Music Appreciation did not incorporate such trifles. And in the succeeding four

years, teaching in New York, it was the same. Mozart's *Don Giovanni*, yes. But please, not *The Gondoliers*. G & S would have vanished for me except for one special thing.

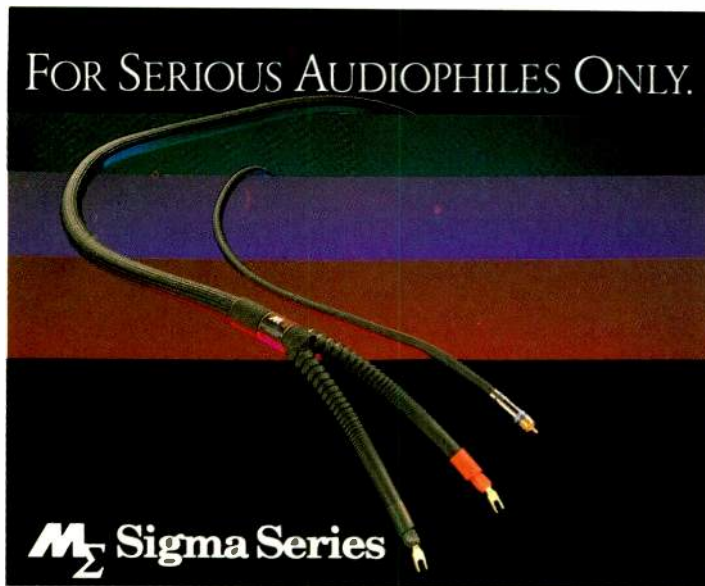
When, earlier, I had transferred from one university to another in my sophomore year, I was able to inject myself

into the then-famed Harvard Glee Club, famed because it was the first, and at that time, the only such club (or so they said) which was devoted to real "classical" music. We sang 16th-century sacred works by Victoria and Palestrina; we did the B Minor Mass of Bach and the Brahms Requiem (with a bit of help from our musical friends in the Boston Symphony). We even took on such as Gustav Holst and Ralph Vaughan Williams, England's best. Again, I was in a new musical heaven but, of course, on a much more exalted scale, being a grown-up man, all of 19.

Our conductor was the well-known Archibald T. Davison, who had us all almost literally hypnotized with his little gimlet eyes and extraordinary personality. Again, I practically wept with excitement when we sang in public—thanks to his charisma and the fancy music.

It was a mild shock, then, to discover after a few months in such an elevated musical surround that "Doc," as we called him, was a G & S nut. In a very special way, however. He arranged vast portions of the operas for all-male chorus (the Glee Club was all male), with occasional solos. He did the same for the sacred music we sang. This widened the G & S repertoire no end for us kids, since now we could sing not only the male choruses but also the ladies' parts! But even better were Dr. Davison's incredible four-hand piano arrangements of the G & S accompaniment, the orchestral music. They were brilliant, splendid, scintillating. Whole overtures were even included, and they brought down the house at every playing. We always had two Glee Club piano accompanists; they did the G & S in spectacular fashion as student members of the college Music Department.

With those piano spectaculars, I caught the bug again. In modified form—just for our yearly Glee Club Davison arrangements. The pianists were my student friends in the Music Department, whose finger skills had me in absolute awe. One of them, by the way, was the composer (later on) Irving Fine, who died in the '60s. His dry, often humorous choral music has a definite touch of Dr. Archibald T. Davison in it. Somehow, I managed to keep my sophisticated contempt for



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The G & S 78s were still around, getting scratchier as the die-hards played them over and over in the transports of ecstasy.

the original operas themselves, which I deemed inferior to our Davison versions. Such is youth when it thinks it's grown-up. The operas were kid's stuff, said this college man.

After all that, I became a record reviewer, before this magazine began. I have absolutely no recollection of any

new Gilbert & Sullivan during those pre-war years, with Hitler rising and war on the horizon. I am surely wrong. There are D'Oyly Carte recordings, with Isidore Godfrey at the helm, on into the 1930s. I didn't hear them.

Obviously, there were no new updates during the long war years and

for a while afterwards. So the G & S bug went underground or became dormant, as every sort of virus, fungus, parasite, or bacterium can do. The old 78 albums were still around, getting scratchier and scratchier as the die-hards played them over and over in the familiar transports of ecstasy—some people never recover, you understand. Amateur groups all over the place put on their versions—some expert, most extremely shaky—and in due course, most schools retired G & S in favor of headier stuff, the ubiquitous musical, now the staple fare for hundreds of school music departments and for entirely too many adult operations that should aspire to higher things. There is no limit to the height of a good G & S production! That is, if you have learned the tradition.

Alas, I had a rude awakening after the LP was well established, many years later. Suddenly, the mail brought me a brace of brand-new LPs of Gilbert & Sullivan operas—from the D'Oyly Carte Opera Company! Could it be? Had time reversed? I could hardly believe it. So long had it been, as least in my experience.

I do hate to have to say so, but these recordings, still extant, were for me a severe shock. *This wasn't G & S.* The musical notes were there and the words—even some extra material, thanks to LP length. But what I heard was wholly alien, D'Oyly Carte or no. Something dreadful had happened.

The sound was standard present-day opera, picked right off the list of celebrities of the time. They sang like Verdi, like *La Bohème*, like Richard Strauss, like anybody but G & S—as I *knew* it had to be sung. Had D'Oyly Carte lost its ancestral memory? Indeed it had. The long tradition was dead. Only the notes and the name remained.

I suppose I should forbear identification. I can't. All the big older recordings were presumably by way of His Master's (splendid) Voice, British HMV, brought to the U.S. on Victor or RCA Victor. These new LPs were from English Decca—London, as sold over here. Rivals! The London label D'Oyly Cartes were, I can only suggest, like the Los Angeles Dodgers—uprooted, in alien territory. Could this perhaps be an explanation? **A**

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BERT WHYTE

HALL MARKS



Recently, I have been discussing recording techniques for classical music, and the vital importance of the hall in which this music is recorded. The acoustical characteristics of a hall are, of course, the primary concern of a conscientious recording engineer. Unfortunately, in many cases, the engineer usually cannot have "the best of all possible worlds" in his choice of a hall. There are many factors involved.

In a given city, the local symphony hall may be an acoustic horror—even though the musicians like to perform in it. On the other hand, the hall may have excellent acoustics for recording, yet it may be located in the busy, downtown heart of the city, so too much external noise intrudes into the hall. This is the situation with the great Kingsway Hall in London, an acoustic gem where, over the years, thousands of great recordings have been made. The external traffic noise has gotten so horrendous that London/Decca can no longer use Kingsway Hall for recordings. Interior noise can also be a problem. Heating and air conditioning systems can easily add a whistling or whirring noise to a recording.

Assuming an orchestra's own hall is not suitable for recording, the engineer

may know of a satisfactory alternative, located a considerable distance away from the local hall. However, the expense of transporting the musicians and their instruments to the distant hall will probably arouse the ire of the orchestra's finance committee.

Another problem that often plagues recording engineers is a hall that has wonderful acoustics when it is full of people during a performance, but less satisfactory acoustics when empty—as is the case when making a recording. Needless to say, there is the obverse of this, in which a hall is great for recording, but not optimum for concert performances.

For all its size and importance in the world of classical music, New York City is woefully lacking in halls suitable for recording a full symphony orchestra. I have noted before that Carnegie Hall is cursed with low-frequency rumble from the subway trains that pass beneath it. Avery Fisher Hall is considered too dry by some of the companies who record in it, but I disagree. It is more a matter of mike technique. When I used the classic Blumlein coincident mike setup to record the Osaka Philharmonic there, the sound did not suffer from a lack of ambience. Of course, all this is really academic because both Carne-

gie and Avery Fisher are so incredibly busy with concerts that very little recording is possible.

In London, there is a somewhat similar situation in that practically no one records in the Royal Festival Hall, the Barbican Hall, or the Royal Albert Hall—partly because of the poor acoustics but also because these halls are in constant use for concerts. However, a recording engineer in London has many alternative recording venues with generally good acoustics. He can choose from the likes of the great Walthamstow Assembly Hall, Watford Town Hall, Fairfield Hall in Croydon, Henry Wood Hall, or EMI's Abbey Road Studio One, as well as churches such as St. Barnabas, St. Jude, All Saints in Tooting (much used by Chandos), and others.

Classical recording in the United States is on a fairly limited scale—as compared to in London and Europe—mainly because of the very high Musicians Union recording fees. Sad to say, most large-scale symphonic recordings in this country are made by foreign record companies. Here, classical recording is geographically linked with the major orchestras in key cities, coast to coast. Thus, Deutsche Grammophon and Philips record the Boston Symphony Orchestra in Boston Symphony Hall. In spite of their reservations about Avery Fisher Hall in New York City, this is where CBS Records does the New York Philharmonic, America's oldest symphony orchestra. At present, the Philadelphia Orchestra is sort of an orphan when it comes to a recording hall. No one uses Philadelphia's concert hall, the Academy of Music, for recording; for years, RCA used the Scottish Rite Cathedral in that city. Recently, the old, run-down, but acoustically good Metropolitan Concert Hall has been used for recording. However, in a couple of years, the Philadelphia Orchestra will have a new concert hall designed by famed acoustician Russell Johnson. EMI is hopeful that it will turn out to have good acoustics for their recordings.

Telarc has been recording the Atlanta Symphony Orchestra in that city's Symphony Hall for some years now. Telarc and London/Decca record the great Cleveland Orchestra mostly in Masonic Auditorium, although Sever-

Illustration: Jeffrey Muhs

ance Hall has been used for certain works. Telarc also records extensively with the Cincinnati Pops in the Cincinnati Music Hall. The Minnesota Orchestra has recorded in their somewhat controversial Orchestra Hall, designed by prominent acoustician Cyril Harris, who also designed Avery Fisher Hall. The new British Virgin Classics label is about to undertake a series of recordings in this hall, with Edo de Waart conducting his Minnesota Orchestra.

VOX, EMI, and RCA Victor have been recording the St. Louis Symphony Orchestra in Powell Hall—another Cyril Harris hall. Recently, RCA signed an exclusive five-year contract to record conductor Leonard Slatkin and the St. Louis Symphony Orchestra.

The magnificent Chicago Symphony Orchestra makes most of their recordings for London/Decca, with others for Deutsche Grammophon and EMI. According to what music is being recorded, and the techniques favored by the recording engineer, either the orchestra's own Orchestra Hall is used, or the nearby and more reverberant Medinah Temple. The Los Angeles Philharmonic records for Philips and London/Decca, and both companies favor the use of Royce Hall at UCLA.

The San Francisco Symphony Orchestra, with new conductor Herbert Blomstedt, now records for London/Decca in the new Davies Symphony Hall—again a controversial hall considered more suitable for recording than for concerts. It has a big advantage in having a new Ruffatti organ, the largest concert organ in the United States. This organ can be heard to good advantage in the Telarc recording of Jongen's "Symphonie Concertante," and the Philips recording of the Saint-Saëns Third "Organ" Symphony.

Friend and colleague John Eargle brings his special engineering expertise to recording the Seattle Symphony Orchestra in the Seattle Opera House for the Delos label. That is about the extent of major recording in this country, save for Pro-Arte recording the Utah Symphony Orchestra in a fine hall in Salt Lake City, and some recordings with the Denver and Houston Symphony Orchestras. Some recording is being done with David Zinman conducting the Baltimore Symphony Orches-



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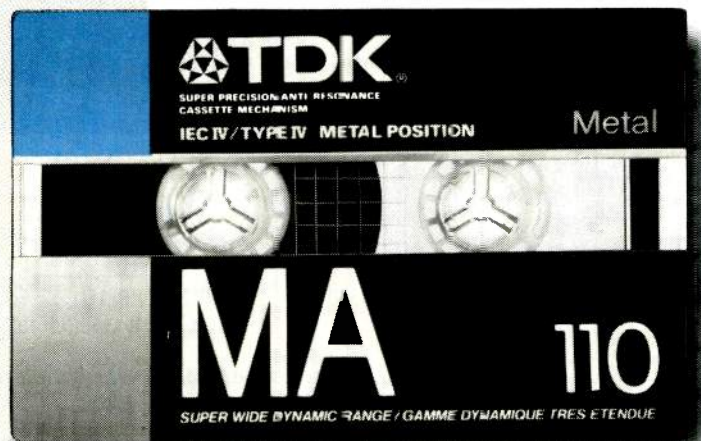
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tra, and many consider their new hall an acoustic gem.


Most recording engineers favor a particular microphone technique that enables them to make good recordings in a large variety of halls. Needless to say, they cannot be dogmatic or hidebound in their employment of

that mike technique, because every hall has distinctive acoustic characteristics which must be dealt with individually. For example, two recording halls might both have a 1.8-S reverberation period, but in spite of this similarity, you cannot very often use precisely the same mike setup. For instance, the

construction and configuration of one of the halls would give a frequency response that exaggerated the bass response, giving this hall a somewhat boomy characteristic; the other hall, however, with a different kind of construction and configuration, would attenuate the bass frequencies.

Once in a while, we get the rare opportunity to compare recordings of the same piece of music, played by the same orchestra, recorded in the same hall, but using different mike techniques. Such is the case with a recent release of Tchaikovsky's "Romeo and Juliet," performed by the Cleveland Orchestra under Lorin Maazel and recorded in Masonic Auditorium by Telarc, using their well-known spaced-array omnidirectional mike technique. London/Decca recorded the same music, again played by the Cleveland Orchestra in Masonic Auditorium, and utilized their famous "Christmas tree" mike technique. The comparison is interesting and instructive, as both techniques provided excellent recordings of this music. I think you will find that in spite of the different mike techniques, there are as many similarities as there are differences in the recorded sound. In other words, although differing mike techniques can provide good recordings, it is ultimately the acoustic characteristics of the recording hall that have the more profound effect on the perceived quality of sound.

Many recording engineers say "good halls are where you find them," and good recording halls are "happy accidents." Other halls, designed and built with all the armamentarium of modern acoustic science, turn out to be totally unsatisfactory—either as a concert hall or as a recording venue.

It is the considered opinion of many musicians and acousticians in this country that Boston Symphony Hall is the second best hall in the world—the best being the Grosser Musikvereinsaal in Vienna. Modelled after the famous Gewandhaus in Leipzig, which was destroyed by bombs during World War II, Boston Symphony Hall was the first music hall in the United States designed according to scientific acoustic principles. Built under the direction of William Sabine of Harvard, the hall opened in October 1900. 

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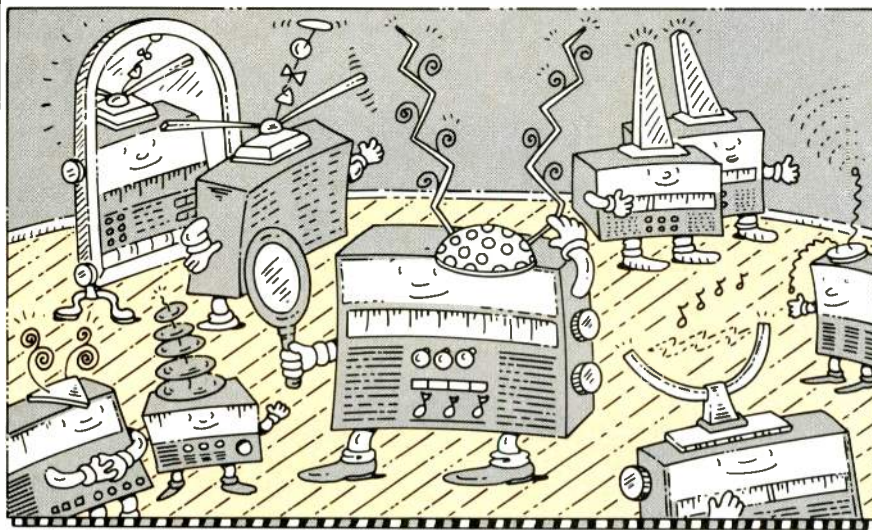
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MIXED SIGNALS

**FMX Haze**

FMX is the brainchild of a company called Broadcast Technology Partners, though its origins go back to the CBS Technology Center that was shut down a couple of years ago. According to its promoters, FMX reduces the noise associated with weak-signal FM stereo reception, making stereo transmissions almost as far-reaching as monophonic or single-channel FM. (For a detailed discussion of how FMX works, see "FMX: Long Distance Stereo, Clean as Mono," May 1986). Not so, say Professor Amar G. Bose and his associate, Dr. William Short. Their recent attack on FMX took place at the Massachusetts Institute of Technology, which endorsed the research project that led to these conclusions. In a tension-filled session attended by members of the technical press as well as graduate and undergraduate students and faculty members of MIT, Bose and Short presented their findings.

There were three parts to the presentation. First, Bose presented a mathematical analysis of the general

case of FM transmission. Simply stated, the analysis concluded that any time you add modulation components at the high-frequency end of the spectrum, performance must suffer if receivers are in an area where direct and reflected signals (multipath reflections) are present. For this and other reasons explained at the session, stereo FM suffers greater degradation than mono FM when multipath occurs.

Because FMX involves the addition of program components at the high-frequency end of the spectrum, Bose concluded from his research that FMX will not only yield poorer reception when received on specially designed FMX receivers but will also degrade reception quality for existing, conventional FM stereo receivers whenever multipath conditions exist.

For the second and third parts of the presentation, Short demonstrated results of both a computer simulation and actual field tests. Those attending the session heard added distortion, loss of stereo separation, fluctuating loudness levels, and increased background noise when FMX was

used. Admitting that under ideal conditions, FMX does tend to reduce background noise, as claimed by its inventors, Bose and Short maintain that such conditions are seldom realized—particularly in a moving car, but on home systems, as well.

An element of tension was added to the presentation when, during the question and answer period that followed, Emil Torick of Broadcast Technology Partners vehemently denied all of the conclusions reached by Bose and Short. Torick pointed out that FMX is currently being broadcast by approximately 50 stations with satisfactory results and asked, "How did we achieve 125,000 hours of broadcast time last year without a single complaint?" Torick noted that although the earliest experiments with FMX, conducted more than two years ago, did reveal some problems, the system has been modified and no longer suffers from those difficulties. Torick suggested that the transmitter used in the over-the-air tests by Bose and his colleagues was probably not adjusted correctly; he said that such a misadjustment would result in just the sort of added distortion demonstrated during the playback of tapes at MIT. Later, in a lengthy written rebuttal, Torick noted that the odds of encountering the extreme distortion heard during the MIT tape demonstration were something like 1 in 6.7 million! Furthermore, Torick maintained that since the major benefit of FMX is likely to be realized when listening to FM in a car, even if such an unlikely distortion level were encountered, better reception would be restored as the car moved a short distance in any direction. The MIT/Bose research project is sure to generate a great deal of controversy which only time and FM listener reaction will be able to resolve.

Leonard Feldman

Grammy Gripes

The classical Grammy awards are rapidly becoming the laughing stock of the recording industry. This year, for the second time in four years, the Atlanta Symphony walked away with five of the 11 classical awards. That's because this year, for the second

time in four years, the Atlanta Symphony and Chorus voted for their own recordings. It's all perfectly legal, according to the voting guidelines of NARAS (the Grammy sponsoring organization), and therein lies the problem. The classical membership of NARAS is far smaller than the pop

membership. When all 325 members of the Atlanta NARAS chapter vote for an Atlanta Symphony recording, that recording wins a Grammy.

"It takes very few votes to win a classical Grammy," CBS Masterworks Senior Vice President Joe Dash was quoted as saying in the *New York*

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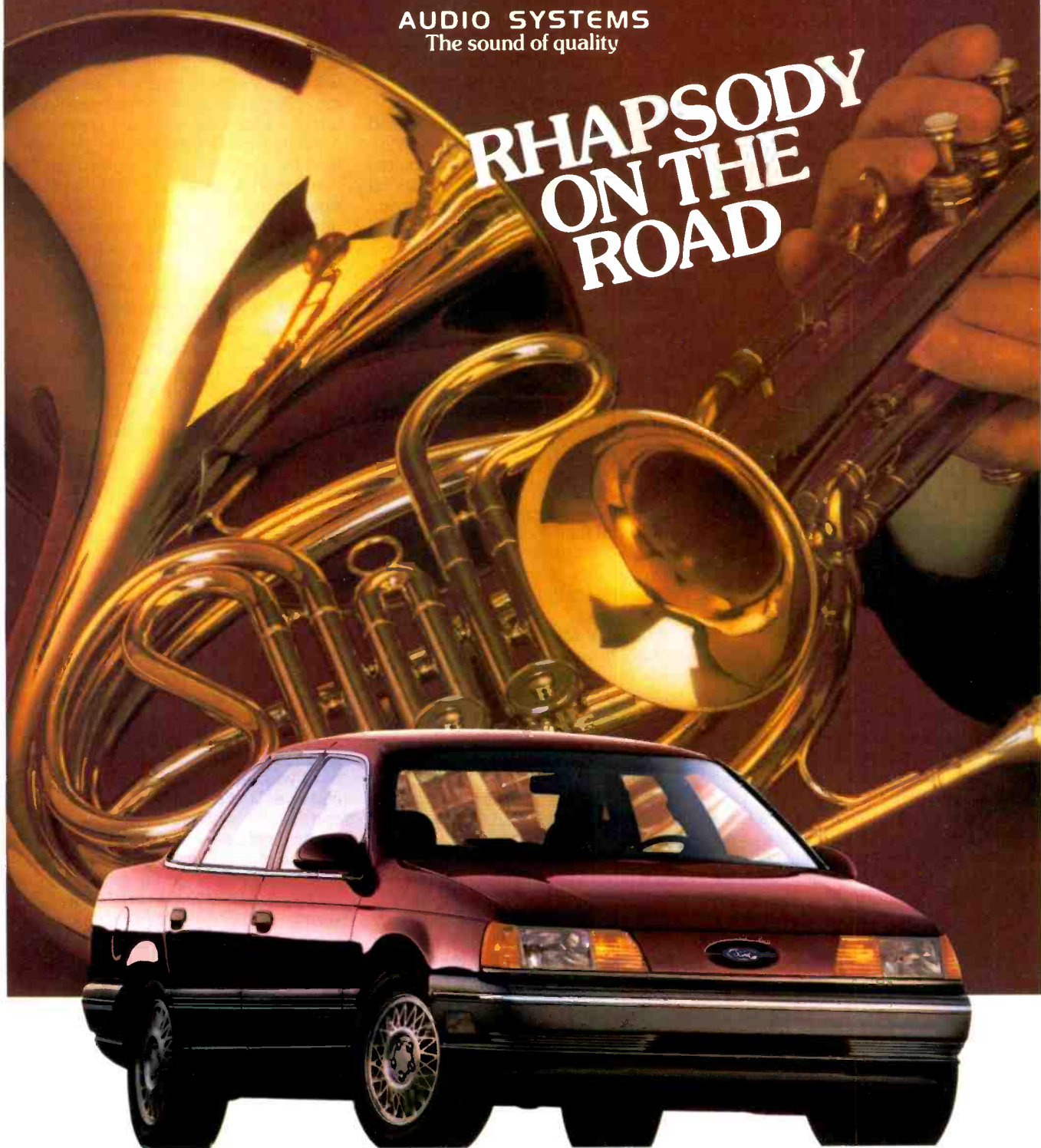
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Current NARAS rules let the members of Atlanta's orchestra vote themselves a classical Grammy, year after year.

Post. "What appears to be a blatant voting block makes a sham out of the Grammy process. NARAS should do something about it as soon as possible, before the value of a Grammy is reduced to zero." (The article appeared on February 24, two days after the awards for 1988 were broadcast on CBS television.)

"It's the next best thing to a national scandal," says Angel Records President Brown Meggs. "We now have a system in which the Atlanta Symphony is encouraged to join NARAS. Then its members are in a position to vote themselves a Grammy or 10 Grammys."

Most of the Atlanta members joined NARAS in 1985 when the local chapter, sorely in need of new members, launched a cut-rate, partial-year membership drive. Suddenly, for the first time in its history, the Atlanta Symphony cleaned up at the Grammy awards. (Neither the orchestra, nor the local NARAS chapter, nor the national NARAS office would tell me how many of the 297 members of the Atlanta Symphony and Chorus are also members of NARAS. Nor would anyone tell me how much of the total NARAS membership votes in the classical categories.)

This time, the Atlanta Symphony released only three recordings within the Grammy eligibility year (October 1, 1987 to September 30, 1988). Not so mysteriously, all three were nominated. Telarc's Robert Woods produced all three; Telarc's Jack Renner engineered all three. Guess who was named "Best Producer"? And "Best Engineer"? Woods and Renner—just as they were for 1985, 1987, and 1988.

"It seems odd," Dash said to the *Post*, "that since [1985], year in, year out, in the face of extremely important releases, the winner is always the Atlanta Symphony."

For 1988, the Atlantans' recording of Ned Rorem's String Symphony, produced by Woods for New World Records, was named "Best Orchestral Recording." The competition included Leonard Bernstein and the New York Philharmonic on Mahler's Symphony No. 2, Sir Georg Solti and the

Chicago Symphony on Bruckner's Seventh, and Roger Norrington with the London Classical Players performing Beethoven's Ninth. The Atlanta Symphony, as good as it may be, is simply not in a league with these ensembles.

The Verdi Requiem, performed by Atlanta and its chorus under conductor Robert Shaw, was voted "Best Classical Album." Here, the other nominations included Vladimir Horowitz, the Vienna State Opera and Philharmonic, and Bernstein and the New York Philharmonic. The Requiem release was also named "Best Choral Performance" and "Best Engineered Recording."

NARAS President Michael Greene, while not acknowledging that there is a problem, reports that this "interesting anomaly" of Atlanta will be reviewed by NARAS' Awards and Nominations Committee. "But the members of that committee are not as concerned about this as some other people, especially the press." Of course, it isn't just the press that's concerned. The classical industry, save Atlanta and Telarc, is up in arms. Any number of producers, engineers, and label executives have expressed their indignation to me privately. Unlike Meggs and Dash, however, they refuse to be quoted for fear of sounding like they are crying "sour grapes."

And what about the public? Doesn't NARAS have a responsibility to the record buyer who thinks, however naively, that a Grammy means The Best? "This record won a Grammy," goes the thinking enroute to the cash register. "We're supposed to be furthering excellence in the field," says Meggs. "It doesn't do anybody any good [for the Grammy] to have a total lack of credibility."

Woods, who makes it quite clear that Telarc had nothing to do with NARAS' 1985 membership drive, points out that Atlanta's situation is simply Grammy history repeating itself. "Early in the 1970s, the Chicago Symphony won year after year. But because it was who it was, nobody found anything wrong with it. I think everybody is angry now because it's the Atlanta Symphony, and everyone thinks it's an inferior orchestra. But

we're getting a lot of votes from a lot of other people besides Atlanta." Woods points out that, even if they weren't, Telarc and the orchestra can't change the system. "We can't do anything about this. The Atlanta Symphony can't do anything about it. It's up to NARAS."

Greene offers several possible solutions: "We might do what we did with jazz a couple of years ago, and move the classical nominations into a craft category. Or we might enhance our entire membership in the classical field by going out on a large-scale membership campaign." But that still doesn't solve the problem of the large ensembles voting for themselves.

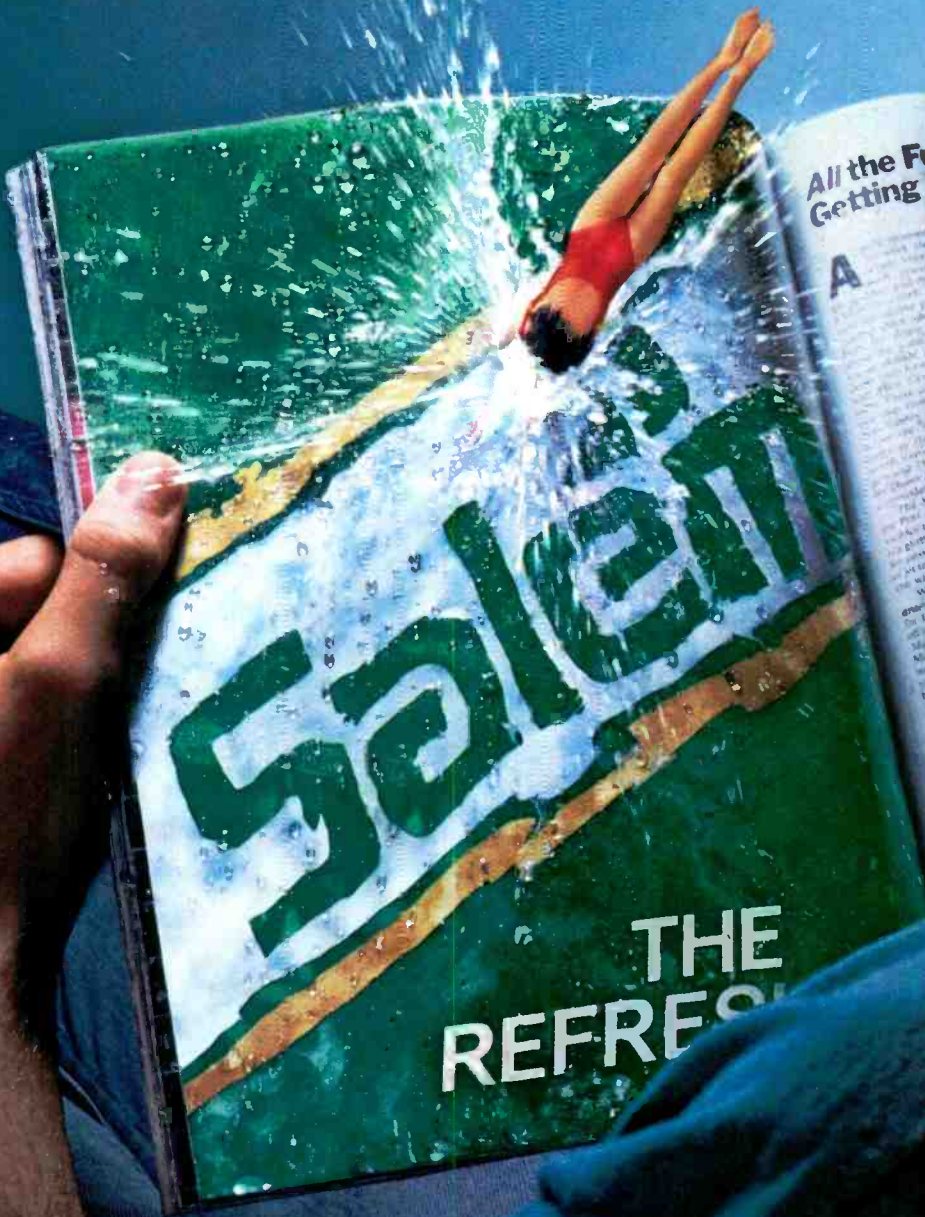
Meggs has a better idea. "I propose a total overhaul of the NARAS mechanism as it applies to classics," he says. "First, all companies and all individuals would be entitled to nominate classical entries, just as they are now. That allows even a little company, with one record that they think is wonderful, to get nominated. Secondly, a screening panel of 50 nationally known, carefully selected, legitimate music critics and record reviewers, who work classics 52 weeks a year, would narrow down the gross list to five nominations in each category. That would solve the block voting problem. Atlanta wouldn't get all these nominations because these 50 people would know better."

Meggs' solution for the third and final vote would solve what he calls the ignorance problem. "As it is, members are allowed to vote on any eight of some 20-odd categories, so people who know nothing about classics—rock 'n' rollers and what have you—are free to vote on classics. That's cuckoo. Classics is a specialty. It requires knowledge. So, for the final ballot, the entire membership could vote either on the pop categories or on the classical categories, but not on both. That solves the problem of ignorance and of high-visibility artists always winning."

Meggs plans to send his proposal to NARAS for review. One can only hope that the organization will overcome what appears to be a severe case of inertia and will change the voting guidelines for classical recordings. It's high time. *Susan Elliott*

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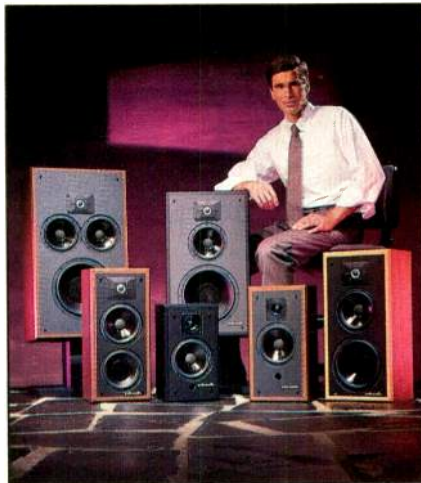
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Matthew Polk with his incredible sounding/affordably priced Monitor Series loudspeakers. Front row (L to R) Monitor 5Jr. +, Monitor 4A, Monitor 4.5 Back row (L to R) Monitor 10B, Monitor 7C, Monitor 5B

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**Where to buy Polk Speakers?
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ROAD WAR 5 CAR AMPS TESTED

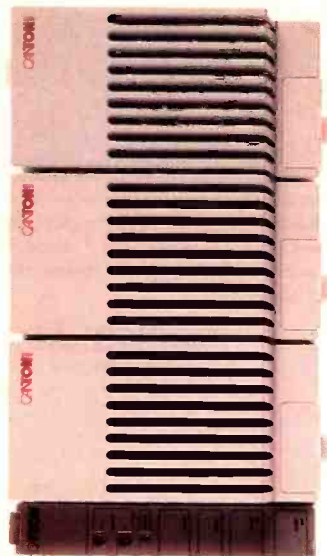
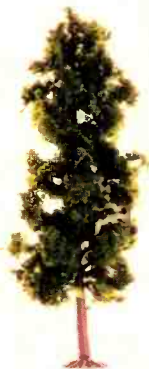
Leonard Feldman and Ivan Berger

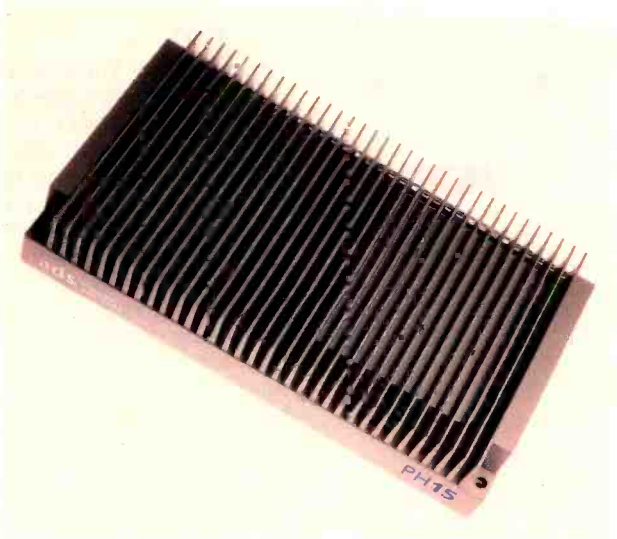
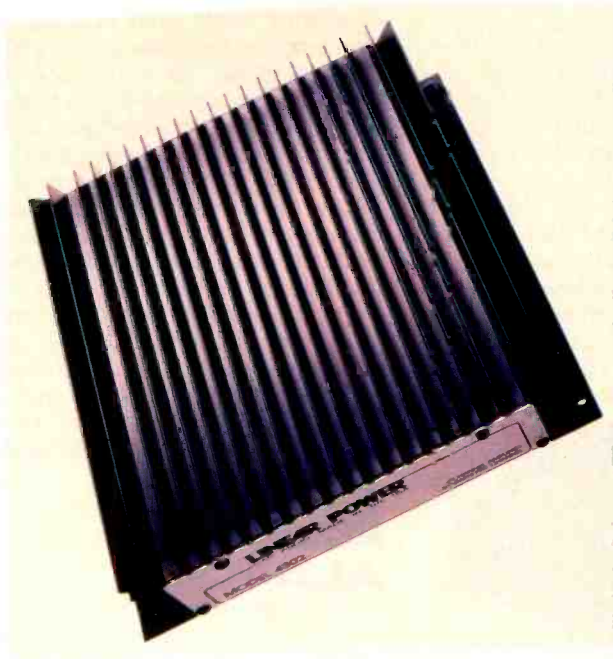
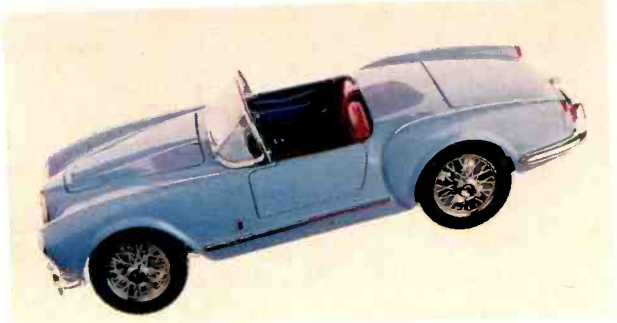
Most car sound systems don't need vast amounts of power, but they do need substantially more than the 5 watts or so per channel available from the amplifiers usually built into car stereo head units. For this year's amplifier roundup, we therefore selected five amplifiers in the popular power range of 30 to 50 watts per channel.

It's more and more common, these days, to provide a separate amplifier channel for each of a car's four main speaker systems—and to make the installation simpler and neater by using amps that combine all these channels on a

single chassis. The five amplifiers tested here can all operate as four-channel amps, but some of them can also be used for anywhere from two- to six-channel operation, depending on the operating modes and options used.

To avoid any appearance of partiality toward any of these units, I will deal with them alphabetically, starting with a description of the features and hookup requirements of each, and following with a summary and comparison of my test results. After that, Ivan Berger will add his comments on the amplifiers' sound, based on listening comparisons.





Photograph: David Hamsley

a/d/s/ PH15

This amplifier is essentially a six-channel unit, with each channel capable of delivering 50 watts of power to 4-ohm speaker loads. Individual pairs of channels can be bridged, however, so that you can use the amp in a five-channel setup (50 watts per satellite and 100 watts to a mono subwoofer), as a four-channel amp (with 50 watts each to the front speakers and 100 watts each to the rear), or as an amp with three 100-watt channels.

Connecting the supply and control voltages, as well as speaker leads, to this amplifier is

Bridging individual pairs of the a/d/s/ PH15's six channels lets you use it as a three-, four-, or five-channel amp.



a/d/s/ PH15

relatively easy. Wires for these functions fit nicely into small holes along one side of the amp and are held in place by tightening set-screws accessible between the ribs of the heat-sink that makes up the unit's top surface. Input level controls for pairs of amplifiers are also accessed in this way. No internal wiring needs to be changed if you want to operate any or all pairs of amp channels in the optional bridged mode for higher power. Slide switches along the same side of the amp need only be switched from stereo to bridged mode. For any pair of amps operated in the bridged mode, care must be taken to connect the associated speaker wires between the two "+" terminals of that pair of amplifier outputs. These connections are noted on the amp panel, but in a dark blue that's not as easy to read as the legends for the normal, unbridged connections, which are printed in white.

Terminal side of a/d/s/ PH15, showing (left to right) power and control-lead terminals, fuses, speaker terminals, bridging switches, and DIN input jack.



The only problem you are likely to encounter in hooking up this amp is accessing the input terminals. As with many car amplifiers, it requires a specially wired DIN plug, which is not supplied. The eight-pin DIN jack has one pin for the hot lead of each signal input, one for a common signal ground, and one for the remote turn-on voltage. Happily, the remote terminal is paralleled by a more easily accessed terminal similar to the other voltage and speaker termi-

nals. Feeding signals into the DIN jack, however, requires a special cable—either an optional adaptor cable (with male or female phono connectors at the cable's other end) or an eight-pin DIN cable for connection to the a/d/s/ 642CSI crossover and signal processor.

Incidentally, two connections are provided for both the positive and negative power leads. Presumably, this allows the use of dual wires to double the current-carrying capacity without requiring heavier gauge wire and extra-large connectors. Two 30-amp, blade-type automotive fuses rest in easily accessible sockets between the power and speaker connectors.

The owner's manual is well written and is complete in every detail; a service manual, with schematic diagram, is also supplied. Three wiring diagrams are illustrated, showing typical six-, four-, and three-channel hookups.

**ALTEC
LANSING**

ALA-435

I found this amplifier to be one of the easiest to hook up, since it utilizes spring-loaded speaker terminals not unlike those found on home amplifiers and because the input terminals for all four channels are the familiar RCA-type phono jacks. Battery power leads and the remote turn-on voltage lead can be inserted into connector bushings at one end of the chassis and tightened with set-screws. The bushing sizes allow for fairly heavy power leads, though



Altec Lansing ALA-435

the remote turn-on lead (which carries no current anyway) must be reasonably light. The front panel is nicely configured, with all inputs and associated input level controls at one end of the panel and speaker terminals and supply-voltage terminals at the other end. In addition to the phono jacks for the preamp-level inputs, there are four-pin plugs for each of the speaker-level inputs, which take the output signal from the low-power amplifiers built into many head units. Four input level controls, adjusted by means of a flat-blade screwdriver, alter input sensitivity for both the low-level and the high-level inputs.

While the power output of this amp was clearly not as high as that of some of the other models I tested for this report, it should be noted that this unit exhibited a very high level of dynamic headroom. In other words, when delivering music signals, each channel can pump out a great deal more than the 35 watts speci-



Terminal side of the Altec Lansing ALA-435, showing (left to right) power and control terminals, home-type speaker terminals, bridging switches, high/low input-select buttons, high-level input terminals, individual-channel level controls, and RCA-type audio inputs.

fied as the continuous power rating for the amplifier. This high dynamic headroom, amounting to about 5 dB (equivalent to approximately 120 watts of power per channel for short-duration musical transients or bursts) is achieved by Altec Lansing with what they call DSE (Dynamic Stored Energy). This is an arrangement in which capacitors are charged during periods of soft musical content and are then discharged automatically during periods of high current demand. The ALA-435 has "floating" (ungrounded) high-level inputs. Since some higher powered, all-in-one car radios have "bridged" outputs themselves, such radios might be damaged if connected to "booster" amps that have one terminal of their high-level inputs returned to ground.

Pushbuttons on the amplifier's panel determine whether the low- or high-level inputs are active and, if required, bridge the two pairs of amps. In the bridged mode, each pair of amplifiers can deliver upwards of 70 watts to a 4-ohm speaker load.

BLAUPUNKT PSA 168

This smartly styled amplifier from Blaupunkt is unique in many ways. Perhaps the most important difference is gleaned from the company's own description of the product as a "Parametric



Blaupunkt PSA 168

AUDIO/MAY 1989

Sound Amplifier." If you just hook it up, as received, its frequency response will be flat throughout and beyond the audio spectrum. Remove a section of its top surface—the section carrying the Blaupunkt name, trademark, and model number—and a recess is revealed. At the bottom of this depression are four multi-pin connectors. Taking a cue from car manufacturers who are now specifically equalizing their amps to suit the acoustics of the automobile in which they are mounted, Blaupunkt has gone a step further.

Car manufacturers, however, know precisely which cars their sound systems will be used in. Independent manufacturers like Blaupunkt do not, so their amplifiers cannot be supplied pre-equalized for specific cars, nor is there any way to make a pre-equalized amp which would match the acoustics of every car on the market. So the PSA 168, as sold, has flat response but accepts plug-in modules (which also fit the less



Lifting the Blaupunkt's top trim plate reveals the socket for its custom equalization module.

powerful PSA 108) to alter that response to suit your car's acoustics. The instructions supplied with my sample amp listed makes and models of some 40 American cars, as well as over 20 European cars, for which equalization modules are available; the part numbers for the appropriate EQ modules were also given. Further, if you should sell your car and purchase a different model, it will take no more than a few seconds to change the module to one suited for your next car—if you keep this amp. Because of the PSA 168's unique equalization system, its four channels cannot be bridged for higher power two-channel operation. It is intended strictly as a four-channel amp for driving front-left, front-right, rear-left, and rear-right speaker systems.

Since I was only going to test this amp on the bench, it didn't really matter what module was supplied to me; I only wanted to check out this EQ system. Accordingly, I was given a module intended for Chevrolet Camaros and Pontiac Firebirds from 1982 and subsequent years. Each module handles all four channels and cannot be plugged in backwards since the circuits are mirror images of each other. Blaupunkt also supplied the necessary DIN-to-phono jack adaptor, which I needed to connect my test signals to its four channels of amplification, as well as the DIN speaker connectors, already hooked up to short wires whose ends are stripped for connection to longer cables of your choosing. Along with the installation and operating instructions that came with this amplifier, I found a guarantee document that listed service centers in literally hundreds of locations around the United States and Canada.

5
CAR
AMPS

The Blaupunkt PSA 168 provides for plug-in EQ modules which are custom-matched to the acoustics of about 60 different cars.

CANTON

M50 Amp Module and MF5 Mainframe

The Canton M50 is actually a single-channel, 50-watt amplifier. What qualifies it for inclusion in a story on multi-channel amps is Canton's "mainframe" system (a term borrowed from computers), which must be the most innovative approach to car audio installation yet. The M50 modules, which have no conventional power or input connectors, snap into a mainframe which holds several modules and feeds power and input signals to each. The system I tested employed the five-port, MF5 mainframe, but there is also a three-port model, the MF3. The mainframes have power and four signal buses. Other modules are in the works, including a two-chan-

Top and bottom views of Canton M50 modules. Channel-assignment and crossover DIP switches are beneath the hinged top flap; switch-setting instructions are permanently painted on the bottom.



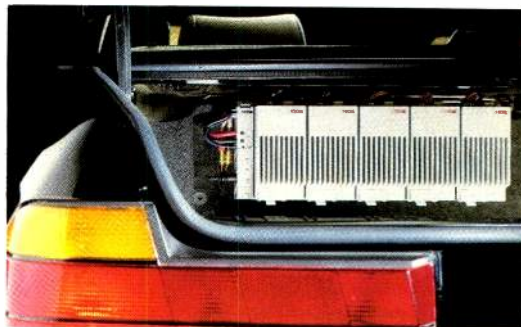
Canton's longer mainframe, the MF5, with three modules in place.



Terminal end of Canton MF5 mainframe showing (left to right) fuse-box lid, power and control-lead terminals, "Alarm" and "Data" plugs, and DIN-plug audio inputs and outputs; see text.



A Canton MF5 mainframe with five M50 modules, installed in a car trunk. Note that the speaker connections are made to the individual modules.



nel amp delivering 15 watts per channel, a 100-watt mono subwoofer amp with low-pass filtration that is undefeatable but adjustable from 50 to 200 Hz in 10-Hz steps, and a car security module.

Power connections and the "Control" turn-on voltage are made to recessed, set-screw terminals along one of the mainframe's short sides. A covered fuse box, with slots to hold one blade-type fuse per module, is just to the left of these terminals. (To prevent powering vacant slots, the fuses are packed with the modules.)

Just to the terminals' right are two jacks, similar to modular telephone jacks but with more pins. The eight-pin "Alarm" jack is used to connect to Canton's optional PIM-1 Performance Indicator Monitor, which can be mounted inside the passenger compartment. The PIM-1 monitors the amplifier system's performance, with such indications as "On/Off," "Clipping," or "System Fault" (either thermal or short-circuit). An adjacent, six-pin "Data" connector is, I am told, reserved for future applications.

An eight-pin DIN jack accepts up to four channels of audio from your head unit (an adaptor cable with four clearly marked, color-coded RCA jacks is supplied), and a matching "Audio Output" jack is used for interconnecting multiple mainframes. Daisy-chaining mainframes makes it possible to build elaborate bi- or tri-amplified systems, or to build a four-channel system with two MF3s where the space available won't hold the longer MF5 mainframe.

Speaker connections are made directly to the amplifier modules. Each module has connections for two speaker plugs, though one set of connections is blocked by a removable plastic molding. One speaker plug (with set-screw tightening for its wire holes) is supplied, but additional plugs are available.

The mainframes have plenty of attachment points (three per module). In addition, curved projections to hold cables neatly in place are molded into the side of the frame on which the amp modules' output terminals are found.

Each module is equipped with 10 tiny DIP switches. The first four of these are used to select which speaker is to be fed from that module (front-left, front-right, rear-left, or rear-right). It is permissible to flip a pair of DIP switches on a single amp module if, for example, you want to feed both left and right signals to the same module that is to drive a subwoofer in the system. The remaining six DIP switches control the crossover filter. Each amplifier may be set up for flat, full-range response, for low- or high-pass filtering at crossover points of 150 Hz or 2.5 kHz, or for bandpass response between those two frequencies. This tremendous flexibility enables use of the same basic M50 amplifier module for all possible speaker-driving functions, from subwoofers to tri-amplified systems. (That accounts for the daisy-chaining feature: A tri-amplified system could require 12 amplifier channels, and a system using bi-amplified satellites with a common, mixed-bass subwoofer would have nine channels.)

The DIP switches, which are clearly numbered, are normally covered by a hinged flap,

which also conceals an input-sensitivity control and a red LED. This LED, which can be seen through the translucent cover, in the dim light of a trunk, glows during the turn-on delay time, while the amp is muted to prevent transmission of noises generated in the head unit. If the LED stays lit thereafter, it may indicate a fault in the amplifier module.

LINEAR POWER 4302

Of all the amplifiers tested for this report, the Linear Power 4302 is possibly the only one that is small enough to be mounted under the dashboard or seat of your car—if there is a reasonable amount of space there and adequate ventilation. Of course, the preferred location for this



Linear Power 4302

or any high-powered amp is in the trunk. The Model 4302 offers four channels of audio amplification, with no provision for bridging. The 4302 has thermal, short-circuit, and polarity-reversal protection. The latter is a diode that guards against component damage from accidentally reversed power connections to the car's electrical system.

Access to the front and rear inputs is via standard phono jacks, while access to speaker connections is via a six-terminal special connector for which a mating plug/cable assembly is needed. This plug/cable, normally supplied, had disappeared, so I did some quick soldering to hook the amplifier's output terminals to my 4-ohm test loads. Six terminals suffice for the four channels because each speaker pair has a common ground.

Input sensitivity controls, adjusted by means of a screwdriver, handle the gain of the two pairs of amplifier channels. As with most multi-channel car amps, any side-to-side imbalance between channels must be compensated for by the head unit's balance control. A hook-up diagram is permanently attached to the bottom of the amplifier. Rubber grommets in the amp's mounting holes prevent possible ground loops through the car's frame.

Measurements

All of the amplifiers were tested under similar conditions. Lab temperature was maintained at 70°, and each amp was turned on for approximately one hour before measurements were made. Supply voltage was maintained at 14.4

V—the rather high level called for in the EIA Standard for measurement of car audio equipment. Where necessary, two car batteries augmented my lab d.c. power supply, which then served to continuously “trickle charge” the batteries while tests were being made.

Each of these amps has a control-voltage terminal. Application of voltage to this terminal turns on the amplifier. Many head units provide a control voltage for this purpose, either from a dedicated terminal or from the terminal used to power the motor that raises and lowers the antenna. Since battery voltages in an automobile are subject to wide fluctuations, I wanted to determine what control voltage must be available in order for the amplifier to turn on and stay on. (Some head units deliver less than full battery voltage to their turn-on output leads.) However, all amps but the Altec Lansing ALA-435 turned on and remained on even with a control voltage of 7.0 V (the lowest available on my d.c. power supply); the ALA-435 turned off when the control voltage was reduced to 9.0 V. Even at that somewhat higher voltage, I doubt if a car owner would be able to listen to his or her car stereo system, let alone start the car.

Frequency Response

All amplifiers were tested with a swept input signal from 20 Hz to 20 kHz, and all exhibited essentially flat response over that range. If one has to differentiate between these amps as far as frequency response is concerned, the “flat-test,” overall, was the a/d/s/ PH15, which was

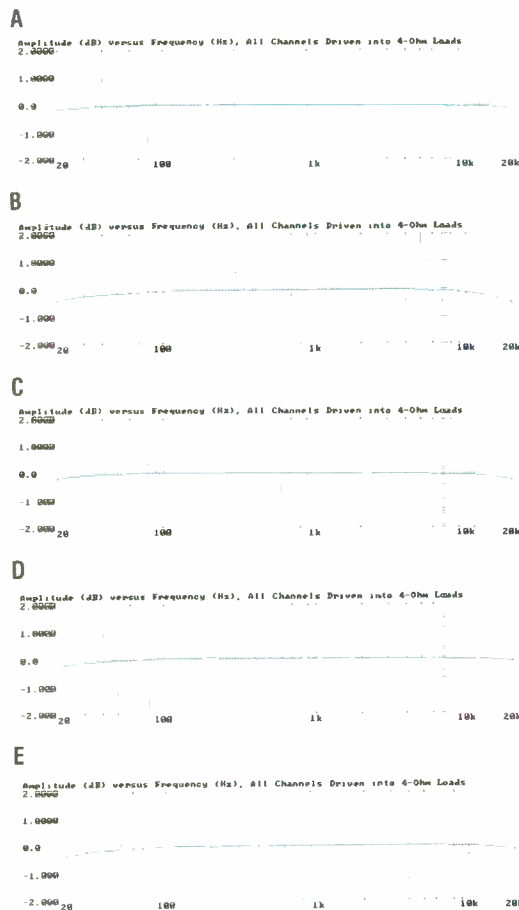


Fig. 1—Frequency response of the a/d/s/ PH15 (A), Altec Lansing ALA-435 (B), Blaupunkt PSA 168 (C), Canton M50 (D), and Linear Power 4302 (E).

5
CAR
AMPS

The Canton isn't just an amp, it's a system offering a choice of amp and other modules that plug into either of two mainframes.

All five tested amps exhibited frequency response which was essentially flat over the entire range from 20 Hz to 20 kHz.

down only 0.15 dB at 20 Hz and 20 kHz. The Altec Lansing ALA-435 was off by -0.5 dB at 20 kHz, while the Linear Power 4302 attenuated 20-Hz signals by 0.3 dB. Response curves for all of the amps are shown in Figs. 1A through 1E; the tested units' measurements are also presented in alphabetical order.

Before going on to measure other operating characteristics of the amplifiers, I wanted to see just how the equalization module of the Blaupunkt PSA 168 affected frequency response when it was installed. As you can see in Fig. 2, response is altered significantly when the module is in place, with carefully tailored rises in response below 100 Hz, between 300 and 600 Hz, at around 2 kHz, and above 5 or 6 kHz. Clearly, no conventional tone controls or simple graphic equalizers could produce such a tailor-made response curve.

I also checked out the various response curves obtained with the different DIP switch settings of the Canton M50 amplifier modules. A composite of the response curves obtained is shown in Fig. 3. Notice how precise the roll-off points are, and how both the high- and low-pass filter settings result in precisely 3 dB of attenuation of those crossover points, as they should. It's no easy trick to maintain such precision in mass-produced filter circuitry, and Canton deserves kudos for such amazing precision.

THD Versus Frequency

Figures 4A through 4E show how THD + N varied with frequency as input signals were carefully regulated to maintain rated output. Of course, these amps have different rated power outputs, so a direct comparison here is not totally valid. The a/d/s/ PH15 delivered 50 watts per channel into 4-ohm loads, with 0.021% THD + N at 1 kHz, 0.022% at 20 Hz, and 0.05% at 20 kHz. In bridged mode (not shown), the amp delivered twice the power for virtually the same THD levels.

The Altec Lansing ALA-435 had no trouble delivering 35 watts per channel into 4-ohm loads at mid- and high frequencies, with distortion levels well below the rated 0.1% (0.052% at 1 kHz and 0.058% at 20 kHz), but at 20 Hz,

Fig. 2—Frequency response of Blaupunkt PSA 168 with Camaro/Firebird equalization module installed.

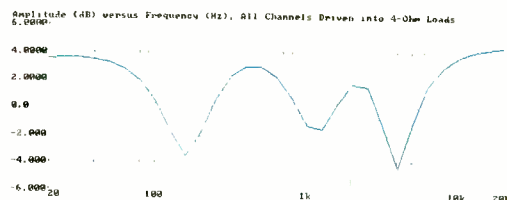


Fig. 3—Crossover-filter curves available on the Canton M50 module. Crossover points are at 150 Hz and 2.5 kHz.

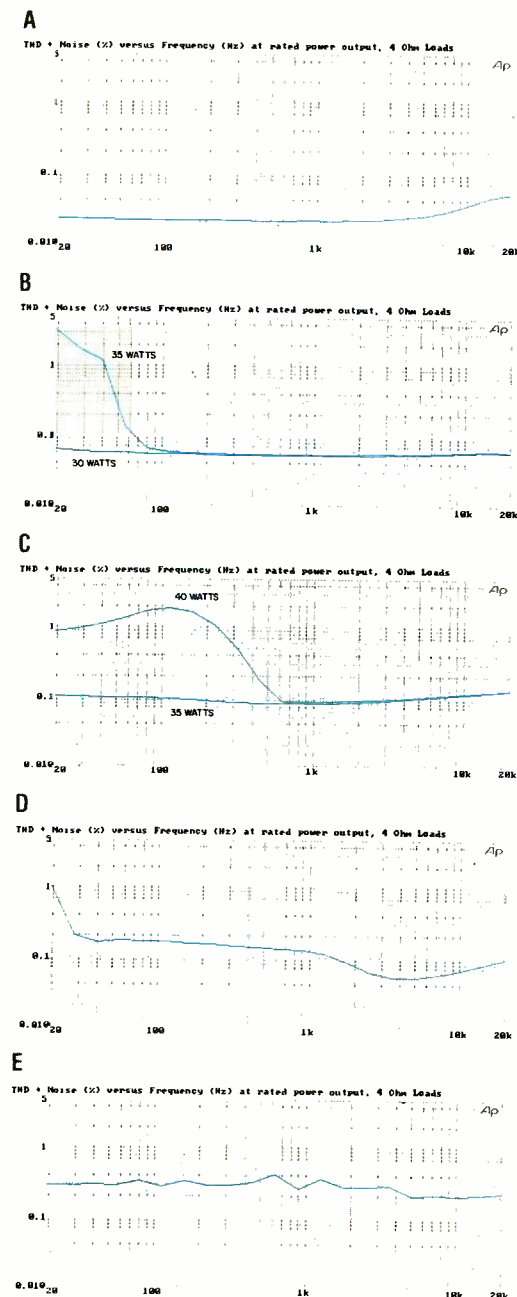
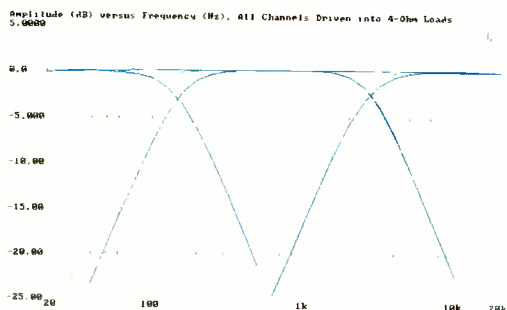


Fig. 4—THD + N vs. frequency at rated output for the a/d/s/ PH15 (A), Altec Lansing ALA-435 (B), Blaupunkt PSA 168 (C), Canton M50 (D), and Linear Power 4302 (E).

distortion climbed to 3%, as shown in the top curve of Fig. 4B. When I reduced the output to 30 watts per channel (lower curve), THD + N settled back to around 0.06%.

The Blaupunkt PSA 168 had similar difficulty at low frequencies (Fig. 4C) and did not quite make its rated THD + N of 0.12%. If it were possible to separate THD from noise in my test setup, I strongly suspect that the amplifier would have easily made its rated output power at mid- and high frequencies, with no more than its rated THD. That's because the S/N ratio of

this amp was a bit lower than that of the others. In any case, a peak in THD + N occurred at around 120 Hz, amounting to 1.8%, while at 20 Hz, THD + N was 0.85% at 40 watts per channel output (top curve). At mid-frequencies, THD + N measured 0.085%, and at 20 kHz, it was 0.12%. When I reduced the regulated output to 35 watts per channel (bottom curve), THD at low frequencies decreased to just over 0.1%.

The Canton M50 modules delivered their rated power of 50 watts per channel, with distortion at most frequencies around the 0.1% mark, increasing to a full 1.0% at 20 Hz. Of course, the curve in Fig. 4D was produced with the DIP switches of the M50 module set for flat response.

The Linear Power 4302 amp exhibited virtually no change in THD + N at any audio frequency while delivering its rated power of 30 watts per channel (Fig. 4E). However, the overall level of THD + N was between 0.2% and 0.4%, as opposed to the claimed 0.12%.

THD Versus Level

In order to determine how residual noise influenced the previous plots of distortion versus frequency, I also measured THD + N as a function of power output, using a 1-kHz test tone. Results for all of the amplifiers are shown in Figs. 5A through 5E. Generally good correlation was noted between the THD + N results obtained in Figs. 4A through 4E, and the results of these new graphs which pass through the rated output levels for each amp. Of particular interest, however, is the rising slope of the curves as progressively lower power levels are plotted. This is typical of what I get when noise, rather than distortion, becomes the dominant component of the THD + N measurement.

IM Distortion Versus Level

The last curves plotted were for SMPTE-IM distortion versus power output, using the standard mix of 60 Hz and 7 kHz in a 4:1 amplitude ratio. These graphs (Figs. 6A through 6E) generally parallel those of Figs. 5A through 5E, in that SMPTE-IM percentages rise steeply at about the same power output levels as the THD curves did. An exception was noted for the Linear Power 4302, which exhibited a steep rise in IM before reaching its rated output of 30 watts per channel, by which point SMPTE IM had reached 3%.

Signal-to-Noise Ratio

Each amplifier's S/N ratio was measured with reference to 1 watt output, using an A-weighting filter. For the a/d/s/ PH15, S/N was 92 dB. For the Altec Lansing, it measured 90.5 dB. The Blaupunkt PSA 168 showed the lowest S/N figure—only 68.4 dB. Canton came in with the best result, an impressive 109 dB below 1 watt reference level. The next highest S/N reading was obtained for the Linear Power amp, with a reading of 94.7 dB below 1 watt.

Damping Factor

Referred to 4-ohm loads, the a/d/s/ amp had a damping factor of 72. Damping factor was 45

5 CAR AMPS

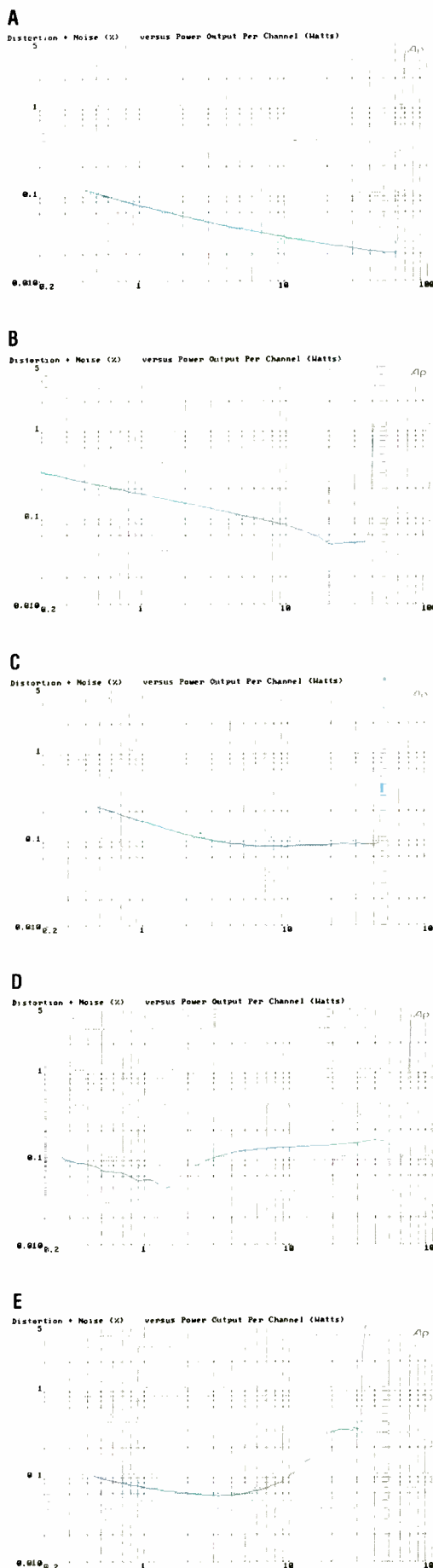
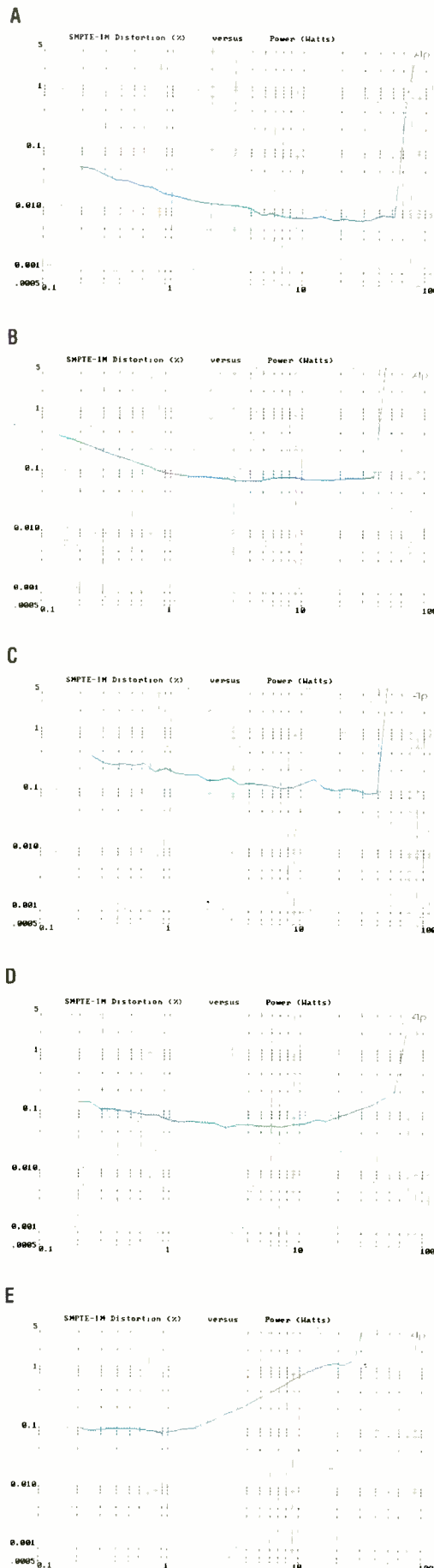


Fig. 5—THD + N at 1 kHz vs. power output per channel into 4-ohm loads for the a/d/s/ PH15 (A), Altec Lansing ALA-435 (B), Blaupunkt PSA 168 (C), Canton M50 (D), and Linear Power 4302 (E).

The Altec Lansing amp was not as powerful as some of the others, but it had extremely high dynamic headroom.

5 CAR AMPS

Fig. 6—SMPTe-IM distortion vs. power output per channel for the a/d/s/ PH15 (A), Altec Lansing ALA-435 (B), Blaupunkt PSA 168 (C), Canton M50 (D), and Linear Power 4302 (E).



The listening tests were done on better loudspeakers than most car systems can boast—big Infinities, KEFs, and Ohms.

for the Altec Lansing unit and 40 for the Blaupunkt. Canton's M50 modules had a damping factor of 30, while the Linear Power amp exhibited the lowest damping factor of the group, with a reading of 15.

Conclusion

If you compare the performance of these car amplifiers with that of those available a decade or so ago, it is immediately apparent that a great deal of progress has been made in bringing mobile audio into the era of true high fidelity. A quirk of the FTC power-disclosure rule exempts car amp makers from the same rigorous and carefully prescribed power-output disclosures required of home amplifier makers. Nevertheless, reputable car amp manufacturers have taken a more conservative approach to "spec" writing and a more scientific approach to the design of good-sounding, reliable amplifiers for use in moving vehicles. At all but the lowest audio frequencies—at which most car speaker systems could not deliver distortion-free power, in any case—not one of the amplifiers I measured exceeded 0.5% THD + N at their rated power output levels. Frequency response for all of these units was every bit as good as that measured for home models having similar pow-

Table I—Manufacturers'

Parameter

Power Output, 4 Ohms (Watts/Channel)
Bridged Output Power (Watts/Channel)
Frequency Response (Hz-kHz, \pm dB)
THD, Rated Power (%)
THD, Rated Bridged Power (%)
SMPTe IM, Rated Power (%)
SMPTe IM, Rated Bridged Power (%)

Input Sensitivity, 1 Watt
Input Impedance
Line Level (Kilohms)
High Level (Ohms)
S/N, 1 Watt (dB)
Damping Factor, 4 Ohms
Current Drawn (Amperes)
At Idle
Maximum

Power Fuse (Amperes)
Audio Input Connectors
Line Level
High Level
Speaker Output Connectors
Input-Level Controls
Other Features & Specs

Dimensions (In.)

Price

Company Address

N.A. = Not applicable.

er output ratings. Excluding possible noise generated by an automobile's electrical system—which, of course, cannot be measured on the test bench—noise levels produced by these amps was certainly acceptable, especially when you take into account the ambient noise in a moving vehicle. Also bear in mind that my S/N readings were all taken with reference to 1 watt. If they were translated to S/N readings with respect to rated output, you could add anywhere from 15 to 17 dB to my S/N numbers.

To be sure, this study represents a minuscule sampling of what's out there in the way of car power amplifiers—as witnessed by the number of Directory entries in this issue of *Audio* for that product category—but it should give you an idea of the performance level of car amps, which has generally come a long way in a short time.—**L.F.**

Listening Tests

Three series of listening tests were performed, using three different loudspeakers. The choice of speaker affected the degree of difference heard between the amplifiers, but not their rankings or the listening panel's specific comments on their sound. Using Infinity RS 9 Kappa speakers, which demand hefty amounts of cur-

rent, the differences between amplifiers seemed exaggerated, far greater than I've ever heard in a car. Using KEF C95 speakers, differences were small and hard to hear. This was primarily because the KEFs are very easy loads—they clearly showed up differences in the software we played through them. The sound heard through Ohm Walsh 4 speakers fell between these extremes, even though their high impedance—8 ohms, versus 4 ohms for the Infinity and KEF speakers—effectively cut each amplifier's power in half. For signal sources, we used a number of CDs, all chosen for their clear and natural sound. These included Haydn's *Op. 76 Quartets* (Orlando Quartet, Philips 410 053-2); "You Look Good to Me," band 6 of *We Get Requests* (Oscar Peterson Trio, Verve 810 047-2), Amanda McBroom's "Amanda" from Sheffield's *Crème de la Crème* sampler (CD-CRM), and "Chambre Separée" (*Elizabeth Schwarzkopf Sings Operetta*, with Otto Ackermann conducting the Philharmonia Orchestra, EMI CDC 7 47284 2).

Listening tests with the Infinity RS 9 Kappas were held in the large living room of Tony Igel, owner of the Stratford Sound Room, a car stereo sales and installation company in New York. Three Soundstream amps—the DA-1 home

Linear Power's 4302, the least powerful of these amps, kept up well with its larger competitors in terms of sound quality.

Specifications

a/d/s/ PH15	Altec Lansing ALA-435	Blaupunkt PSA 168	Canton M50	Linear Power 4302
50/6	35/4	40/4	50	30/4
100/3	70/2	N.A.	N.A.	N.A.
10-40, ±1	10-40, +0, -1	5-100, +0, -3	20-50, ±0.2	20-20
0.05	0.1	0.12	0.1	0.12
0.05	0.18	N.A.	N.A.	N.A.
—	0.05	—	0.04	—
—	0.1	N.A.	N.A.	N.A.
45 mV	—	0.4 to 4 V	75 mV	36 mV to 0.88 V
60	10	—	—	50
N.A.	22	—	—	—
88	95	90 dB (unwtd.)	77	91
350	50	—	—	100
1.2	—	—	0.4 per channel	0.7
48	—	—	8.5 per channel	12.0
30 (two)	—	30	10	—
8-pin DIN	Standard phono	8-pin DIN	8-pin DIN	Standard phono
N.A.	4-pin in-line	Small DIN speaker	—	Standard phono
Screw clamp	Spring clip	Small DIN speaker	Special	6-pin in-line
4	4	1	1 per channel	2
3-, 4-, 5-, or 6-channel operation	5-dB IHF dynamic headroom	Accepts custom preprogrammed EQ modules for specific cars	Fits 3- or 5-slot mainframe; crossover filters at 150 Hz and 2.5 kHz; modules assignable to any channel or channels	—
14¼ × 2½ × 8¼	11½ × 2½ × 7½	—	MF3, 11½ × 1½ × 6½; MF5, 18½ × 1½ × 6½	7¾ × 2 × 7½
\$690	\$500	\$399.95	\$300 per module; MF3, \$225; MF5, \$325	\$425
One Progress Way Wilmington, Mass. 01887 For literature, circle No. 95	Milford, Pa. 18337 For literature, circle No. 96	2800 South 25th Ave. Broadview, Ill. 60153 For literature, circle No. 97	915 Washington Ave. So. Minneapolis, Minn. 55415 For literature, circle No. 98	11545 D Ave. Auburn, Cal. 95603 For literature, circle No. 99

5 CAR AMPS

If you compare these car amps to those of a decade ago, it's obvious how far car audio has progressed into the era of real high-fidelity sound.

amp and the D200 and D100 car amps—served as references there.

Listening tests with the KEF and Ohm speakers were held in my living room (for which the 9 Kappas are, alas, too big), using a Carver M1.5t and an Aragon 4004 as reference amps. In each case, all discs were first auditioned through the reference amps before the car amps were substituted. Listening levels were kept constant by adjusting system gain for equal level readings from a test tone before playing each amp. An Audio Control SA-3050A analyzer was used for these measurements.

As with this magazine's last car-amp roundup, I did not read Leonard Feldman's lab reports until after testing was complete, so as not to be influenced by them.

a/d/s/ PH15

The PH15 is built like a battleship, with "strong and indestructible" coming to mind as adjectives. It was at its best on loud passages, as might occur when one is trying to overcome road noise, and all the listeners agreed that its bass was punchy. A minority opinion on the listening panel was that the bass wasn't quite as tight as with the other amps. At moderate listening levels, there was a slightly muffled quality, lacking crispness and depth.

Altec Lansing ALA-435

The ALA-435 sounded very clear and clean. I thought it exceptionally so and noticed details in my old familiar test discs that I'd missed on countless prior hearings. One panel member, however, while praising its clarity on instrumentals, felt that it did not present song lyrics quite as understandably as some of the other amps in the group. Another panel member felt the background was a bit noisier when listening to this amp but was unsure whether the amplifier's own noise level was high or whether the Altec Lansing was letting the background noise in the program material come through more clearly. There was plenty of headroom for loud peaks.

Blaupunkt PSA 168

With this amplifier, transients seemed to lack a bit of impact—for example, the drums on "Amanda" had more clatter than snap—and there seemed to be a slight, distortion-like edge on some vocals. Overall, the sound was very neutral, with a great sense of clarity and plenty of midrange detail, though one listener felt that detail was lacking in the bass. The Haydn seemed to have a bit less depth than it did on the other amplifiers, but depth on some of the other recordings was quite good. The noise that showed up in the lab tests was only commented on once during the listening session—and then by someone who was passing right by the speaker at the time. In a moving car, it would probably be inaudible.

Canton M50/MF5

The Canton's sound was very warm and full—"incredibly musical," one listener commented; all panel members found it extremely natural and pleasant. The strings on the Haydn sound-

ed silkier, and the instruments less woody than with the other amplifiers tested. "Amanda" sounded somehow slightly metallic and not as lively as on the other units.

Linear Power 4302

Though this was the least powerful amplifier in the group, it kept up well with its larger competitors. Its sound was slightly less warm and airy than that of some other amps, but was very natural; one listener felt it had the finest midrange in the group. There was a smidgen less clarity than panel members would have liked on Amanda McBroom's vocals, but her voice also sounded less distant than on the other amps, which we considered a plus. "You Look Good to Me" seemed to have a hair less bass than it did on the other amps, and there was a very slight harshness on peaks, but these effects were probably due to the low power available. Overall, the effect was very musical.

Conclusion

Though none of these amps quite matched the quality of our far more powerful reference amps, most of them—especially the Canton, Linear Power, and Altec Lansing—sounded very musical. The most musical sounding was the Canton, the most powerful car amp in the group, but the least powerful amp, the Linear Power, came so close that we suspect it would have been a tie had both amplifiers been of equal wattage.

In the car, the subtle sonic differences between good amps become less audible than in home listening tests like these, and factors such as dimensions and special features become more important than they are when choosing amps for home systems.

Car stereo buyers are putting more stress on appearance, too, these days: On that ground, I'd rank the Canton and a/d/s/ ahead of the others, but that just reflects my own aesthetic priorities. The Linear Power, incidentally, can now be purchased with an anodized finish (in six colors, including gold, burgundy, sky or metallic blue, red, and even purple), replacing the normal black on its hefty heat-sink. —I.B.





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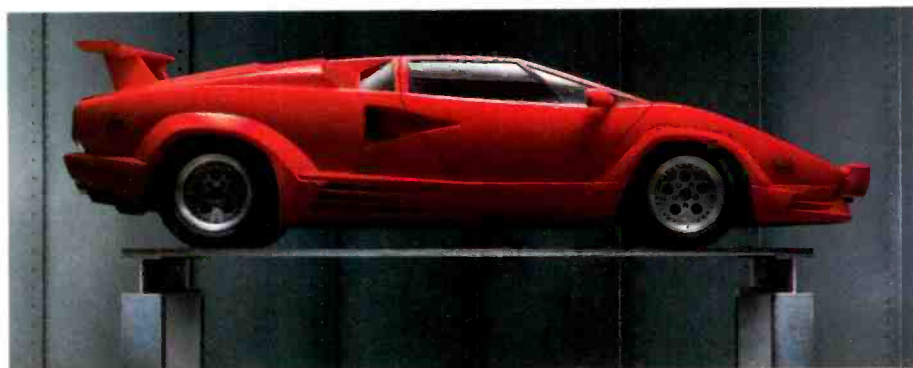
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TWO

QUICK-BUILD

CAR PROJECTS

RICHARD J. KAUFMAN

OP-AMP POWER SUPPLY

Whenever one of my articles on an audio construction project is published, I get several letters asking how to adapt the circuit for use in an automobile. The problem is this: Op-amps typically run from supply rails of ± 18 V, while a car's battery supplies only +12 V. The voltage isn't the issue. An op-amp will run fine on ± 12 V. It's the lack of a negative supply rail that's the serious problem.

There are many possible solutions. You might redesign a circuit to run on a single positive supply, but this isn't really satisfactory. Op-amps designed to run on a single supply, such as the LM324, do not have such good performance as a TL072 or a TL082: Their input impedance is lower, they are noisier, and their frequency response (bandwidth) is not as great. You might use a voltage divider to create an artificial ground reference for the op-amps, but you then have an effective supply of ± 6 V, which is barely adequate even for an undemanding circuit. Performance is not likely to be satisfactory with some filter circuits, and the circuit will not sink more current than the voltage divider can dissipate.

You could use an inverter to convert +12 V d.c. to ± 12 V d.c. Building inverters from scratch can be tricky, but they are available ready-made. In fact, Mouser Electronics sells d.c.-to-

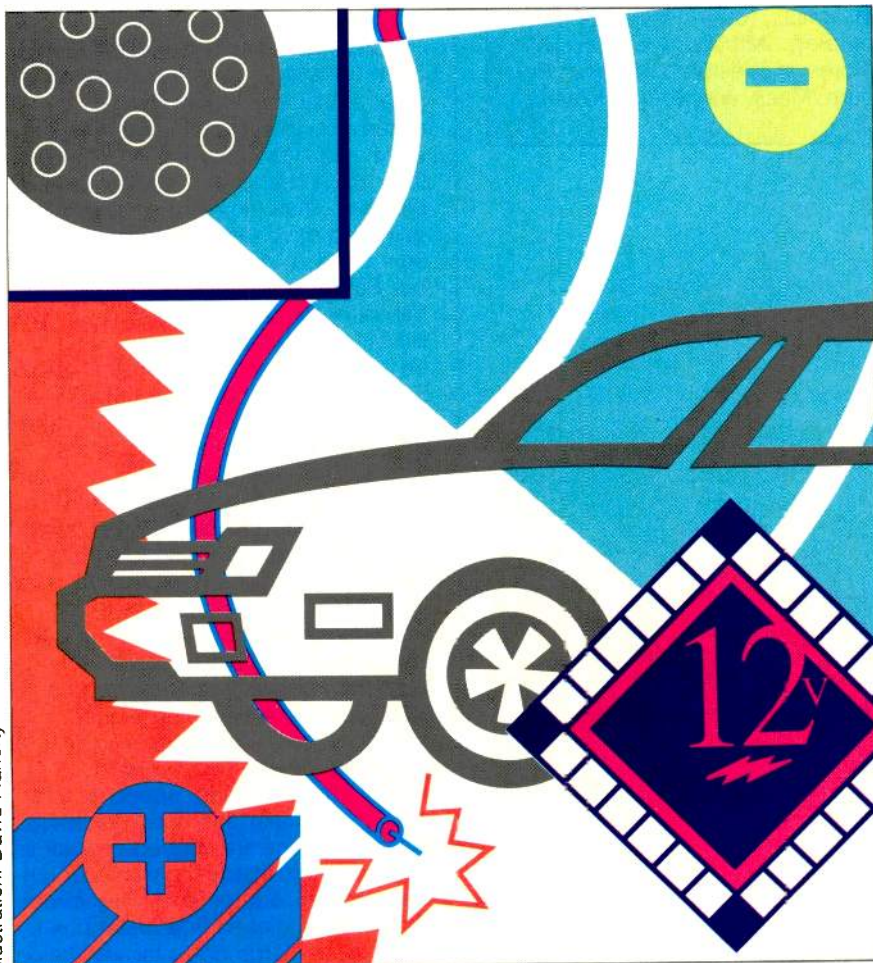


Illustration: David Flaherty

Op-amps require ± 12 V, but car batteries deliver only $+12$ V. This inexpensive inverter circuit delivers the missing -12 V, to power your car audio projects.

PARTS LIST

Power Supply

IC1—555 timer.

Q1—VN10K or IRF511 power MOS-FET.

R1—43 kilohms (10 kilohms in series with 33 kilohms), $\frac{1}{8}$ watt minimum.

R2—50 kilohms (100 kilohms paralleled by 100 kilohms), $\frac{1}{8}$ watt minimum.

R3—10 kilohms, $\frac{1}{8}$ watt minimum.

R4—33 or 50 ohms, 5 watts minimum.

L1—100- μ H choke coil.

C1—100 pF.

C2, C3, C5, C7—0.1- μ F plastic film; may be Mylar, metallized polyester (metal film), polystyrene, etc.

C4, C6—10- μ F electrolytic.

D1, D2—Schottky barrier diode (Radio Shack #276-1165).

D3—12-V zener diode.

Sources

All parts, or acceptable substitutes, may be found at Radio Shack.

Mouser Electronics, (800) 346-6873. Mail-order only, free catalog. Minimum order, \$20. Distribution centers in Cal., Tex., and N.J.

Active Electronics, (800) 228-4834; in Mass., (508) 366-0500. Free catalog. Minimum order, \$20. Stores in Westborough and Woburn, Mass. and Seattle, Wash.

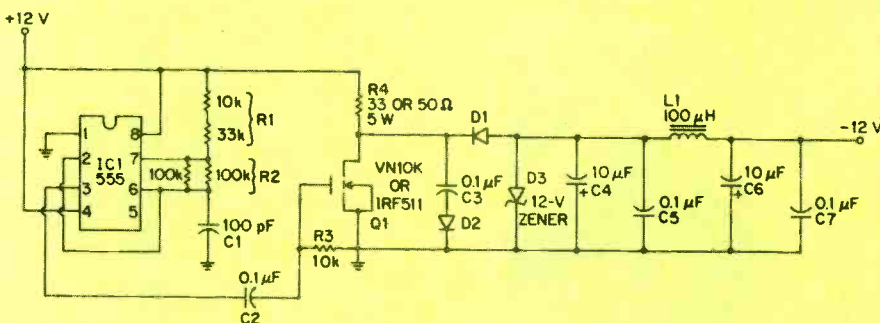


Fig. 1—Inverting power supply, which delivers -12 V from $+12$ V source. Note that there is no connection to pin 5 of IC1.

d.c. converters that are mounted in a single in-line package (SIP) that is about the size of an op-amp. Their ME 461-MNA1212S will deliver ± 12 V from $+12$ V in, at 750 mW. Performance is optimum with a load current of 30 mA, which is enough to power several op-amps. The price, \$23.55, is probably too high for most people, but if space is at a premium, this is a very attractive solution.

As an alternative, you could build a negative supply from discrete components, using the circuit in Fig. 1, for less than half the cost of the SIP converter. In this circuit, IC1 is a 555 timer, configured as an astable multivibrator (in layman's language, it turns on and off continuously). It switches at about 70 kHz, with a duty cycle (on period) of roughly 8 μ s. The purpose of the timer is to turn Q1 on and off. When Q1 is off, C3 charges up to 12 V through D2. When Q1 is on, C3 is grounded by the transistor, and D2 is reverse-biased by the charge on C3; C3 then passes a negative charge through D1. In fact, the chopped d.c. voltage at the drain terminal of Q1 looks like alternating current to C3, C4, D1, and D2, which act as a voltage doubler; the cathode of C4 will have a charge of -24 V. Diode D3 is a 12-V zener that regulates the output to -12 V.

Note that Q1 is a power MOS-FET. Such transistors switch faster than bipolar transistors, making them better suited for this circuit, and the gate drive requirements are much lower than the base drive requirements of bipolars. Thus, no extra circuitry is required to drive them from the 555 timer. I used a VN10K in my prototype, but Radio Shack has not carried this transistor for several years. The larger IRF511, which they currently carry, can be used without modifying the circuit because higher powered MOS-FETs do not impose an increased drive requirement, as bipolar transistors would. The only penalty is an extra dollar or so in cost. Active Electronics carries the VN10K (see "Parts List").

Both D1 and D2 are schottky barrier diodes. They switch faster than ordinary power rectifiers, so less energy is lost when they turn on and off. In addition, schottkys have a lower voltage drop than bipolar rectifiers. You could also use 1N914 switching diodes.

The biggest drawback to such a switching power supply is electrical noise. The switching speed is high enough to make this noise inaudible, but precautions are needed in order to prevent it from interfering with your tuner or other equipment. The circuit should be enclosed in a metal box by itself. Overly large holes for ventilation

are likely to leak r.f. energy, which could be a problem. The inductor, L1, and the extra capacitors, C5 through C7, are included to reduce switching noise. Using ferrite beads, if they are available, on all wires entering and leaving the box will also help. Mouser carries a selection of ferrite beads, and Radio Shack has a toroid choke core (273-104) that will perform the same function. However, no noise was audible without ferrite beads, when this supply was used to power the crossover shown in Fig. 2—even when the power supply and crossover were not mounted in enclosures and were placed near each other.

The power supply draws about 200 mA, which a car's generator can easily provide, though it is somewhat inefficient; this circuit can deliver 40 mA into a load. There will be enough power for several op-amps, for the bass-boost filter described in my article "Tailor-Made Bass" (August 1985), or for an active crossover for a subwoofer.

If you want to drive more than about eight op-amps, you should use multiple negative supplies of this type. To keep the noise level down, use the same drive circuitry for both MOSFETs. The 555 will easily supply enough current for several of these.

SUBWOOFER CROSSOVER

Figure 2 shows a fourth-order Linkwitz-Riley crossover set at 112 Hz for a subwoofer. The cascading of two second-order Butterworth filters gives the desired constant-voltage response. A fourth-order Butterworth filter would give constant-power response, resulting in a perceived peak at the crossover frequency. The high- and low-pass outputs are in phase at the crossover frequency, so it isn't necessary to invert the high-pass response by reversing speaker leads, as it is with a second-order crossover.

You can vary the frequency for your own application by scaling the resistor values. For instance, assume a 125-Hz crossover is wanted. Using 90-kilohm resistors, instead of 100 kilohm, for R2, R5, R9, and R11 will move the crossover point to 124 Hz (112 Hz multiplied by 100/90, the ratio between the old and new resistors). If you don't have 90-kilohm resistors, parallel 1 megohm with 100 kilohms. The resulting resistance is about 91 kilohms. This would yield a crossover point of 123 Hz (112 multiplied by 100/91).

Used in conjunction with the power supply, this crossover will give performance superior to any commercial automotive crossover I have heard. **A**

Fourth-order Linkwitz-Riley crossover networks provide constant-voltage frequency response, but have no audible peak or polarity inversion at their crossover points.

PARTS LIST

Crossover

IC1—TL074 or TL084 (two TL072s or TL082s may be substituted).

R1—15 kilohms, 1/8 watt minimum.

R2 through R11—100 kilohms, 1% tolerance, 1/8 watt minimum. R2, R5, R9, and R11 may be changed to alter crossover frequency; see text.

C1 through C4, C6 through C11—0.01 μ F, plastic film, 5% tolerance or better; plastic film capacitors may be Mylar, metallized polyester (metal film), polystyrene, etc.

C5—1 μ F, nonpolarized.

C12—10 μ F, nonpolarized

C13, C14—0.1- μ F, plastic film; see note on C1.

P1, P2—100-kilohm potentiometers.

Sources

All parts, or acceptable substitutes, may be found at Radio Shack.

Mouser Electronics, (800) 346-6873. Mail-order only, free catalog. Minimum order, \$20. Distribution centers in Cal., Tex., and N.J.

Active Electronics, (800) 228-4834; in Mass., (508) 366-0500. Free catalog. Minimum order, \$20. Stores in Westborough and Woburn, Mass. and Seattle, Wash.

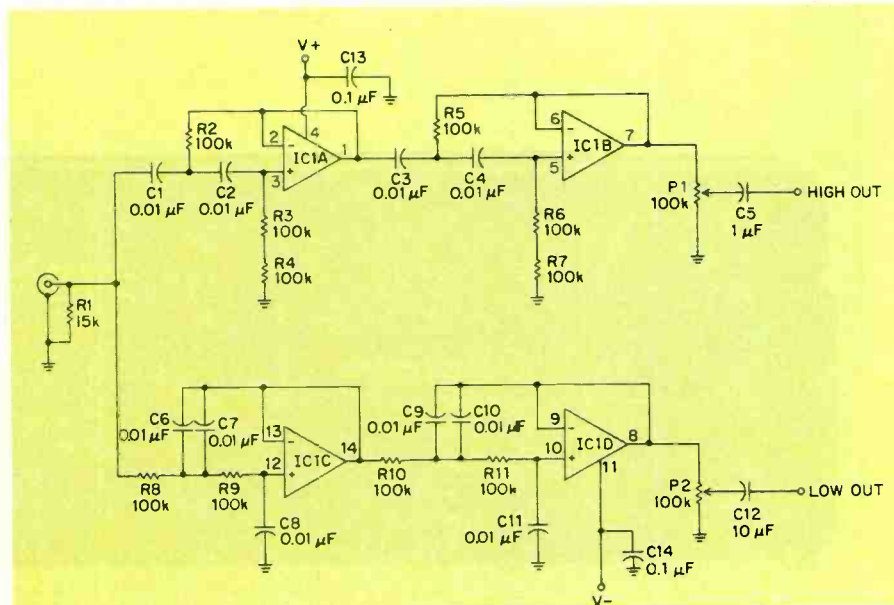


Fig. 2—Fourth-order Linkwitz-Riley crossover. The crossover frequency, 112 Hz, can be altered by changing resistors R2, R5, R9, and R11; see text.

1

HARMAN KARDON CR151 CAR STEREO

Manufacturer's Specifications

FM Tuner Section

Usable Sensitivity: Mono, 14.8 dBf.

50-dB Quieting: Mono, 18 dBf.

S/N: Mono, 72 dB; stereo, 68 dB.

THD: Mono, 0.2%; stereo, 0.4%.

Capture Ratio: 1.5 dB.

Alternate Channel Selectivity: 70 dB.

I.f. Rejection: 80 dB.

Image Rejection: 55 dB.

Frequency Response: 30 Hz to 15 kHz, ± 3 dB.

Stereo Separation: 40 dB.

AM Tuner Section

Sensitivity: 30 μ V.

Selectivity: 50 dB.

Cassette Section

Frequency Response: 20 Hz to 18 kHz, ± 3 dB.

Wow and Flutter: 0.09%.

S/N: Without Dolby NR, 54 dB; with Dolby B NR, 64 dB; with Dolby C NR, 72 dB.

Amplifier Section

Line Output Level and Impedance: 0.8 V, 10 kilohms.

Power Output: 12 watts per channel into 4 ohms, 20 Hz to 20 kHz.

Rated THD: 1.0%

Bass and Treble Tone Control Range: ± 10 dB.

Loudness Contour: +10 dB at 50 Hz.

General Specifications

Dimensions: Chassis, 7 in. W \times 2 in. H \times 5 $\frac{7}{8}$ in. D (17.8 cm \times 5 cm \times 15 cm); housing, 7 $\frac{7}{16}$ in. W \times 2 $\frac{5}{16}$ in. H \times 6 $\frac{11}{16}$ in. D (18.8 cm \times 5.8 cm \times 16.9 cm).

Weight: 3.4 lbs. (1.5 kg).

Voltage Requirements: 11 to 16 V.
Current Consumption: 4.5 amperes.

Price: \$659.

Company Address: 240 Crossways
Park West, Woodbury, N.Y. 11797.
For literature, circle No. 90



Harman Kardon has two complete receiver/cassette player car stereos that offer just about everything a car audio enthusiast could want in a one-piece unit. Both the CR131 and the CR151 deliver 12 watts per channel to a pair of speakers connected directly to them, and both also make provision for connecting additional amplifiers via front and rear preamplifier output jacks. The differences between the two are not in their performance specs, but in their features—specifically, on the less expensive CR131, in the absence of the CR151's Dolby C NR, full-logic tape transport, "Hi-Q" FM switch, external dash-illumination lead, and external input and output jacks. Those jacks make it possible either to feed the signal through a graphic equalizer or surround-sound processor or to feed in the signal from a CD or DAT player.

In terms of installation features, I was delighted to find that the wires and cables emanating from the CR151 did not terminate in oddly wired DIN plugs or in strange multi-pin connectors which match nothing in the average do-it-yourself installer's parts box. Instead, speaker wires are simply stripped at their ends, while the shielded cables for all inputs and outputs terminate in familiar phono jacks. There are also triggering wires for power antenna and remote amplifier turn on, and power leads for memory backup of the tuner's presets and for illumination of the front panel.

The tuner section employs digital frequency-synthesized tuning, and up to six AM and 18 FM stations can be simultaneously stored in memory. The preset scan stops at each memorized frequency for about 5 seconds. As is true of most car FM stereo tuners, separation decreases gradually as signals grow weaker, until complete muting finally takes place. A "Hi-Q" function provides FM interference rejection by narrowing i.f. bandwidth when necessary.

The tape player, besides offering Dolby B and C NR, is equipped with music search, mechanically assisted tape loading, and a dual-azimuth transport mechanism that improves azimuth alignment for both forward and reverse playback. The preamp and dual 12-watt-per-channel amp sections of the receiver incorporate true full-range bass and treble controls, front/rear fader control, loudness compensation, and a balance control.

Control Layout

Harman Kardon has managed to cram all of the needed controls and buttons into a DIN-sized panel and has placed them logically, with the driver's needs in mind. Closest to the driver is the usual dual-concentric rotary, push-pull control for on/off, volume, balance, and fader. Just below are a tiny button used to select the external input/output loop and an equally small button that engages the loudness-compensation circuitry. Alongside the main volume control are smaller bass and treble tone controls which, once set, can be depressed into the panel to prevent inadvertent change of preferred settings. Below these controls is the digital display area, which shows frequency, band selected (FM1, FM2, FM3, or AM), stereo reception (when a stereo signal is received), and during tape play, direction of tape travel.

The tape eject button is just to the left of the cassette insertion slot; to its right are fast forward and rewind buttons and a "Prog." button that reverses direction of tape travel.

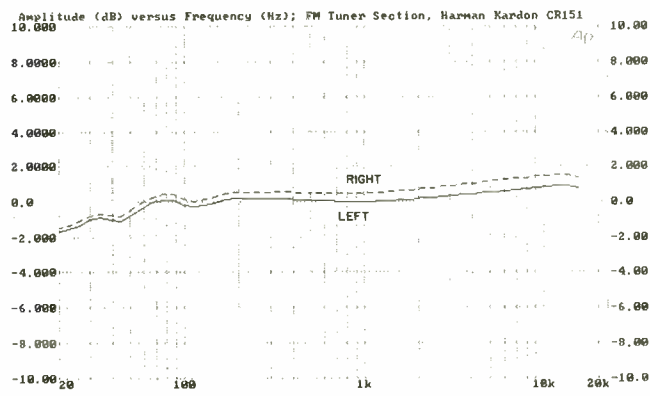


Fig. 1—Frequency response, FM tuner section. Right-channel response has been offset slightly, to make it visible.

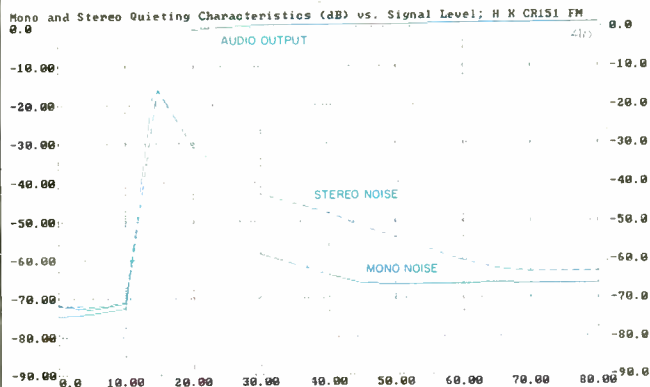


Fig. 2—Quieting characteristics, FM tuner section. The steep drop below 15 dBf is due to the non-defeatable muting circuit.

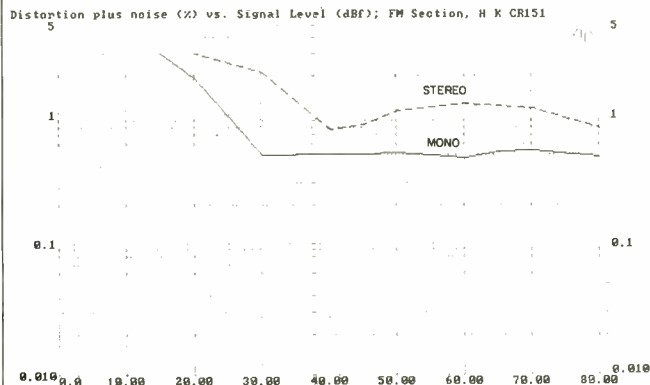


Fig. 3—THD + N vs. r.f. signal level.

ARIA. SUMO proudly introduces a revolutionary new planar loudspeaker, Aria, which after years of development promises to change our conception of reproduced music.

Aria provides a remarkably coherent, almost tactile, soundstage. A presentation so natural, so believable that we are left without adjectives – or words. Only the experience of having heard what is truly one of the most important loudspeakers to be offered in decades.

Like ripples spreading in a pond, sound emerges in nature to reach our ears with an integrity that is clearly different from reproduced sound. This is particularly true of musical instruments; whether plucked, struck, or blown.

Aria recreates sound in much the manner it occurs naturally. Like many other planar loudspeakers, Aria's radiating surface is a thin polyester membrane. There are no cone drivers. However, unlike other designs – whether conventional or planar – Aria does not attempt to move air as a piston. Instead, drive is precisely applied to a small area at the center of the diaphragm, elegantly approximating a point source. A series of controlled traveling waves then spread passively from the middle of the diaphragm, producing a spherical waveform – the virtual ideal. Energy is distributed with remarkable uniformity across the audible band. Treble dispersion is excellent. And with a single element generating sound, there is an incredibly coherent sonic picture.

Aria reproduces sound the way it occurs in nature. Much the same way that a pebble thrown into a still pond spreads waves across the water's surface. As a single element full range loudspeaker, its design is also a clear departure from approaches that have gone before. There are no crossovers. There are no delay lines. There is no response shading; nor are there associated electronics, either active or passive. Aria breaks new ground to such an extent that patents have been applied for and are pending worldwide.

Designed and manufactured exclusively for SUMO by Highwood Audio in Canada, Aria will be available at only a few very select dealer locations. Among those dealers displaying Aria are:

Pro Audio Consultants
182 Essex Street
Millbourne, NJ 07041
201/467-1950

Audio Video Systems
3250 Rochester Road
Rochester Hills, MI 48063
313/853-2170

THE NATURE OF BALANCE.

The logo for SUMO, consisting of the letters S, U, M, O in a stylized, outlined, blocky font.

SUMO PRODUCTS GROUP, 21300 Superior St., Chatsworth, CA 91311 818/407-2427
SUMO CORP CANADA, 1305 Odium Dr., Vancouver, B.C. V5L 3M1 604/254-5148



Harman Kardon has come up with a well-designed unit which properly balances features and performance against cost.

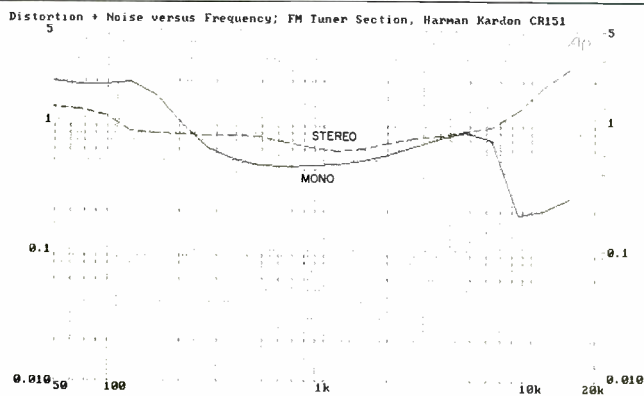


Fig. 4—THD + N vs. frequency for 65-dBf signal.

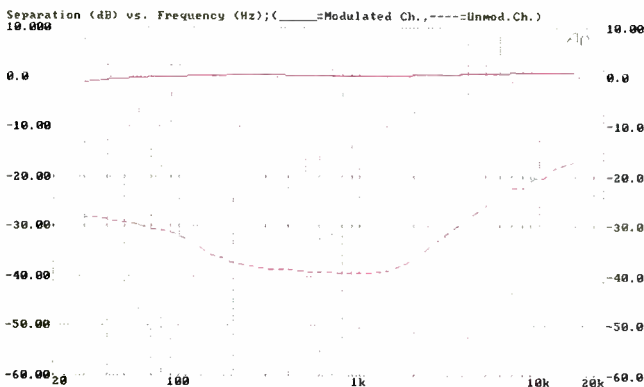


Fig. 5—Frequency response (solid curve) and stereo separation (dashed curve).

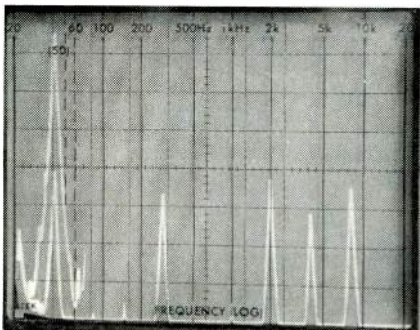


Fig. 6—Spectrum analysis of tuner output with 5-kHz modulation on one channel shows separation and crosstalk, plus unsuppressed pilot and subcarrier components.

Two rows of buttons are beneath the cassette slot. The upper row includes up and down tuning buttons, "Seek," the "Me" (memory) button used when storing presets, a "Mono" button, a "Local" button, the "Hi-Q" button, and the "P.Scan" (preset scan) button. The lower row has buttons numbered 1 through 6, for storing and recalling presets, and a seventh button labelled "FM/AM/MS" for selecting the desired radio band, and in the tape play mode, for initiating the music search function that advances tapes to the start of the next selection.

Tuner Measurements

I measured the performance of the tuner and the tape deck sections of this receiver by connecting my Audio Precision System One test gear to the preamplifier outputs rather than to the speaker leads. The power amp section, of course, was measured by hooking up the speaker wires to the test equipment using 4-ohm loads.

Figure 1 shows the frequency response of the FM tuner section. The dashed curve, for the right channel, has been deliberately displaced since the response of both channels was virtually the same. There was a slight rise in output amounting to +0.8 dB at 15 kHz, and an attenuation of slightly more than 1.0 dB at 30 Hz. Figure 2 shows the quieting characteristics of the FM tuner in mono and stereo. In mono, 50-dB quieting required an input signal of 26.5 dBf as against 18 dBf claimed by Harman Kardon. The manufacturer does not quote a sensitivity figure for 50-dB quieting in stereo, but in the sample I tested, that degree of quieting took place with a stereo input signal of 42 dBf. Notice how the mono and stereo quieting curves come together at lower signal levels. That's caused by the gradual "blending" that reduces noise—and stereo separation—under weak signal conditions. The steep drop in noise, as well as audio level, below 15 dBf is a result of the non-defeatable muting circuit that is activated at that signal level. Signal-to-noise ratio for mono reached a maximum of 67 dB, while in stereo, best S/N with strong signals measured 64 dB.

Figure 3 shows how THD + N varied with signal strength for mono and stereo signals, with my generator set precisely to the nominal frequency shown on the tuner display. Usable sensitivity, defined as the point where THD + N reaches 3%, is about 15 dBf in mono and 20 dBf in stereo; with Hi-Q on, it improved slightly, to about 14 dBf in mono, but with no change in sensitivity for 50-dB quieting. At 65 dBf, mono THD + N for a 1-kHz modulating signal measured just over 0.5%. Without retuning the generator for minimum distortion, stereo THD + N was just over 1.0%.

Before plotting THD + N versus frequency (Fig. 4), I tweaked the generator to yield lowest THD in stereo. This required shifting the generator frequency no more than 20 kHz away from the nominal frequency shown on the tuner display, but it did improve stereo THD readings significantly. It also indicates that the i.f. and ratio-detector alignment in the receiver was very slightly off. Stereo THD + N now measured 0.6% at 1 kHz, while mono THD was actually very slightly lower than in the earlier test.

Figure 5 shows how stereo separation varied with frequency when receiving a strong, 65-dBf, stereo signal.

....*remarkable!*



par.a.digm [par'adim] *noun: serving as an example or model of how something should be done.*

Every once in a great while a product comes along that offers performance which rises above the current variety of clever designs and marketing hype. When this occurs the new level of performance achieved can be readily heard by both the ardent audiophile and the novice listener. Paradigm is a breakthrough loudspeaker that

provides a level of musical truth that simply must be heard.

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In Canada: **Paradigm Electronics Inc.**, 457 Fenmar Dr., Weston, ON M9L2R6
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Night illumination is very good, with halos around the knobs, tuner-function buttons, and tape slot, even when the unit is off.

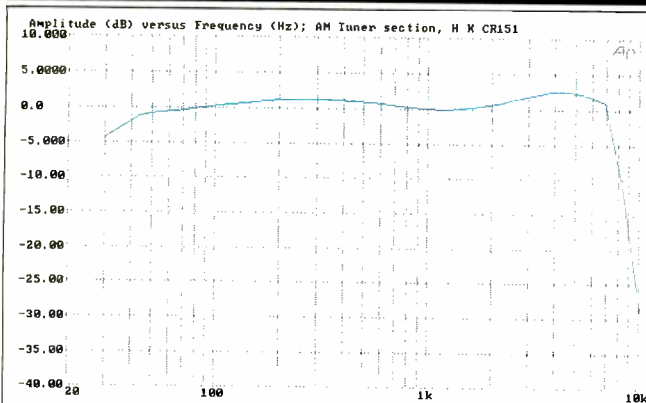


Fig. 7—AM frequency response, with 75- μ S pre-emphasis, was unusually broad and flat.

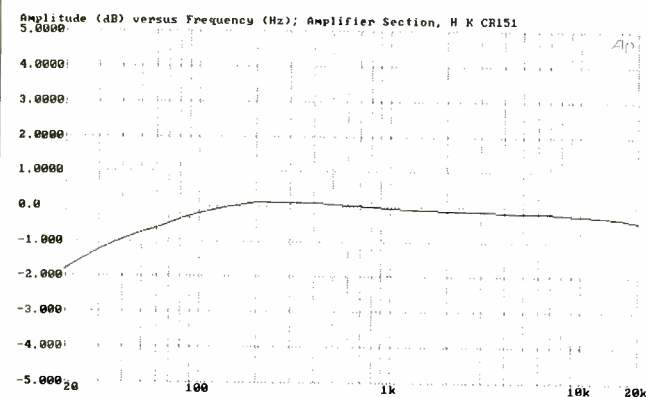


Fig. 8—Amplifier frequency response at about 1 watt output. Note the bass roll-off.

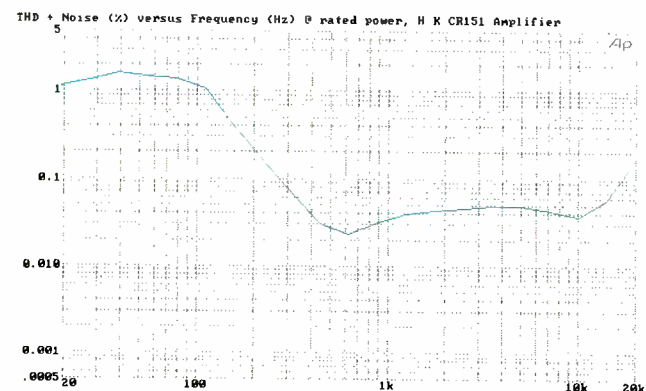


Fig. 9—Amplifier THD + N vs. frequency at rated output of 12 watts per channel into 4 ohms.

Separation was just short of 40 dB at 1 kHz and decreased to 32.5 dB at 100 Hz and to about 20 dB at 10 kHz. The spectrum analysis oscilloscope photo in Fig. 6 reveals that, as is true in most car FM sets, little effort is made to suppress either 19-kHz pilot leakage or 38-kHz subcarrier components and their sidebands, all of which show up prominently to the right of the main 5-kHz modulation "spikes" for the modulated and unmodulated outputs.

Capture ratio measured exactly 1.5 dB, as claimed, while alternate-channel selectivity measured 72 dB. Adjacent-channel selectivity was the usual, unimpressive 5 or 6 dB—until I switched in "Hi-Q," whereupon it rose to 15 dB! That improvement could be very useful on the road. I.f. rejection measured 83 dB while image rejection, though agreeing with published specifications, was a rather low 56 dB. Frequency response for the AM section was surprisingly uniform, when measured with the new pre-emphasis curve interposed between the audio generator and the modulation terminals of my AM generator. AM response (Fig. 7) extended from below 30 Hz (the lowest frequency I test for) to 7.7 kHz for the -6 dB cutoff points usually specified for AM.

Amplifier Measurements

Next, I measured the performance of the power amp by feeding in signals via the external input jacks. Frequency response (Fig. 8) was virtually flat to 20 kHz but was down nearly 2 dB at 20 Hz. This moderate roll-off was probably deliberate on the part of the designers, taking into account the lack of ultra-low bass response in the speaker systems commonly used with the amplifiers built into head units. The CR151's amplifier section is rated at 12 watts per channel, so I kept the output regulated at that power level into 4 ohms while I plotted THD + N as a function of frequency (Fig. 9). At that output level, THD + N rose rather rapidly below about 400 Hz, reaching a maximum of over 1.0% from about 100 Hz downward. At mid-frequencies, on the other hand, THD + N was only around 0.03% to 0.05%, increasing above 10 kHz to reach a maximum of 0.17% at 20 kHz. Separate plots of THD + N versus power output are shown for frequencies of 20 Hz, 1 kHz, and 20 kHz in Fig. 10.

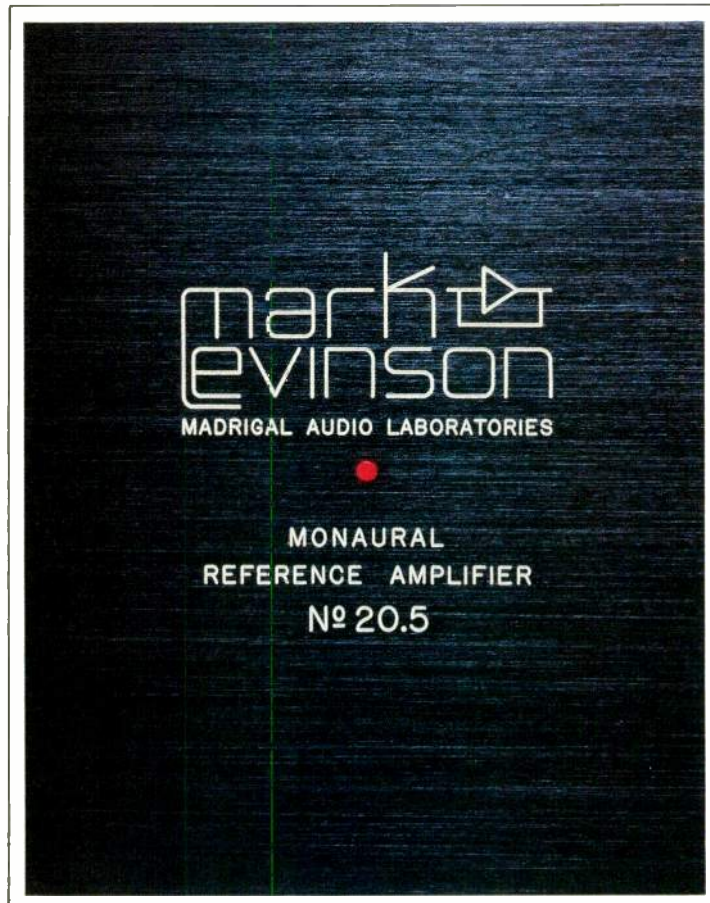
The bass and treble tone controls offered symmetrical amounts of boost and cut (Fig. 11), while loudness compensation at various settings of the volume control yielded appropriate amounts of bass boost with only minor amounts of treble boost added at low listening levels (Fig. 12). The S/N, measured via the external inputs and referred to 0.5 V input and 1.0 watt output, was 72.6 dB on the left channel and 75.1 dB on the right.

Cassette Player Measurements

To measure frequency response of the cassette player, I used specially recorded Type I and II calibration tapes prepared by BASF. Results for both tape types are shown in Fig. 13. Response using the Type II tape was excellent and would have extended beyond the 18.0 kHz shown if the calibration tape had gone beyond that frequency.

Using the same calibration tapes, I plotted the interchannel phase response of one of these tapes by first running the tape in the forward direction, and then inverting it and reversing its direction. I did this in order to see if Harman

THE EVOLUTION CONTINUES



ENGRAVING — January 1989

In the three years since the introduction of the Mark Levinson No. 20 Monaural Reference Amplifier, advances in circuit topologies and components available to the Madrigal design staff have made it possible to produce a new reference. The No. 20.5 Monaural Reference Amplifier is an ultimate statement of our craft and a benchmark for future designs.



It enables you to achieve emotionally complete musical reproduction in your home. Owners of the No. 20 may incorporate these advancements through an exchange of modules. Mark Levinson products are handcrafted in limited quantities to ensure their high standards. Visit your Mark Levinson dealer to hear how good music can sound in your home.

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P.O. Box 781, Middletown, CT 06457 ITT TLX 4942158

The excellent frequency response I measured with Type II tape would have extended even past 18 kHz, if my test tape did.

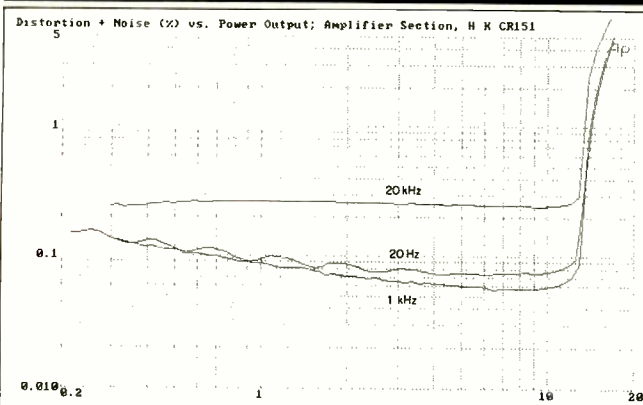


Fig. 10—THD + N vs. power output per channel.

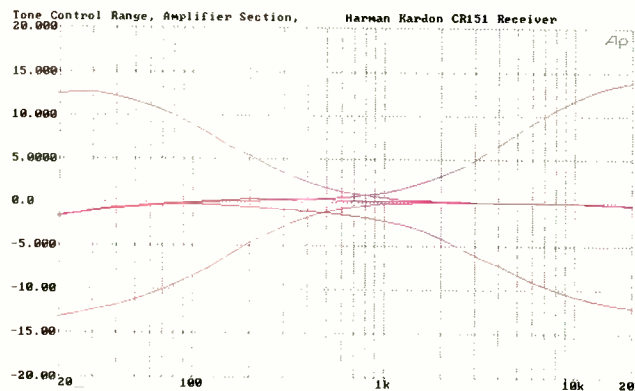


Fig. 11—Tone-control characteristics.

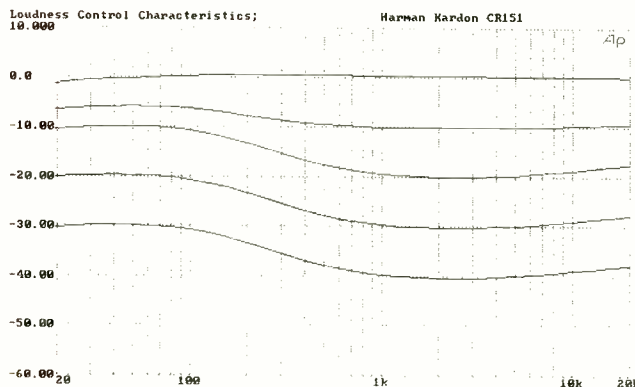


Fig. 12—Loudness-control characteristics.

Kardon's claims about low azimuth error in either direction of travel were significant. From the results of Fig. 14, I would say they have achieved their claim. Bear in mind that the "degrees" measurement in Fig. 14 refers to degrees of phase error between the upper and lower tracks of the recorded cassette at the frequency of the test signal currently being reproduced. A phase displacement of 80° in an 18-kHz sine wave works out to be a physical displacement between the left- and right-channel head gaps of less than 0.6 microns! That's holding the azimuth pretty steady, by anyone's reckoning. Remember, too, that Fig. 14 is the worst-case result of the two runs. For the better aligned channel, with tape running in the opposite direction, the error was only about 45° at 18 kHz, which works out to a little more than 0.3 microns!

Figure 15 shows the spectral distribution of residual tape noise, measured using a high-grade Type I tape that I had previously prepared by recording only the high-frequency bias. The three curves clearly show the effects of Dolby B NR and C NR. Notice that with Dolby C NR, noise reduction begins at lower frequencies than it does with Dolby B NR. Of course, actual S/N values will differ with different tapes, but for the sample I used, the A-weighted S/N without Dolby NR measured 56.1 dB on the left channel and 58.3 dB on the right. With Dolby B NR on, S/N improved to 64.4 dB for the left channel and 66.7 dB for the right. For Dolby C NR, the readings were 73.5 dB for the left channel and 75.1 dB for the right.

Wow and flutter was plotted for 30 seconds (Fig. 16). Average readings were around 0.1% over that period, falling just slightly short of Harman Kardon's claimed value of 0.09%. There are many weighting methods used in the measurement of wow and flutter; some standards call for peak measurements while others require averaging. Harman Kardon does not specify which method they used, but I presumed they had chosen the familiar weighted root-mean-square method (sometimes referred to as the JIS Standard), so that's the method I used.

From the stationary vantage point of the lab test bench, I would say that Harman Kardon has come up with a well-designed receiver in which features and performance have been properly balanced against cost. As for how the receiver behaves in the mobile environment, I'll let Technical Editor Ivan Berger tell you about how a second CR151, installed in his car, performed in and around the difficult New York City metropolitan area.

Leonard Feldman

Behind the Wheel

The CR151 is the first head unit I've tested in my new Scorpio, and I must say its styling matches the car's interior beautifully—especially as that styling does not greatly compromise the unit's human engineering.

The one fly in the ergonomic ointment is the long row of seven identical buttons along the bottom. When you're working by touch, three-button rows are easy to use, four-button rows are still reasonable, and the common row of five is stretching it a bit—but seven? In radio mode, where six buttons serve as station presets while the seventh switches bands, it's only a minor hassle. In tape mode, where only the four most distant buttons are used and their effects are

"They Were Designed To Play Music—And Make It Sound Like Music. This They Do Very Well, In A Most Unobtrusive Way, At A Bargain Price... It's Hard To Imagine Going Wrong With Ensemble."

Julian Hirsch — Stereo Review, Sept. '88

Cambridge SoundWorks has created Ensemble,[™] a speaker system that can provide the sound once reserved for the best speakers under laboratory conditions. It virtually disappears in your room. And because we market it directly, Ensemble costs far less than previous all-out designs.



Henry Kloss, creator of the dominant speaker models of the '50s (Acoustic Research), '60s (KLH), and '70s (Advent), brings you Ensemble, a genuinely new kind of speaker system for the '90s, available factory direct from Cambridge SoundWorks.

The best sound comes in four small packages.

Ensemble consists of four speaker units. Two compact low-frequency speakers reproduce the deep bass, while two small satellite units reproduce the rest of the music, making it possible to reproduce just the right amount of energy in each part of the musical range without turning your listening room into a stereo showroom.

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What Henry Kloss tells his friends:

Every time I came out with a new speaker at AR, KLH, or Advent, my friends would ask me, "Henry, is it worth the extra money for me to trade up?" And every time I would answer, "No, what you've already got is still good enough."

But today, with the introduction of Ensemble, I tell them, "Perhaps now is the time to give your old speakers to the children."

Ensemble, on the other hand, *takes advantage* of your room's acoustics. The ear can't tell where bass comes from, which is why Ensemble's bass units can be tucked out of the way—on the floor, atop bookshelves, or under furniture. The satellites can be hung directly on the wall, or placed on windowsills or shelves. No bulky speakers dominate your living space, yet Ensemble reproduces the deep bass that *no* mini speakers can.

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Unlike satellite systems which use a single large subwoofer, Ensemble features separate compact bass units for each stereo channel. They fit more gracefully into your living environment, and help minimize the effects of the listening room's standing waves.

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With "Hi-Q" switched in, the CR151's selectivity for adjacent channels became an impressive 15 dB! On the road, that's useful.

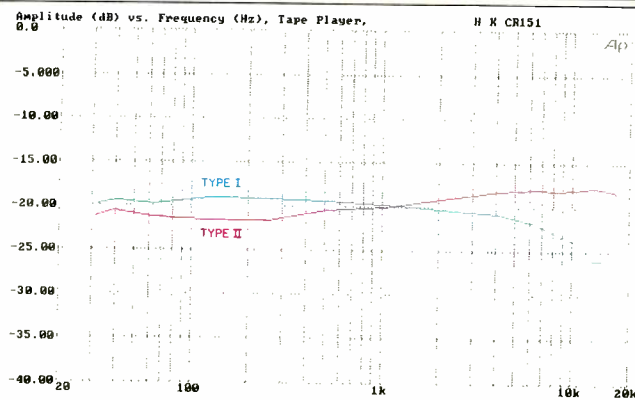


Fig. 13—Frequency response for tape playback. Note the excellent response on Type II tape.

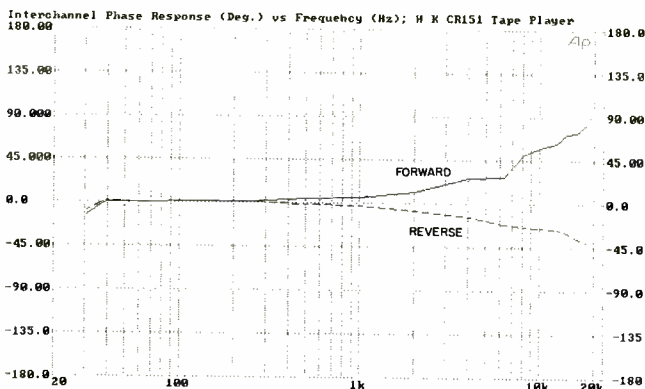


Fig. 14—Interchannel phase response for forward and reverse tape directions shows that azimuth error is low for both directions of play.

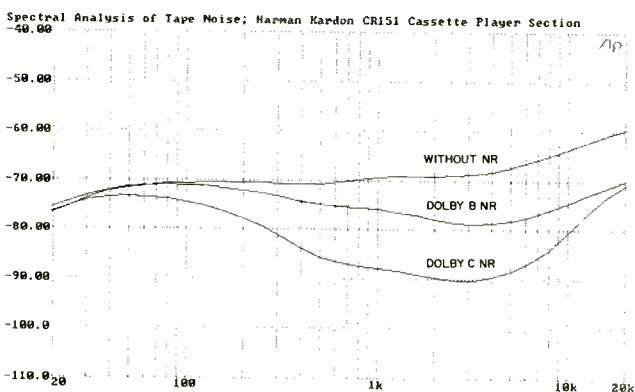


Fig. 15—Spectral distribution of tape noise, without Dolby NR and with Dolby B and C NR.

harder to tell apart by ear, it's a real nuisance. At least the bright red LED indicators make it easy to see which buttons are set.

Having got that off my chest, I must say that all other controls and the display were a delight. The volume control is easy to find and grip, as knobs usually are, and is not hemmed in by other controls. The only other functions on that shaft are volume-related—a concentric fader lever and a balance adjustment reached by pulling out the knob. The bass and treble controls recess when you don't need them. The buttons for the external input, loudness compensation, and tape reverse are sufficiently out of the way that you won't hit them accidentally, but not so much so that you can't get at them when you want. The five tiny tuner-function buttons below the tape slot are easy to find by touch, and the lights showing which ones are set are visible by day or night—still, a bit more tactile distinction between the buttons would be welcome.

Tape loading is easy, helped by the full-logic transport's tape grabber and the access notch above the tape slot. Thanks again to the logic system, pushing the fast-wind rocker to the left always rewinds the tape and pushing it to the right always advances it, regardless of actual tape direction. Inserting a tape turns the CR151 on; if it's already on, you hear the radio during fast-winding, but you can defeat that by pressing the volume control.

The display is exceptionally clear and easy to read by night or day. The stereo indicator is a large double-loop symbol, much easier to note at a glance than having "Stereo" or "ST" spelled out in tiny type, as on most car stereos. Night illumination is excellent, with halos around the three knobs, the four tuner-function buttons, and the tape slot—even when the unit is off. Having an external illumination line that can hook into your dashboard's dimmer circuit lets you match the CR151's illumination intensity to your preferred dash-lighting level.

Some other side comments on controls and features: The features are well chosen. I would have liked to have scan tuning in addition to the CR151's seek and preset scan. I would also have liked to see AM stereo, but Harman Kardon did provide a switched "Mono" circuit for tuning—a valuable feature most stereos omit. It would have made more sense to me to make seek tuning the default setting and have manual tuning require pressing a button, but the manual/seek button does stay pressed. I'd have liked to see some visual indication when the tape is in fast-wind—most units now flash their tape-direction arrow to show this—and an automatic tape-type sensor, which would mean one less control to fuss with. The multiple FM memories were a joy; even in this station-packed area, I had a few left for trips to Connecticut.

The CR151 pulls out of its dashboard housing easily and reseats firmly, and its handle lies out of the way when the unit's in the dash. Its internal batteries held station memory contents over several two-week periods when the unit was out of the car, but faded over one six-week period during which the unit was not in use.

The sound on radio was sometimes more open and spacious than that of my reference unit. On tape, however, the reference unit had the edge except on very loud tapes,

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On the whole, the CR151 was an extremely likable unit and a good performer, with no real flaws except for multipath rejection.

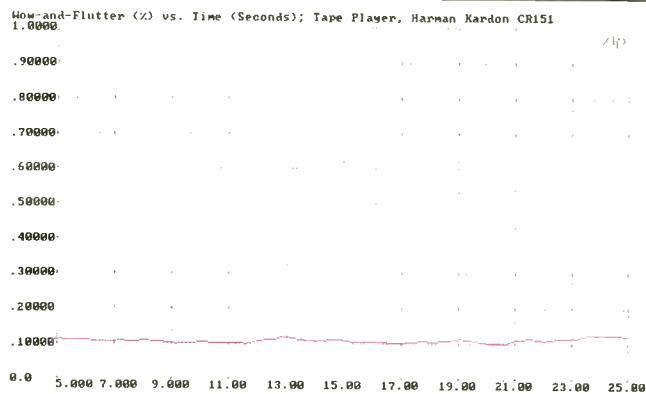


Fig. 16—IEC-weighted wow and flutter over 30-S period.

such as Telarc's *Ein Straussfest* (30098), where the CR151 had more headroom. Tape performance was about equally good in both directions. The loudness compensation levels were just right for my system. The volume jump when shifting from tape to radio was less than it is on most car stereos, but there was still some jump, especially on stations broadcasting highly compressed signals.

Radio reception in the country was excellent on FM—rather better than our sensitivity measurements would have led me to expect. The CR151 pulled in about as many good stations as my reference unit, though some stations only came in well when I switched on the "Hi-Q" system. The extra selectivity was most helpful in the suburbs, where one is often between adjacent-channel signals from two different, often distant stations. In the city, reception was only fair due to multipath problems, and "Hi-Q" made things slightly worse. Outside the city, the "Hi-Q" system also raised a few poor signals just above the muting level, making them audible without making them good—but that's only noticeable because the CR151 has muting, a feature I've sorely missed on many of this unit's competitors. I didn't even mind that the muting couldn't be defeated. As Fig. 2 showed, any signal that falls below the 15-dBf muting threshold wouldn't be worth hearing anyway. On AM, performance was a tad better than the reference unit's.

One small installation problem: The d.c. turn-on signal for external amps was 1.2 V below battery voltage—too little to turn my test amp on. The d.c. at the power-antenna terminal, however, was only about 0.5 V low, and it worked fine.

On the whole, the CR151 is an extremely likable unit and a good performer. Aside from its relatively poor multipath rejection—a problem which listeners in flat country will not encounter—it has no serious flaws. *Ivan Berger*

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A-5

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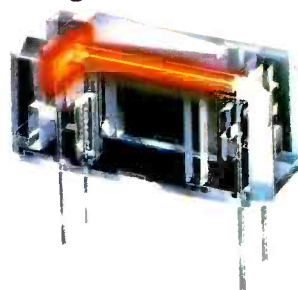
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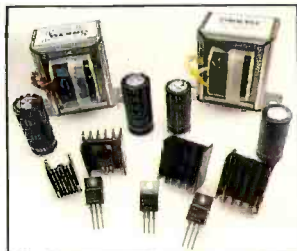
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2

MITSUBISHI DT-10 CAR DIGITAL AUDIO TAPE PLAYER

Manufacturer's Specifications

Frequency Response: 20 Hz to 20 kHz; no tolerance given.

Maximum Output Voltage: 1.4 V rms at 1 kHz, 0-dB tape.

THD: 0.01%

Dynamic Range: 85 dB.

S/N: 90 dB.

Channel Separation: 75 dB, no frequency specified.

Search Speed: Approximately 150 times playback speed.

Bass Control Range: ± 10 dB at 100 Hz.

Treble Control Range: ± 10 dB at 10 kHz.

Output Impedance: 100 ohms.

Output Level for Auxiliary Inputs: 0.4 V for 0.5 V input.

Input Impedance for Auxiliary Inputs: 20 kilohms.

Power Requirements: 14.4 V d.c.

Dimensions: Chassis 7 in. W \times 2 in. H \times 5 $\frac{7}{8}$ in. D (17.8 cm \times 5 cm \times 14.8 cm); front panel, 7 $\frac{3}{8}$ in. W \times 2 $\frac{1}{4}$ in. H \times 3 $\frac{5}{8}$ in. D (18.7 cm \times 5.8 cm \times 1 cm).

Weight: 4.4 lbs. (2 kg).

Price: \$1,650.

Company Address: 800 Biermann Court, Mt. Prospect, Ill. 60056.

For literature, circle No. 91



As we all know by now, introduction of home DAT recorder/players is still stalled by litigation threats from the recording industry. That won't prevent you from owning a DAT player in your car, though, since such devices are for playback only. Unfortunately, there isn't too much prerecorded software available for DAT players, but what limited

number of titles there are, offer sound quality that's every bit as good as that delivered by a CD player.

I had a chance to check out a prototype Mitsubishi car DAT player more than a year ago and felt then that the format certainly made a great deal of sense in a moving vehicle. After all, most of us are quite accustomed to push-

ing a tape into a slot while driving, but not too many of us have learned the knack of opening a CD "jewel box" with one hand, while the other hand is on the wheel!

The production model of the DT-10 that I just finished testing is a lot sturdier than that early prototype—and a lot more positive in its mechanical action. However, testing a DAT player is very much like testing a CD player. In fact, I use a test tape with the same signals as my CD-1 test disc, recorded in digital-to-digital mode at 44.1 kHz. Simply transcribing the signals from the CD-1 test disc via the analog outputs of my CD player and the analog inputs of one of my two DAT recorders would produce a test tape which no longer had the digital integrity of the original test CD. Using such a tape would yield meaningless test results. Of course, it would be nice to have the same test signals on a tape recorded at a digital sampling rate of 48 kHz (the alternate sampling rate for DAT recorder/players), but for the moment, I will have to settle for the one type of test tape I have. Actually, since most of the existing DAT prerecorded software uses a 44.1-kHz sampling rate (there are a few exceptions that do use 48 kHz, even for prerecorded tapes), the limitation is not a serious one.

Getting back to the features of the DT-10 itself, these include automatic tape loading, sequential scanning of the first few seconds of each numbered track on the tape, four types of repeat playback (all, one selection, preset program play, or non-repeat), separate bass and treble tone controls, an audible acknowledgment whenever a tape is loaded or a button is depressed, a remote-amplifier trigger lead, an auxiliary tape/radio input, and a tape-moisture protection circuit. Fast forward and reverse tape winding are also included, as are "program skip" capability and last-tape-position memory. If you wish, you can treat this product as a head unit: It is self-sufficient, even if a tuner is not part of your system. All you need to complete a basic DAT system for your car is a suitable power amplifier (two channels or four) and the speakers. In testing the DT-10, there was one feature that I wished the unit had. There is no way to "fast forward" the tape with audible monitoring. In other words, if you press the fast forward or reverse buttons while a tape is playing, playback stops and the mechanism goes into the fast-wind mode. It is therefore impossible to move ahead (or backwards) within a given selection without watching the time-counter section of the display—a potential hazard, while driving. You can, of course, use the program-skip buttons to advance to the next numbered track or return to a previous one.

I also found that tape loading, though power assisted, requires a rather strong set of fingers since the power assist does not take over until the tape is almost all the way in the tape slot. Getting the DAT in that far requires rather heavy pressure against the rear edge of the tape, compared with the light touch required to load a CD into some of the car players I've tested recently.

Control Layout

The volume knob, at the left end of the compact front panel, pulls out to act as a balance control, and the control tab for the concentric fader revolves around it. Below are separate bass and treble controls, each with a center-

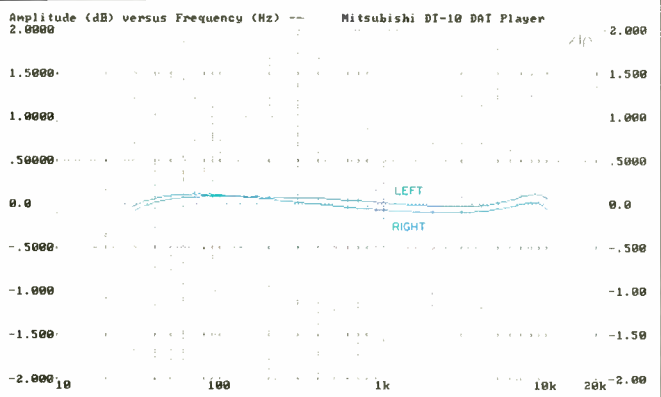


Fig. 1—Frequency response.

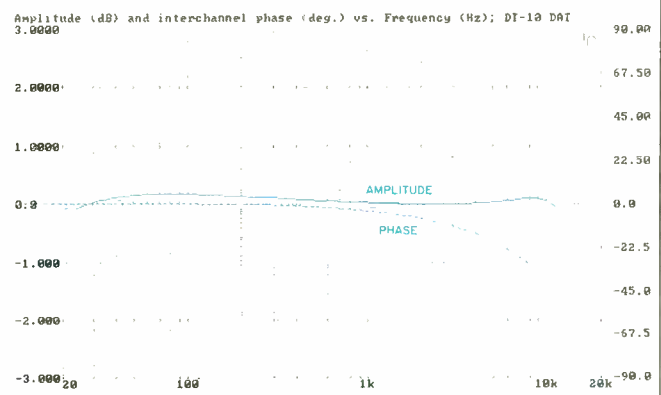


Fig. 2—Interchannel phase and amplitude vs. frequency. Phase difference, in degrees, can be read from the right-hand scale. No significant phase difference was observed within the audio frequency range.

detent "flat" position; both knobs can be pushed in when not in use. The DAT insertion slot, normally protected by a cover flap, is near the top center of the panel. Below it are buttons for reverse and forward skip, fast forward and fast rewind, and play. The stop/eject, scan, and repeat mode buttons are further down, near the bottom edge of the panel. To the right of the tape slot is a display that tells the user what track is being played and elapsed time of the current

Over the audio frequency range, response was fairly flat, and THD + N remained at or below 0.01% until the onset of beat tones.

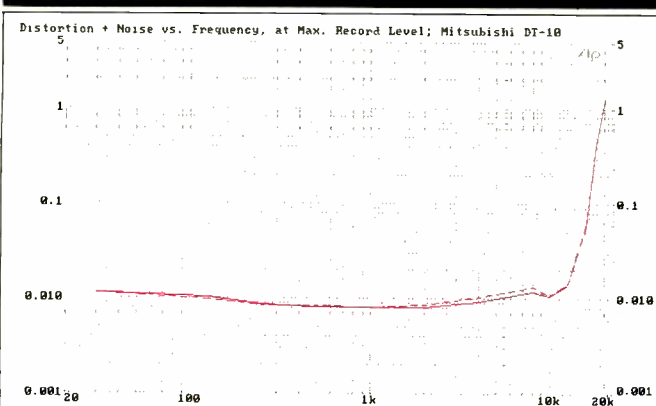


Fig. 3—THD + N vs. frequency at 0-dB (maximum) recorded level. The steep rise above 10 kHz is caused by "beats," not actual distortion; see text. Solid curve is left channel, dashed curve is right.

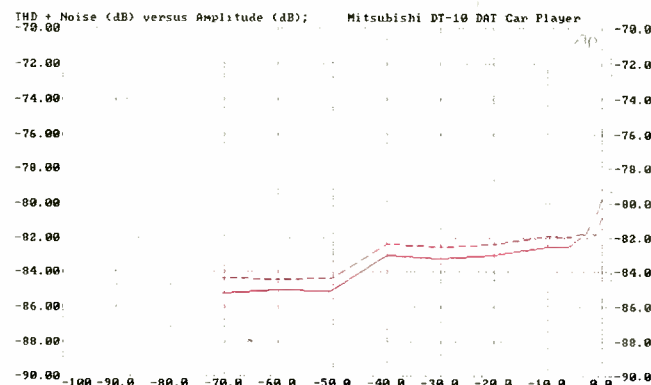


Fig. 4—THD + N, referred to 0-dB recording level, vs. signal level; see text. Solid curve is left channel, dashed curve is right.

track; it also indicates when the unit is in play, scan, or repeat mode. If moisture is present, the word "Wait" illuminates in the display area. Between the tape slot and the display, a tiny symbol lights up when a tape is inserted in the player. A "Memory" button, below the display area, is used to select and store program tracks for the preset program play mode. Up to 99 selections can be entered into memory. When in the program play mode, the tape will rewind to the beginning after all selections have been played, and stop.

Measurements

Frequency response, shown in Fig. 1, was relatively flat over the entire audio frequency range, with an attenuation of -0.4 dB at 20 Hz and just over -1.0 dB at 20 kHz. Channel balance was accurate to within 0.1 dB with the balance control set to its midpoint. In a second plot of frequency response (Fig. 2), I also measured interchannel phase response, which is represented by the dashed curve. The increasing phase error at high frequencies reveals the fact that only a single D/A converter is used in this player.

Figure 3 shows how THD + N varied with frequency when reproducing a signal at maximum recorded level. Over much of the audio spectrum, THD + N remained at or below 0.01%. At higher frequencies, however, the apparent THD + N increased markedly, reaching just above 1% at 20 kHz. This steep rise in readings is caused not by harmonic distortion but by the familiar out-of-band beats that take place in many digital playback devices. When 20 kHz is reproduced from a test tape, it "beats" with the 44.1-kHz sampling frequency to produce a distinct output component at 24.1 kHz. The test instrument cannot distinguish between such "beats" and actual harmonic distortion, hence the sudden rise in the curve.

Figure 4 shows how THD + N varied with level for a reproduced 1-kHz test tone. In this plot, THD + N is expressed in dB below maximum recorded level (0 dB). At 0 dB, THD + N was around -80 dB, which corresponds to 0.01%. This agrees closely with the 1-kHz point on the plot of Fig. 3, also recorded at 0 dB. When the level was backed off a bit, THD + N dropped a bit further, to -82 dB, while at -50 dB recorded levels, it dropped still further to between -84 and -85 dB, depending on which channel was measured. The test equipment is unable to read lower levels (-80 and -90 dB) that exist on the tape. This seems to be a characteristic of many car CD and DAT players. I suspect that it may be due to random noise caused either by the a.c.-powered d.c. supply which I use or by the circuitry of the device under test. In any event, being able to recover signals over a range of more than 70 dB is quite an improvement over other car stereo program sources, such as analog cassette tapes or even most car AM/FM tuners.

A-weighted S/N ratio measured -87.6 dB for the left channel and -86.6 dB for the right. For the spectrum analysis of residual noise, plotted in Fig. 5, no weighting was used and the highest levels of residual noise were observed at the high end of the audio spectrum. A third-octave band-pass filter was used to plot this curve. The slight rise in residual noise observed at 60 Hz is undoubtedly caused by residual hum in my d.c. power supply and would no doubt be absent if the unit were connected directly to a car battery.

Stereo separation measured about 73 dB at 1 kHz and nearly 90 dB at 125 Hz (the lowest test tone available for making this measurement). As shown in Fig. 6, however, separation decreased rapidly with increasing frequency, measuring 49 dB on one channel and 46 dB on the opposite channel at 16 kHz.

Figure 7 shows deviation from perfect linearity for a series of 1-kHz test tones of gradually diminishing amplitude. Deviation was negligible from maximum recorded level down to -70 dB. Again, however, the test system was unable to

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The ACS Advanced Component Series speakers Contains ACS 1220 polypropylene woofer w/200 watts maximum of deep bass power (93 dB sensitivity) ACS 5090 5-inch sealed back mid-range w/90 watts maximum power (93 dB sensitivity) ACS 1000 "aluminum sputtered" tweeter w/100 watts maximum power (90 dB sensitivity).

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The fade-to-noise test's results were surprisingly good, for overall dynamic range measurements (using the EIA method) of 95 dB.

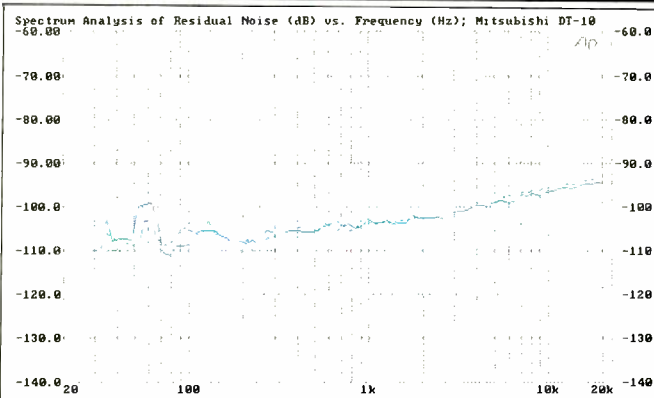


Fig. 5—Spectrum analysis of residual noise when playing "no signal" track of CD-1 test tape. The slight noise peak at 60 Hz is probably due to the external power supply used in the lab and would not occur in a car. Solid curve is left channel, dashed curve is right.

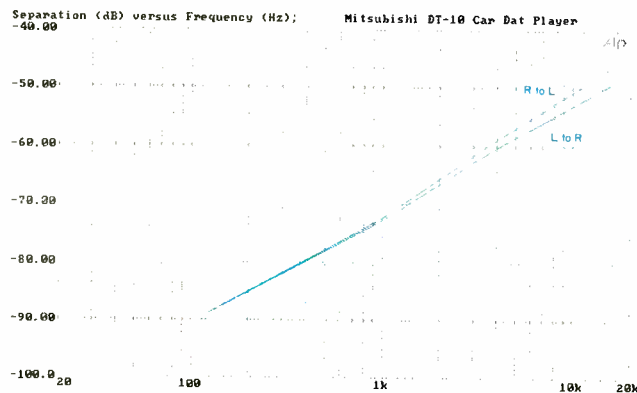


Fig. 6—Stereo separation vs. frequency.

pick up readings below -70 dB, even though the tape contains recorded levels at -80 and -90 dB. I have no way of knowing how much deviation from correct levels playback of such low-level tones would yield. Furthermore, since the dithered low-level test signals available on my test tape begin at -70 dB, this was the only point I was able to measure. Therefore, no graph was produced from those test tones, which extend down to -100 dB. At -70 dB, for the low-level dithered signals, linearity was accurate to within -0.25 dB for the left channel and within -0.13 dB for the

right. These are actually excellent figures for linearity, as far as they go.

The fade-to-noise test that I always include when testing CD or DAT players surprisingly yielded better results than the earlier linearity tests. In this test, with results shown in Fig. 8, linearity remained excellent all the way down to -90 dB. If I were to measure dynamic range in accordance with the new EIA method, I would have to rate this DAT player as having a dynamic range of around 95 dB. That's the level at which the noise begins to overwhelm the signal by 3 dB. Measuring dynamic range using the EIAJ's proposed method yielded a figure of 93.6 dB for one channel and 90.3 dB for the other. I also measured SMPTE-IM distortion for a maximum recorded signal—consisting of 60 Hz and 7 kHz in a 4:1 ratio—and obtained readings of 0.013% on the left channel and 0.014% on the right.

It's been some time since I've seen a square wave like the one reproduced by this DAT player and shown in the photo of Fig. 9. Early CD players that did not use digital filtering and oversampling exhibit just this sort of square-wave playback, so it is safe to presume that this DAT player also depends upon steep analog filtering and employs a clock rate of 44.1 kHz rather than the 88.2 kHz, 176.4 kHz, or even higher frequencies now commonly employed in late-model CD players.

Since this DAT player offers some of the control functions of a complete head unit, I decided to measure its tone control characteristics (Fig. 10). While maximum bass and treble cut at 100 Hz and 10 kHz, respectively, were close to the -10 dB specified by Mitsubishi, maximum bass and treble boost were limited to around $+6$ dB at those same reference frequencies. The DT-10 DAT player, I learned by reading the owner's manual, is also equipped with an "automatic" loudness control. The action of this loudness control (Fig. 11) is relatively mild: A boost of around $+5$ dB when the volume control is set at -40 dB below maximum and no treble compensation, as indeed there should not be. Still, I rather wish that Mitsubishi had not incorporated this feature or, if it had to be there, I would have liked to see a front-panel button that could disable it. As matters stand, however, you can probably defeat this compensation quite accurately by turning down the bass control just a bit.

Mitsubishi is to be commended for offering a DAT player to Americans in spite of the fact that sales are not likely to be great until there is some solution to the so-called "copyright" issue. When that happens, perhaps the major record companies will at last realize that producing a wide variety of prerecorded digital audio tapes can only result in increased profits, just as prerecorded cassettes—once equally feared by many major labels—have become their single greatest source of revenue and profit. I've had a DAT player in my car for several months now, and I continue to believe that this program source is particularly suited for mobile use. Of course, I have an advantage. I am able to make my own software from my collection of CDs, using my home DAT recorders. In one sense, I'm no different from those of you out there who create your own cassette tapes by recording songs from various CDs or LPs that you already own. By making such digital audio tapes for my car, I am no more of a pirate than you are. It's just that my DAT recordings sound

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The S/N ratio was above 86 dB on an A-weighting basis, while a spectrum analysis was smooth, with a small 60-Hz hum blip.

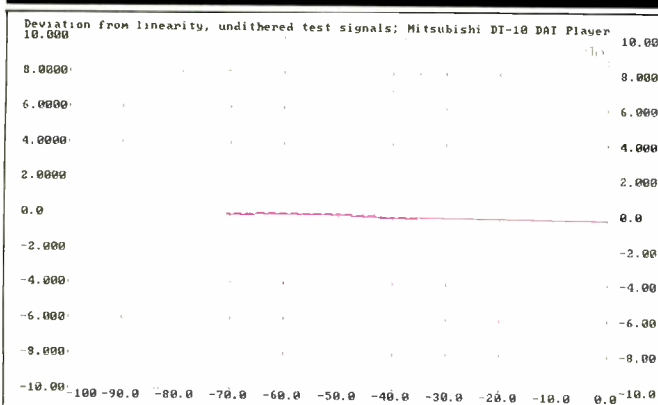


Fig. 7—Deviation from perfect linearity for undithered signals; see text. Solid curve is left channel, dashed curve is right.

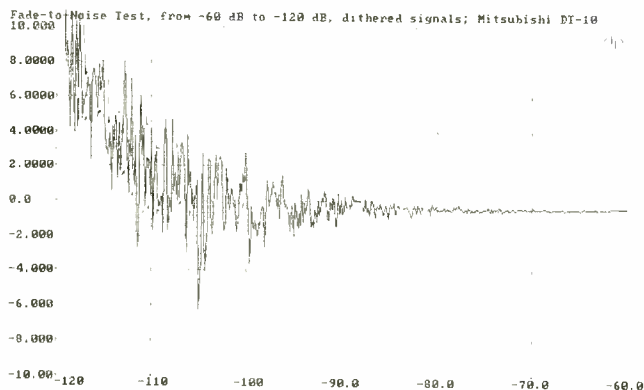


Fig. 8—Fade-to-noise test, using dithered signals.

a bit better—even in a mobile environment—than your analog cassette tapes. Isn't that what audio progress is supposed to be all about?

Leonard Feldman

Behind the Wheel

The DT-10 is the first DAT player I've ever used in a car, but its functions are basically the same familiar ones found on all the cassette players I've used over the years. This, plus a good control layout, had me operating it like an expert in seconds—at least by day.

Night illumination is also good. Even when the unit is turned off, it's easy to spot the tape slot, the control knobs, and the play and stop/eject buttons. The smaller buttons are fairly hard to see but became easy to find after I had a few hours in which to become familiar with the DT-10. Raised spots on these buttons helped me find them by touch, which is even more significant than the ability to see them.

I had only a few, minor criticisms of the controls. The bass and treble control knobs are too close together for easy use, but you can always retract one when you use the other; I found little need to use the treble control in my system. I'd have preferred control curves with even less impact on the midrange. The repeat button is just a bit too easy to hit unintentionally (a stiffer spring on this button would help), but the display shows what's going on so clearly that you can easily catch and correct any mistakes you make. The rewind and fast-forward controls only work from play mode, a minor nuisance to those with instincts honed by old tape decks. But these are merely ergonomic freckles on a basically good design.

Simply inserting a tape, as Leonard Feldman noted, does take a lot of effort. However, a note buried in the manual's text points out that if you push the play button as you insert the tape, loading becomes easier. After you slide the tape in until you meet resistance, pushing the play button sucks the tape right into the slot. You can't reach the button easily until you slide the tape into loading position, but the button has no effect before that point in any case. When ejected, the tape goes back to loading position, so if you eject it by mistake, pressing play will reload and restart it for you. This button-operated power loading system helps protect the alignment of the transport. Still, I'd prefer to have a sensor in the tape compartment trigger the soft-loading mode, rather than making the driver perform yet another function that the player could have been designed to perform for itself.

Inserting a tape turns the unit on, illuminating the over-bright "Tape In" indicator to the right of the tape slot and putting numbers on the large display. I had no chance to check the display's visibility in bright sunlight, but it was easy to read in moderate daylight and at night.

To my surprise, the fast-wind and tape-search times of the DT-10 did not seem much quicker than a regular cassette player's, but in all other respects, performance and features were vastly superior. Cassette players usually have fast forward and rewind buttons that double as forward and reverse music-search controls, depending on the setting of an extra switch. Having forward- and reverse-skip buttons in addition to the fast-wind buttons, as the DT-10 does, is a great convenience, especially as Mitsubishi has made the skip buttons easier to find than the fast-wind buttons are. In either fast-wind or skip mode, the display shows clearly where you are on the tape; hardly any car cassette players do that. In skip mode, the display also shows the track number you have selected (to move ahead three tracks, you press the forward-skip button three times); in fast-wind mode, it shows what track you're passing. According to the display and my stopwatch, the scan function plays the first 8 seconds of each selection on the tape (the manual says 9), which is just enough time to identify each track. Pressing the play button stops the scan.

ZAPCHORD

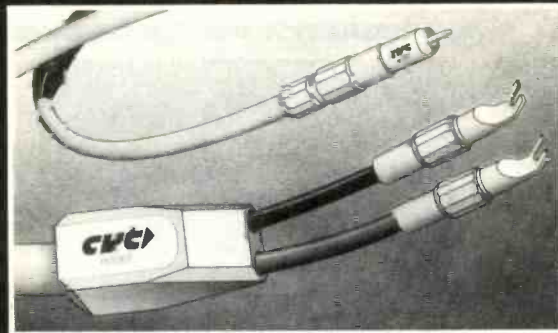
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The Fruit Doesn't Fall Far From The Tree

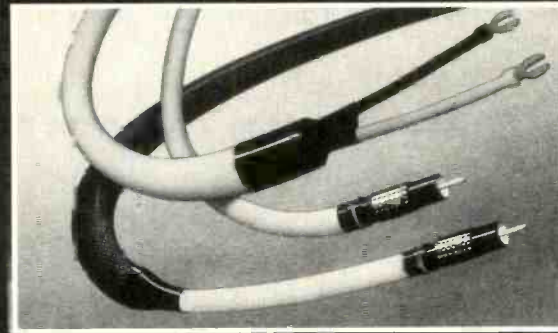
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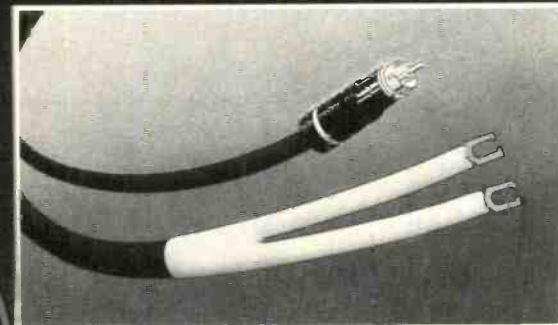
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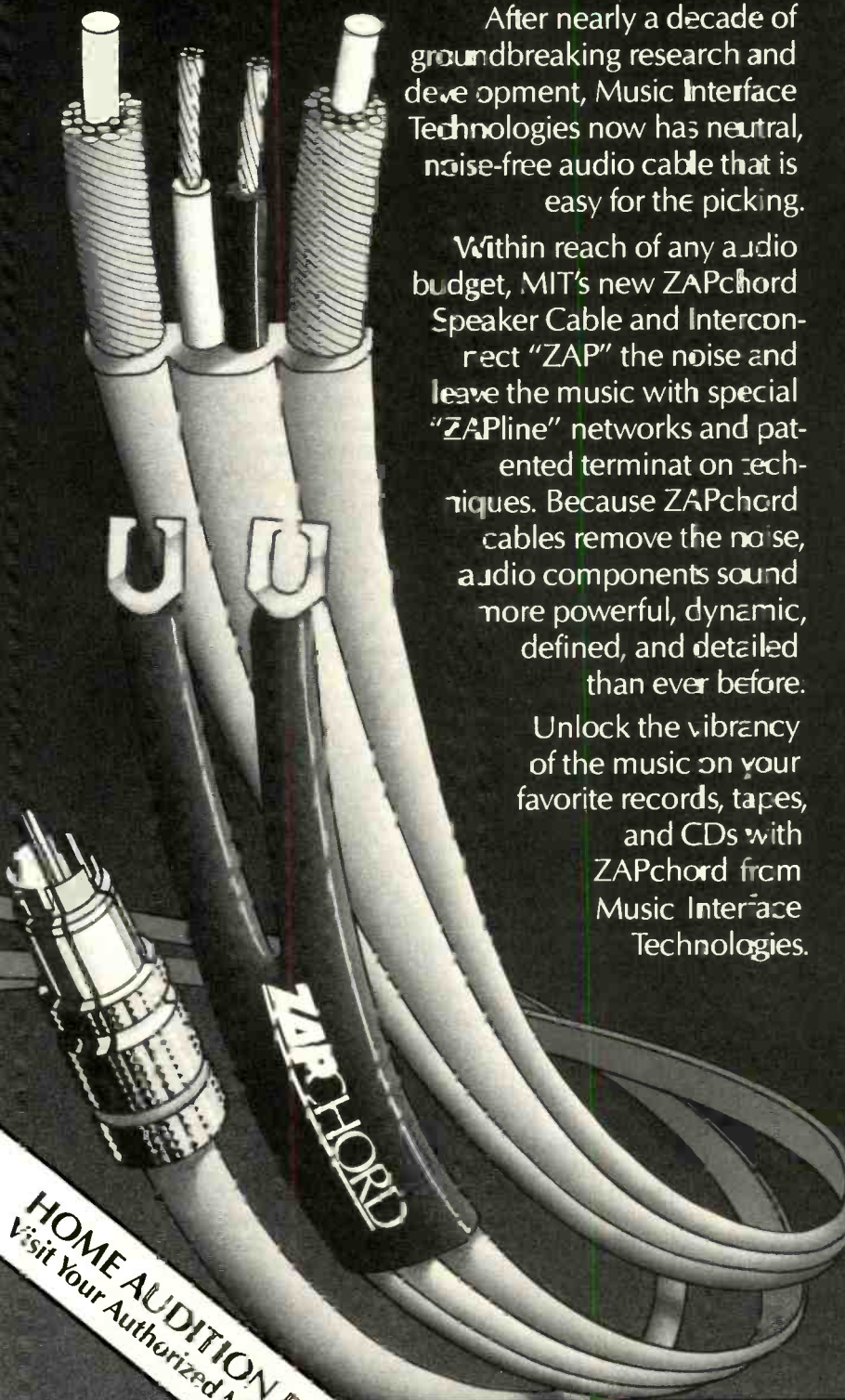
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The sound from the DT-10 was clear, clean, dynamic, and wide-ranging—a real delight, with silence like velvet between the tracks.

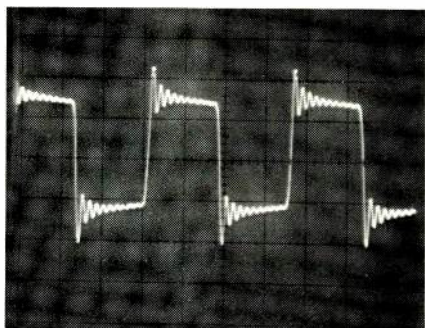


Fig. 9—The DT-10's 1-kHz square-wave response indicates that this player does not use digital filtering and oversampling.

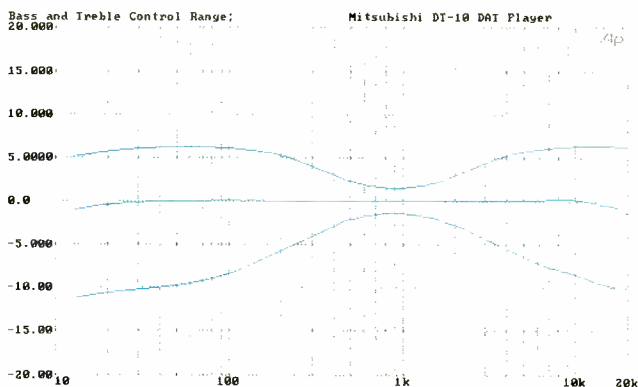


Fig. 10—Tone control range.

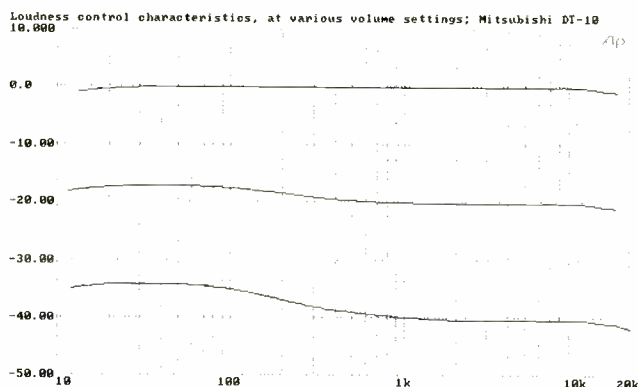


Fig. 11—Loudness compensation at different volume-control settings.

Since DAT selection numbers are digital subcodes, neither the skip nor scan functions stop on quiet passages on classical tracks, another advantage over cassette. If your tape has program-number (PNO) subcodes recorded on it, the DT-10 will identify the current track even if you insert a tape that has not been rewound. On tapes with start IDs but without PNOs, it will call the first track it finds "1" and number up from there.

The sound from the DT-10 was clear, clean, dynamic, and wide-ranging—a real delight, giving me new insight into how good my system-in-progress is becoming. The silence between tracks was like black velvet, providing an almost awesome contrast with tracks that start with a bang. If you don't have Mitsubishi's DIN adaptor cable, I discovered, it's also possible to feed pretty good signals out of the DT-10's AUX input phono jacks. However, this bypasses the volume and tone controls, lets through some otherwise inaudible thumps and background noise, and seems to limit the system's dynamics, so it's strictly for emergencies. Mitsubishi stresses that this connection is not recommended.

The otherwise excellent manual's text does not say how the AUX input is selected, but it can be deduced from the manual's wiring diagrams. An unshielded wire labelled "Remote Input" is connected to the power-antenna or amplifier-turn-on lead of a CD player, cassette receiver, or other head unit. When that signal source is turned on, the DT-10 turns on and switches to its AUX input; the signal can then be controlled by the DAT player's volume and tone controls. However, if the DAT unit is playing at the time, the incoming signal does not override it.

There were no audible problems when travelling over moderately rough roads, which is just what I'd expected. Unfortunately—at least for testing purposes—New York City's street department apparently had taken advantage of our mild winter to patch my favorite tape-deck testing streets, so I couldn't test it over severe bumps.

In the car, DAT is a far more convenient format than cassette, and slightly more convenient than CD: You can carry a lot more music in a lot less space, finding selections is a breeze, and you don't have to fiddle with tape-direction, tape-type, or noise-reduction switches. The flap which automatically covers the DAT slot probably makes it less vulnerable to dirt and damage too. And it goes without saying that DATs sound better than analog cassettes. The only drawbacks inherent in the system, as far as I can see, are that DAT labels are tiny, making it hard to select tapes at a glance while driving, that track-to-track access time is far slower than with CDs, and that DAT lacks CD's audible fast-scan facilities.

Nonetheless, mobile DAT players will appeal mainly to people who have a good stock of travelling music in this format, as Leonard Feldman does. As the owner of a large number of CDs and cassettes but only a few DATs (and no DAT recorder), I'm not in that category . . . yet.

The Mitsubishi DT-10's design is based upon a useful, low-key concept, taking advantage both of DAT's virtues and of our familiarity with tape deck operation. It acts just like an ordinary cassette deck, only better. In fact, the DT-10 is so ordinary, it takes a while to realize just how much better this unit is.

Ivan Berger

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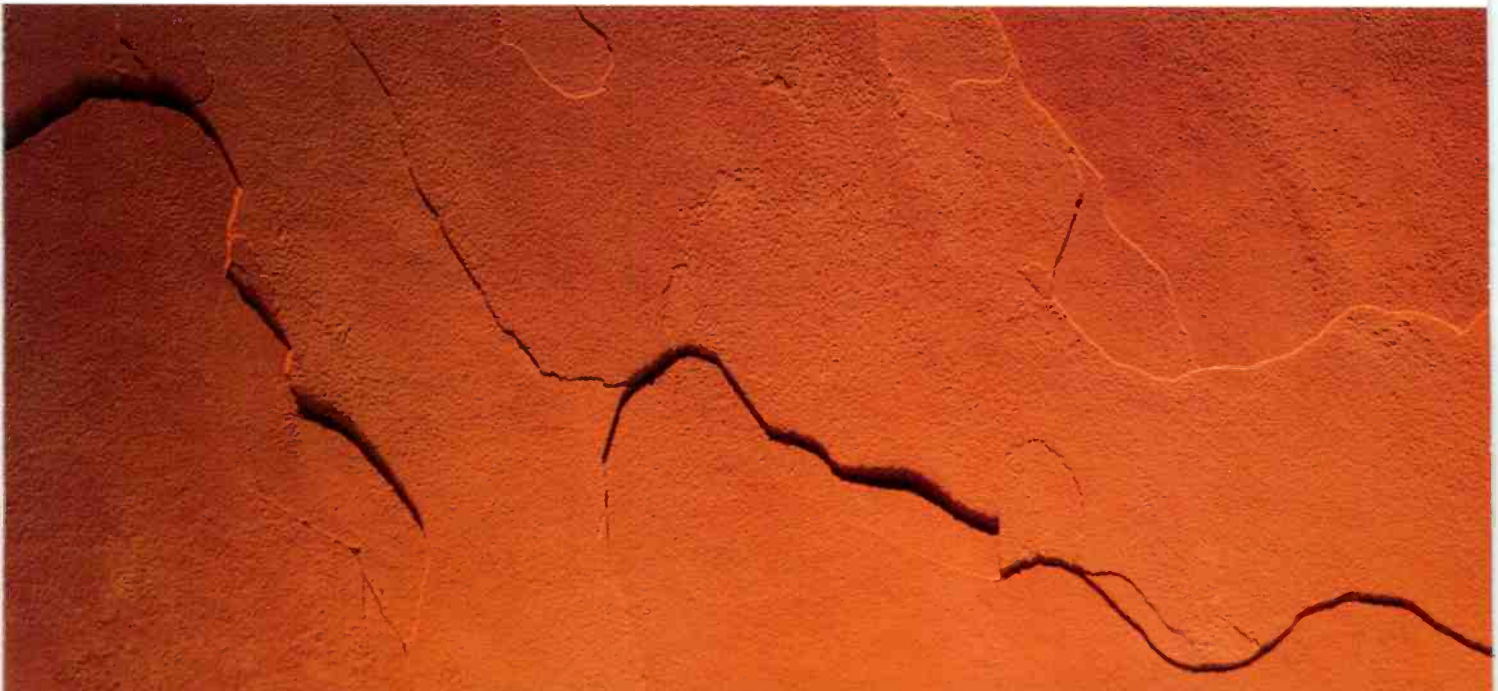
But while you're sure to appreciate the technology that went into the RS-Z1, we suspect there's something about it you'll like even better.

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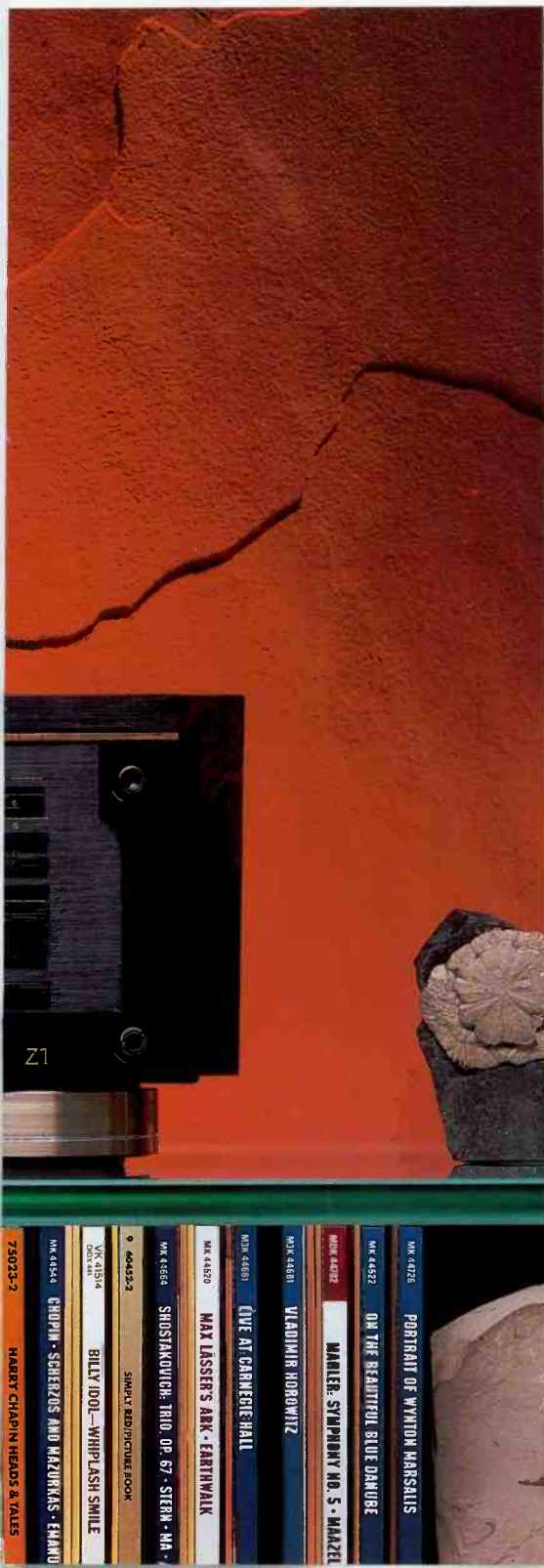
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CANADIAN COWBOYS

The Trinity Session: Cowboy Junkies
RCA 8568-2-R, CD; 52:57.

Sound: A Performance: A

Sometimes, no matter what you say, it's going to end up sounding like one of those movie ads with all the stupid, gushy quotes. I'll keep this simple, then: Cowboy Junkies' *The Trinity Session* is a masterpiece, full-blown and with all promises fulfilled. It's the best record I've heard in years.

This major-label debut by the Toronto band—siblings Margo, Michael, and Peter Timmins on vocals, guitar, and drums, respectively, and Alan Anton on bass—came from out of nowhere; RCA picked it up from a local label. Yet Cowboy Junkies has created a completely distinctive, haunting, highly personal sound, one that blends elements of country, blues, traditional folk, and torch singing in a delicious soup. Spearheaded by Margo Timmins' vibrant, ethereal voice, sweet and juicy as ripe fruit, the band and some choice sidemen create a universe of dark, powerful beauty and stripped-naked emotion. The fact that almost all the songs are midtempo is no crime; rather, the album has a focused, deliberate quality that's just as scornful of packaging concerns as was the solidly uptempo punk movement at the opposite end of the spectrum.

Half the songs are originals, the other half are covers ranging from Hank Williams (a painfully moving "I'm So Lonesome I Could Cry") to Lou Reed (a lilting, if perhaps too somnambulant, "Sweet Jane"). The album opens with guts: An a cappella solo of the traditional folk song "Mining for Gold." From there, it segues into "Misguided Angel," a sweetly defiant ballad of passion for a man who's "crazy and he scares me," with a "soul like a Lucifer, like gold on a piece of lead." And, in a song with a most unpromising title—"Blue Moon Revisited (Song for Elvis)"—Timmins' lament for idealized love intertwines with the Rodgers and Hart evergreen, investing it with the awful, eternal sadness of longing and regret, without ever slipping into melodrama or bathos.

The playing is impeccably precise—sparse and silky with accents in just the right spots. The melancholy wail of pedal steel guitar or accordion sweeps



in like a sad-eyed Appalachian breeze; mandolin and harmonica slip in and out without overstaying their welcome. While the band never exactly rocks out, they certainly seem capable of it: On the old folk song "Working on a Building," a jaunty walking bass gets stabbed by a flurry of guitar notes, with Margo Timmins' voice moving in for the kill as perfectly as Rod Serling introducing an episode of *Twilight Zone*.

Cowboy Junkies is all the more impressive for having recorded this brilliant album live, at a church, in a single day—using, according to the liner notes, a Calrec Soundfield microphone. High tech, but sweet and simple. Maybe that's their secret, and maybe a serious studio and weeks of recording would dilute them into just another band. I doubt it. There's just so much sheer talent at work here. Genetics, I guess.

Frank Lovece

Rattle and Hum: U2
Island 91003-2, CD; AAD; 72:29.

Sound: A— Performance: B—

It could never be said that the Irish lads collectively known as U2 are small

thinkers. Here is a group which, fanaticism as de, is on a musical par with a good, steady bar band. Yet here they are out touring the world, commenting on political affairs, bringing home plenty of dough, and making a movie about all of it. Life is good.

Rattle and Hum is the aural partner of the movie of the same name. This audio/video marriage is a diary of U2's "Joshua Tree Tour," which ran over hill and dale for much of 1987. The album is a 17-song collection combining studio and live recordings. It includes two non-U2 performances: One 38-second performance of "Freedom for My People" by Sterling Magee (with Adam Gussow on harmonica), and a 43-second guitar explosion of "The Star Spangled Banner" as whipped into shape by the master-blasters of rock, Jimi Hendrix. In addition, Bob Dylan ("Hawkmoon" and "Love Rescue Me") and B. B. King ("When Love Comes to Town") drop in for guest stints.

U2 didn't scrimp on the technical talent for this CD. The live cuts were done using The Black Truck, a remote recording rig operated by David Hewitt of Remote Recording Services. Up to

U2's *Rattle and Hum* shows up too many faults in the band's abilities, while offering too few musical high points.

four analog multi-track machines were in service at any one time, with at least 48 tracks available for capturing the live shows. Many excellent engineers were called in to record, as well as do some mixing of the live and in-studio tracks, but engineer Shelly Yakus (of Tom Petty and Feargal Sharkey fame) mixed most of the studio tracks on the album.

Despite all the technical help, *Rattle and Hum* is not a great collection. Perhaps because of musical or audience problems, the best or most exciting live performances were unable to be used. The fact remains that this album shows up too many faults in the band's abilities, while offering too few musical high points. Choosing two cover tunes to showcase the band is not in itself a bad idea, but choosing "Helter Skelter" and "All Along the Watchtower"? After The Beatles, Bob Dylan, and Jimi Hendrix have done those tunes, what could be left to say?

There are high points, however, mostly in the studio recordings. The current hit, "Angel of Harlem," is one. Any group which has the good sense to write a song honoring Billie Holiday can't be all bad. "I Still Haven't Found What I'm Looking For" (live) and "When Love Comes to Town" are also strong. The thread that holds these three songs together is that the band is accompanied by other musicians, filling out the small, open sound ordinarily



ly generated by U2's three-piece instrumentation. The Memphis Horns, The New Voices of Freedom, and B. B. King, respectively, shift the music into an emotional gear which the band doesn't seem to have without these extras. The rhythm section holds its own, but lead singer Bono and lead guitarist The Edge are underachievers.

Bono has a tendency to sing in similar registers in a somewhat monotonous manner. He nearly always sings the melody line straight—no playing with phrasing or pushing the boundaries of the melody envelope. Only when he reaches for notes slightly out of his range does he manage to accomplish more than a basic reading of a tune. Perhaps this is why he is so often accused of resorting to histrionics to deliver the point. It's almost embarrassing to hear Bono exchange vocals with B. B. King—the pretender and the king on the same song.

Rattle and Hum is one of the few CDs that actually delivers the warm, round, deep bottom that vinyl—due to the technology of that medium—is capable of. The segues between live and studio cuts are carefully done, with audience noise kept to a realistic, unobtrusive level. Additionally, the album's lyrical content is strong and its political messages astute.

Unfortunately, though, this disc simply doesn't come across as heartfelt. This is not to question the honesty of the boys in the band, it is just to say that frenzy doesn't necessarily equal true emotion. *Hector G. La Torre*

New York: Lou Reed
Sire 25829-2, CD; AAD; 56:40.

Sound: A Performance: A

The city as social microcosm is certainly no new metaphor, but it's novel for a rock concept album and is at the

heart of Lou Reed's *New York*. This disc conjures Dylanesque images from mean streets and the daily news to send a warning to Mr. Jones' America that "Oh you better hold on—something's happening here," and *it's coming your way*.

Reed's highly literate drama—intended to be heard in one sitting—begins with *West Side Story* turned drug war ("Romeo Had Juliette"), and then segues from AIDS in Greenwich Village ("Halloween Parade"), to child abuse ("Dirty Blvd."), New Jersey shoreline medical waste ("Sick of You"), Howard Beach racism ("Hold On"), political hypocrisy ("Good Evening Mr. Waldheim"), homeless Vietnam vets ("Xmas in February"), environmental suicide (the brilliant "Last Great American Whale"), finally concluding with a paean to *tempus fugit* in a tribute to the late Andy Warhol ("Dime Story Mystery"). This is not the dilettantish decadence of the wild side; this is dead serious.

Reed orchestrates this stark apocalyptic vision simply, with two guitars, bass, and drums pumping out a lean roots-rock which occasionally veers toward jazz. Reed searched out an old Neve tube board to add warmth to his essentially "live" recording technique. All the guitar tonal textures were achieved through hot-rodged electronics on the instruments, rather than with studio tricks. Reed wanted his record to sound good with modern digital playback, and he succeeded.

Lou Reed's *New York* is a powerfully moving statement that's both disturbing and inspiring. It's like hearing "Like a Rolling Stone" all over again. In "There Is No Time," when he says: "This is no time for phony rhetoric . . . This is a time for action . . . This is the time," you feel like he's right on. Don't miss *New York*. *Michael Wright*



Lou Reed



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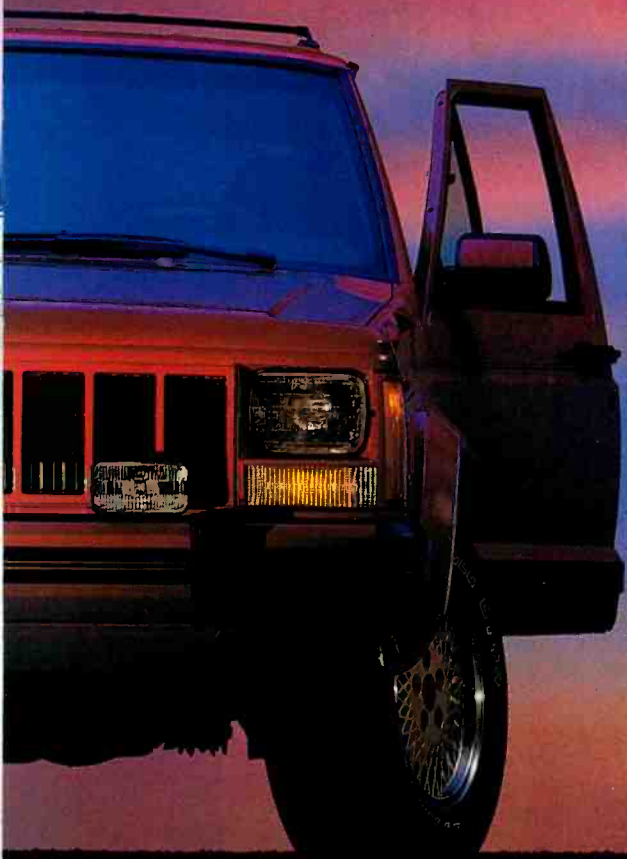
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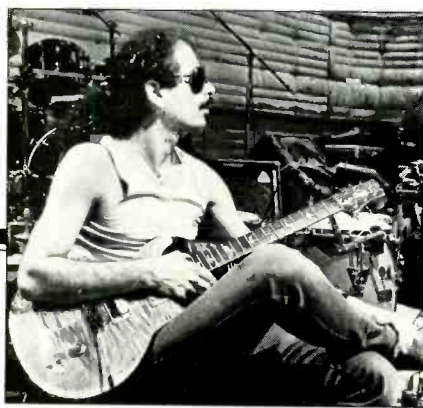
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Viva Santana!: Santana
Columbia C2K 44344, two CDs.

Sound: B Performance: B+

Viva Santana!, Carlos Santana's most recent release, is not so much a collection of "greatest hits" as it is a two-CD, 30-song musical toast to an original artist's career. Where many other musicians have been unable to support themselves in the industry and make music their life's work, Santana has had no such problem. Actually, he has managed to maintain several musical careers, having altered his style a number of times as his beliefs changed and developed. Throughout it all, though, the sound of his Mesa Boogie amps married to his Gibson Les Paul, Yamaha, or more recently, PRS (Paul Reed Smith), has been unmistakable. The searing, sustained tone and guitar lines dancing between the Latin beat are his signature.

This set provides listeners with a look at Santana from his early days (starting in 1966) through various tours and recording dates into the middle '80s. The 48-page booklet chronicles Carlos Santana's career and the many personnel changes in his group, and gives detailed recording data and songwriting information.

Many of the live and in-studio cuts are of previously unreleased material, some of which may not have seemed right for release at the time they were originally recorded. The collection, therefore, is not likely to gain many new fans for the guitarist. Santana dilettantes will want a pristine "greatest hits" package, while possible new converts will find the jams too indirect and musically dense to appreciate. Moreover, the fidelity on some tunes is not what it could be, given the live mixes. As such, it seems that *Viva Santana!* will be best enjoyed by longtime fans who are familiar with the cleaner, previously released recordings, and are anxious to hear Santana's soloing capabilities in old/new settings.

Many of the classic songs are part of this musical compilation, including the

Carlos Santana remains a reservoir of musical talent, but *Viva Santana!* lacks the satisfaction of a typical Santana release.

career-making "Soul Sacrifice," which the world at large first heard at the Woodstock Festival. There also are two versions of Peter Green's "Black Magic Woman" and Gabor Szabo's "Gypsy Queen," which Santana so successfully combined with a clever, jumping percussive segue.

Santana and Columbia have made a good attempt to bring us something different in a compilation album. The trick was to come up with the right combination—avoid the same old "greatest hits" assemblage and simultaneously provide previously unheard material. It seems perhaps that, in this case, one too many tape libraries was raided, with tapes pulled out and re-mixed that should have stayed in the archives.

Carlos Santana will remain an American reservoir of musical talent. Let's face it: No one else has managed to successfully combine Afro-Latin rhythms with rock and lived to tell about it. *Viva Santana!*, however, does not supply the musical tension and satisfaction of the usual Santana release.

Hector G. La Torre

What Up, Dog?: Was (Not Was)
Chrysalis VK 41664, CD.

Sound: B+ Performance: B

SNOB: Royal Crescent Mob
Moving Target/Celluloid MT 020, LP.

Sound: B- Performance: A-

Funk is back! Finally, '80s musicians have found some '70s gold to mine, some "influences" to peddle. And just as the rock bands of yore found themselves building on the R&B foundations of the '60s, the last '80s blast finds its roots in the past decade's funkmasters. At its worst, this throw-back music is good background stuff. At best, it's inspired wildness.

Was (Not Was) is an interracial combine led by Don and David Was, and they are making their bid for the slicker side of pop/R&B. They alternately get catchy ("Spy in the House of Love") and quirky ("Dad I'm in Jail"), and only occasionally do the twain meet ("Out Come the Freaks"). They never surpass their derivations, but even we can find a soft spot in our hearts for this band's note-for-note rendition of Otis Redding's "I Can't Turn You Loose."



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Roberta Flack's *Oasis* should re-establish this peerless vocalist as a powerful influence for the 1990s.

Royal Crescent Mob wears its influences on the sleeve, covering The Ohio Players' "Love Rollercoaster," Led Zep's "The Immigrant Song," and any James Brown licks they can remember. These four wild men have assimilated the best of the Cleveland funk scene and '70s white rock to syn-

thesize an exciting new form of music. Singer David Ellison is the weak link—he's got only *slightly* more soul than the guy in Devo—but the force of personality coupled with the phenomenal musicality (and rhythmic irresistibility) of the Mob gives us high hopes for this combine. *Jon & Sally Tiven*

Oasis: Roberta Flack
Atlantic 81916-2, CD.

Sound: A — Performance: A

Oasis is the first new solo studio album Roberta Flack has released in 10 years. Never an artist who would release "product" to satisfy the machinations of the record biz, this singer's career has been largely determined by her own sense of uncompromising integrity and her desire to control her own endeavors. The perseverance of Flack's artistic vision has enabled her to maintain a successful and enduring career as a concert performer without having to depend on chart positions for recognition.

Flack is credited as executive producer on the 10 songs here, and as co-writer on four. Several different producers are listed for the various tracks. The overall sound purveys a "perfection" that seems to have become intrinsic to big-money record production these days—ultra-polished, overly clean, and slightly antiseptic in feeling. However, at the core of *Oasis* is the crystalline purity of Roberta Flack's singing and the sensuous blush of her voice, which is as evocative as ever.

The players, of course, are top-notch and include Dan Huff and Earl Klugh on guitar, Randy Kerber and Greg Phillinganes on keyboards and synthesizer, drummer extraordinaire Steve Gadd, percussionist Paulinho Da Costa, and the ubiquitous David Sanborn soloing on alto sax.

The record opens with the title cut—a dynamic six-minute opus co-written by Marcus Miller. Ashford and Simpson contributed one song, "Uh-Uh Ooh-Ooh Look Out (Here It Comes)," and Marvin Hamlisch penned "All Caught up in Love" with Michael Jackson protégé Seidah Garrett. Writer/producer Andy Goldmark has three songs on the album—an outstanding ballad, "You Who Brought Me Love"; "(His Name) Brazil," written with Flack and Andy Gaffney, and "Shock to My System," a duet with Simon Climie (from the English group, Climie-Fisher).

All in all, *Oasis* is a very strong return to active recording for Roberta Flack. Several of the cuts have single-cross-over potential and should re-establish this peerless vocalist as a potent influence for the '90s. *Michael Aldred*

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Tapiola Choir: *Water Under Snow Is Weary*. Tapiolan Kuoro, Erkki Pohjola. Finlandia FACD 921, CD; DDD; 60:20.

***Flying Free*.** F.A.C.E. Senior Treble Choir of Montreal, Iwan Edwards.

Arundel ARU 8701D, CD; DDD. (Available from Arundel, 173 "B" Carter Ave., Pointe Claire, Que., Canada H9S 4R9.)

Here are two prize-winning children's choirs on CD, very much of the same age group, if distant from each other. Both are in northern lands—Montreal in Quebec, Greater Helsinki in Finland. Both are well into the travelling stage, for assorted choir competitions in distant spots (the Canadian choir went to Wales, for instance). And both, of course, represent high technical expertise in their area, of the sort that wins competitions.

But does it win *us*, who buy CDs for our own pleasure and interest? If not, why send review copies to reviewers who cater to the non-school adult population? The contrast between these two CDs in that respect is heartening—or the opposite, depending on which disc you play.

If you have ever taken yourself to your local school in order to hear your genius child sing in a concert before all the parents and relatives and teachers, you will have an idea of the sound

of the Canadian offering, *Flying Free*. Frankly, prizes or no, it doesn't fly very far. The music goes the usual way, nice little folksy songs set for trebles in a schoolish way, with a teacher-type accompaniment here and there. After a few, your mind may wander, as mine did. Oddly, too, though the school is in the downtown area of a city with a large French-speaking population, all but a handful of the songs are strictly English (or Irish, Native Indian, black, and more). There's even a pair of bits by Elizabethan Thomas Morley. And there's humor—three nice morsels by our own Irving Fine from *Alice in Wonderland*. But for my ear, the music never rises far from the teacher/school-children level. (F.A.C.E., by the way stands for Fine Arts Core Education, which is the best academic designation you could want.)

The Finnish recording, on the other hand, is a delight and a wonder. This choir started as just a school thing in a smallish city, but in 25 years has built into a national institution, perhaps what the famed Vienna Choir Boys were in the days of the Austrian Empire. The youngest performer in the Tapiola Choir is only 9, a few are alumni—soloists here—pro, but still young. The rest are kids. But what astonishing kids! Such excitement, such verve, such intensity, such utter joy in the

performing. Every one of them also plays an instrument, and you will hear those, too. The record starts off with a brace of the usual folk songs, but we know that special quality of Finnish folklore, à la Sibelius. In no time, they are off into "contemporary" music, mostly composed especially for them. But contemporary over there is a lot different from contemporary over here. It is much more traditional, even in the most dissonant formats, and much more pragmatic—written to be *used*.

No room to describe the astonishing sounds that come from this disc as you go on and on! I jumped, I roared with laughter, I stood still in disbelief. All that is genius in the small child is here, and it is both impressive and wonderfully entertaining. Little devils! They sing with that naughty gleam in the eye which you know so well in your own kids when they're about to get away with something. But they also show absolutely breathtaking technique and control. Why say more? If you want to know what "core education" really can do, listen here. *Edward Tatnall Canby*

Schubert: *Sonata in B Flat; Impromptus, Opus 90*. Carol Rosenberger, piano.

Delos D/CD3018, CD; 69:12.

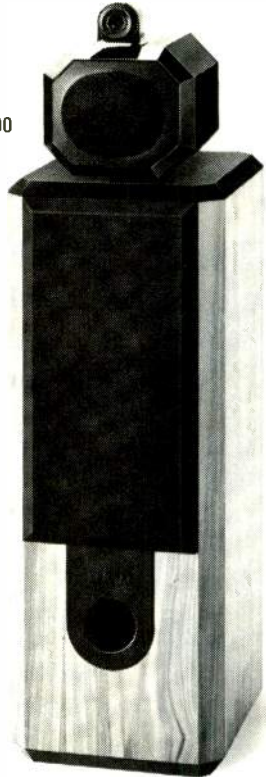
Carol Rosenberger has made a CD splash with rather elegant and high-level "mood" recordings, perhaps the mod equivalent of Chopin's Paris salon playing. Here she tackles a whopper—a work that demands the very highest and sternest musicianship over a vast length and breadth in performance—one at which many an otherwise-great pianist has failed and plenty more are wise enough to stay away. The B Flat Sonata is one of the supremely great works of the 19th century, no less.



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many records. Second and more important, decidedly, Rosenberger hears the marvelous Schubert harmonies, the strange, incredible changes of key that no other composer for piano has matched. And she allows them to be heard, to impact the ear. Throughout this very long piece, she never misses

a twist or turn in the startling changes from one harmony to another.

Her Sonata does not have the long, stiffening intensity, over such a span, that a very few other recordings (and live performances) have achieved. It is really too big a piece for a salon approach, even by a small amount. And yet, if the long architecture is not sustained, the shorter pleasures of each segment are wonderfully expressive and continuously interesting. This is surely a valid alternative to the more rigorous, big-scale shaping, such as the recent recording by Richard Goode. I enjoyed every moment of Rosenberger, and the buzzing little *Impromptus*, too.

It ought to be added that, publicity or no, the huge Bösendorfer Imperial is a poor choice of piano for Schubert. Its enormous but dark-toned bass is out of place in this composer's works, merely blurring what should be bright and clear. And its bland, unchanging upper works, loud or soft, subdue what is the greatest glory of Schubert piano music—the brilliant floods of very high-pitched figuration, which ought to have a metallic edge, even a sharply clanking sound in the loudest segments. Rosenberger does her best, but this piano elephant simply cannot dance to Schubert. *Edward Tatnall Canby*

Henry Lawes: Sitting by the Streams—Psalms, Ayres, and Dialogues. The Consort of Musicke, Anthony Rooley.

Hyperion CDA66135, CD: DDD; 58:43.

Chroniclers of music's twisty path through the Renaissance often lapsed into a patronizing attitude toward composers whose music was entirely at the service of song texts. The poets and writers of the same time, however, were tickled absolutely pink with the few masters who translated the word's meaning and conveyed its spirit through note and ornament. It would be inaccurate to claim that any sort of controversy raged over Henry Lawes (1596 to 1662), brother of the equally prolific Thomas, but critical appreciation of his works continued long after his generation was dust. Milton believed in him to the extent that he wrote some remarkably effusive praise of



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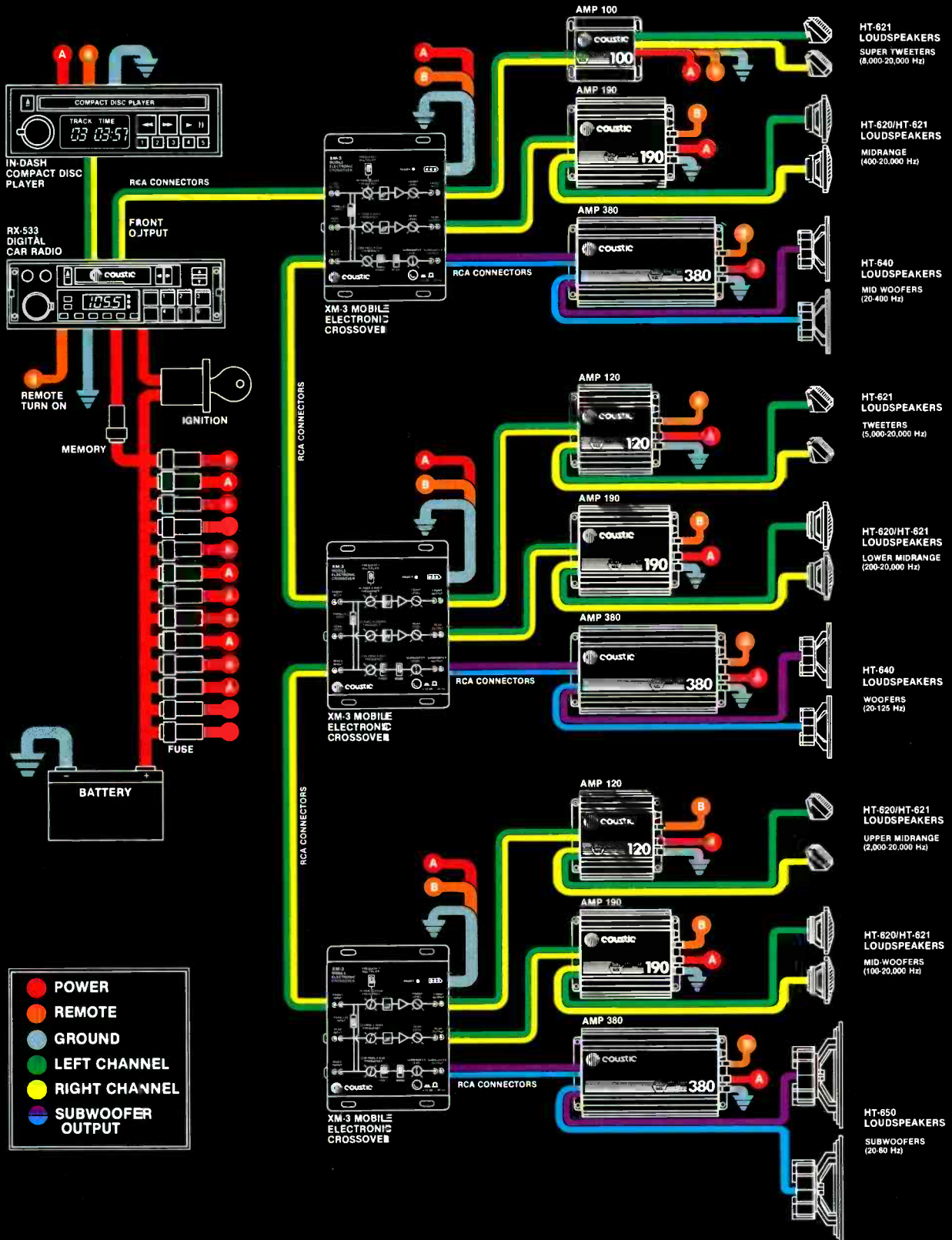
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Mancini's Greatest Hits irresistibly combines the composer's most tuneful, toe-tapping music with spectacular sonics.

Lawes, including a famous sonnet. (Every composer should be so lucky, but then I can't imagine Jack Kerouac waxing rhapsodic over Elliott Carter, or John Masefield dashing off a handful of enraptured iambs and dithyrambs over Ralph Vaughan Williams.) There is one good one on Lawes by James

Harrington, a contemporary of Lawes and a Utopist, who manages to praise the song settings *and* the music.

Which is all by way of saying that this is an evocative and special album that leaves one with a warmth only the Elizabethans and some of the generation or two after (among them Lawes) seem

to have mastered. This is heavenly writing. The texts are skillful but simple (Carew, Walton, Hughes, Birkenhead—good, lesser literary lights), as are the settings on their surface. A second hearing entices forth small moments and little harmonic or rhythmic gifts the composer may have intended the performers to discover before we hearers get there. The instrumental writing, as realized by the magnificent Consort of Musicke in fleshed out or reconstructed parts, is charming. It makes one want to hear some straight instrumental works by this brother of a great instrumental composer.

Emma Kirkby and five singers of similar skill and vocal beauty really bring the 17 secular and churchly settings to vivid life. The very spare instrumental underpinning is by lute, two period violins (very sweet and sinewy), and small organ. Anthony Howell, a major contributor to the Hyperion catalog of excellent recordings, provides spacious, clear, warm sound and exemplary vocal/instrumental balance. Don't buy this album just for the texts, however beautiful they may be. The music is too good to pass up.

Christopher Greenleaf

Mancini's Greatest Hits. The Cincinnati Pops, Erich Kunzel.
Telarc CD-80183, CD.

I'll go out on a limb and predict that *Mancini's Greatest Hits* will be one of Telarc's biggest-selling Cincinnati Pops recordings. Take the irresistible combination of some of Henry Mancini's most tuneful and toe-tapping music, in brilliant orchestrations and polished performances by Kunzel and the Cincinnati Pops, all embellished with some of Telarc's most exciting and spectacular sonics, and you have a sure winner.

They are all here—Mancini favorites like "Moon River," "Charade," "Breakfast at Tiffany's," along with "Hatari" and the haunting penny-whistle strains of "The Molly Maguires." There are lesser known, but sonically spectacular pieces like "Strings on Fire" and "Drummers' Delight," which can be a great demo track for repeated bass drum shots. The sound is very clean, with great projection and presence.

Bert Whyte

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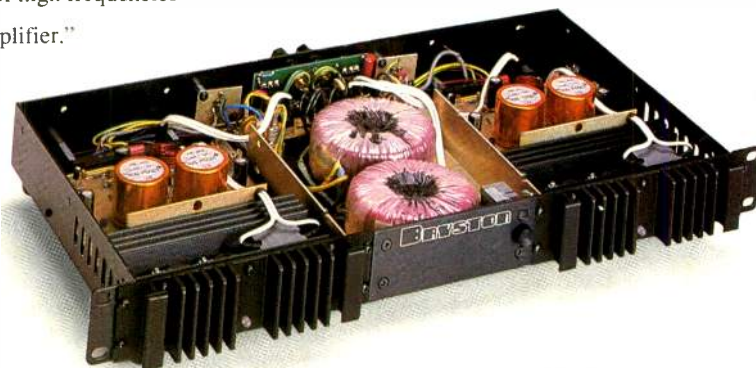
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Audio Magazine, U.S.A.

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THE PIANO MAN



The Amazing Bud Powell
Mosaic MR5-116, five LPs.

Sound: A-/B+ Performance: A/B+

This superb Mosaic collection of everything Earl "Bud" Powell recorded for Alfred Lion's Blue Note Records from 1949-'58 shows beyond question that Powell was the supreme pianist of this latter-day jazz style. Here, he is heard at the height of his creativity.

Powell's family was musical and his early years included much formal study of the great classical masters. Powell was known for his life-long appreciation and love of Bach as well as his admiration of many different pianists, including some of his contemporaries, none more so than the great Art Tatum. He literally lived for the piano. Happiest when he was playing, Powell constantly begged fellow pianists for a chance to sit in.

There are just four hours of music on this Mosaic collection, but most of them are priceless. I'm not particularly drawn to modern jazz, preferring instead the work of the older masters on a day-in/day-out basis, but Powell's piano remains, to these ears, head and shoulders above everything that has come along since his days of absolute authority.

All cuts here have Powell backed only by a rhythm section, except for

the tracks from the '49 session, which include the stimulating addition of Fats Navarro and a young, energetic Sonny Rollins, two takes from '57, which feature trombonist Curtis Fuller, and Powell's solos of "Over the Rainbow," "Bud on Bach," and "It Could Happen to You." At various times, the drummers are Roy Haynes, Max Roach, Art Taylor, and Philly Joe Jones, while the bass players include Curly Russell, George Duvivier, Paul Chambers, and Sam Jones.

The major selections are: "Dance of the Infidels," "Bouncing with Bud," "Ornithology," and "You Go to My Head" from the '49 session; three takes of Powell's composition, "Un Poco Loco," each of which builds with a constant intensity; "Over the Rainbow" and "It Could Happen to You" (1951), and the incredible four-part "Glass Enclosure," "Reets and I," and its highly charged alternate (1953). Highlights from the '57 session include: "Some Soul," which shows Powell's complete mastery of the blues form in an era when soul became an overworked vehicle for players with a mere fraction of his abilities; "Idaho," featuring Fuller; "John's Abbey," and "Time Waits." The cut to listen for on the final session is "Borderick," which was dedicated to Powell's three-year-old son. It seems much like an old children's song with some wonderful stride-style passages showing his constant ability to surprise his audience.

Uncompromising and often ill-served by record companies, Bud Powell was truly an amazing pianist. Aside from Thelonious Monk, whose work is really beyond category, I can think of no other pianist remotely comparable to Bud Powell in modern jazz. He is what it was all about, and no one who wishes to understand real piano mastery in this difficult form can do without hearing Bud Powell at his greatest. This is an absolutely essential jazz package.

Frank Driggs

Illinois Jacquet—The Black Velvet Band
Bluebird 6571-2-RB, CD; ADD.

Sound: B+ Performance: B-

Illinois Jacquet has always been a formidable saxophone player, and certainly a highly visible and most suc-

cessful one over a period of more than 40 years. He first came to fame with his solo on Lionel Hampton's big band version of "Flying Home" on Decca back in 1941. This solo was widely imitated, and Jacquet quickly became a big star, moving through Cab Calloway's and Count Basie's bands before forming the combo which recorded for RCA Victor from 1947 to 1950. In 1945, while he was with the Basie band, he made some classic solos, including "Bottoms Up" and "Robbin's Nest" for the Apollo label, which were eventually released on a 10-inch LP. A French company released them several years ago, and some got to this country on imports, although they have not had a general release here since then.

Despite the presence of equally formidable players like Joe Newman, J. J. Johnson, Leo Parker, Henry Coker, Sir



Photographs: Frank Driggs Collection

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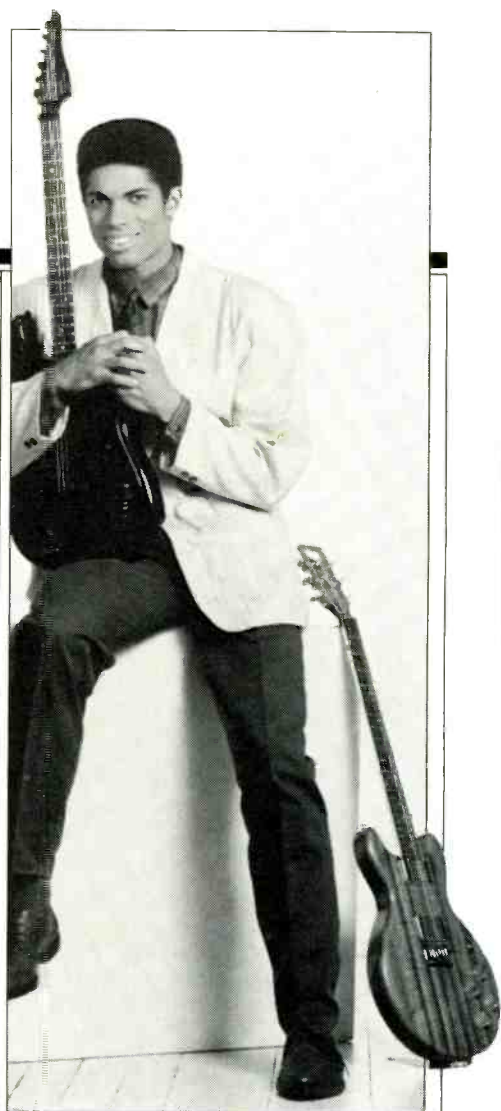
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On his newest release, finger-tapping maestro Stanley Jordan changes direction—to a slightly funkified fusion.



In the long run, most of these simply don't swing. They never settle into the satisfying groove that Jacquet found on the older and long-sought-after Apollos. Only a saxophone freak or a Jacquet completist is going to be willing to sit through this entire album. Look for the French import, if it can still be found—the music is much more satisfying.

Frank Driggs

Flying Home: Stanley Jordan
 EMI Manhattan CDP-7-48682-1, LP;
 CDP-7-48682-2, CD; AAD; 47:53.

Sound: A - / B + Performance: A -

Finger-tapping maestro Stanley Jordan changes direction from his last unaccompanied solo set as his fleet digits dance to a more mainstream, slightly funkified fusion on the all-instrumental *Flying Home*. Jordan's novel guitar technique—tapping simultaneous melody and bass with both hands, sans plucking—continues to distinguish his sound, although here, by returning to combo form, it becomes a means to a musical end rather

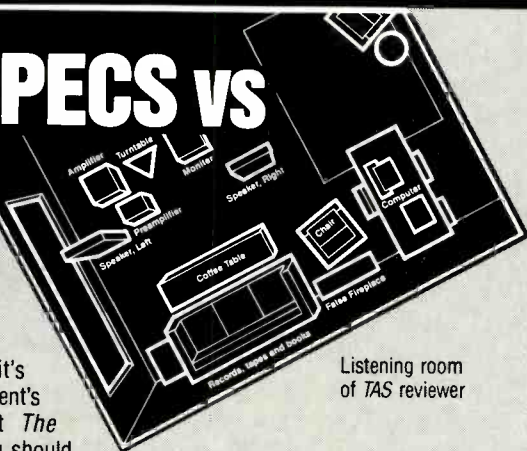
Charles Thompson, and John Lewis, I can in all honesty state that only half a dozen of the 19 tracks released on this Bluebird CD impressed me as being listenable. "Riffin' at 24th Street," "A Jacquet for Jack the Bellboy," and "Black Velvet" are among the better sides—if only because they are played

at something resembling medium or near-ballad tempos. This brings out some of the warmth and the more subtle elements in the leader's playing. Too many of the rest are taken like "Jet Propulsion," at terrifying tempos, though this does prove that Jacquet can execute with the best of them.

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Enya's *Watermark* CD is so supremely calm that it is hard to feel anything but tranquil as you listen to her beguiling music.



Soundwise, Jordan has favored lean arrangements mixed close to center stage, filling up the sonic space and highlighting his smooth guitar tone. You will, however, notice occasional analog tape hiss on some of the pieces when you crank up the volume, especially in quieter passages on the CD.

Stanley Jordan's *Flying Home* has some very tasty moments and is definitely a step in the right direction. This is good, contemporary fusion.

Michael Wright

Watermark: Enya
Geffen 24233-2, CD: 40.05

Sound: A — Performance: A —

You might call Enya's music "progressive smooth," because it integrates elements of traditional Irish music, church music, and sounds of nature into a beguiling unity. Enya is Irish and a former member of the group Clannad. Using overdubs, she plays most of the instruments herself, excepting uilleann pipes, whistle, clarinet, and some odd percussion. Layering up to 120 vocal tracks, Enya creates vast aural sweeps that are at once astonishing and lovely.

Most of the music on *Watermark* is so supremely calm that it is hard to feel anything but tranquil as you listen. But this is not a sleepy sound. There is a subtle chill that makes the dreamy music bracing, and a firmness that makes the ethereal beauty of the sounds substantial, elevating the album way beyond most so-called New Age music. It makes the difference between background and foreground music.

Enya works with producer Nicky Ryan and lyricist Roma Ryan, whose

er than the *raison d'être*. The result is a nicely varied program, ranging from mellow ballad to raving rock riffola, that shows off his talents. Hot spots include the cascading scales of "Street Talk," the circular improv on "Can't Sit Down," the blistering distortion of "The Time Is Now," and the gorgeous deli-

cacy of the tapping solo, "Flying Home." The show-stopper, however, is a hot read of Led Zeppelin's "Stairway to Heaven," which unwinds from its elegant, ethereal statement to the unrestrained blowing of its crazy denouement. This cut alone is worth the price of admission.

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Michael William Gilbert has an ear for putting the right sounds together and he has a fascinating approach to rhythm.

lyrics, by the way, alternate between English, Latin, and Gaelic (Enya's first language). Lyric content, however, is not the most important aspect here—sound is, and Enya uses her voice as an instrument to excellent effect.

There is one genuinely upbeat selection here in the frothy "Orinoco

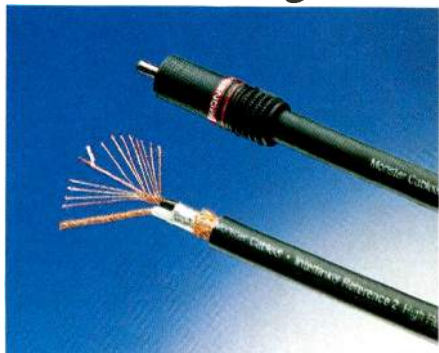
Flow," which was the biggest-selling single in England in the fall of '88. It is such a seductive piece that it would not surprise me one iota to see it emerge as a big left-field hit here, too. Once heard, it is not easily forgotten.

Enya's earlier album, on Atlantic (*Enya* 81842-2), is a collection of music

originally created for the BBC-TV series "The Celts." It is not as elaborate as *Watermark*, but if you like what you hear on the new album, I heartily recommend the earlier work as a fitting companion.

Michael Tearson

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Point of Views: Michael William Gilbert

Gibex 004, CD. (Available from Gibex Recordings, 73 Spaulding St., Amherst, Mass. 01002.)

Michael William Gilbert's second solo album presents a carefully crafted group of his eclectic compositions. As an adherent of the world-music concept, he borrows instrumental sounds and musical styles from a wide variety of sources. But Gilbert's own personality always pervades his music, giving it a strong anchor in a boiling sea of influences. He also has a fascinating approach to rhythm. Irregular groupings and unexpected accents within each line create still more complex effects when he combines several lines polyphonically. "Motion/No Motion" is an especially good example.

Gilbert never allows the rich sonic resources of the synthesizers to put his ideas out of focus. Instead, he restricts his instrumental palette to just the right group of sounds for each piece. In "Zawinul," a nice evocation of the Weather Report style, Gilbert gives the melody line to a cheerful penny-whistle sound, setting it off with an intricate but laid-back percussion accompaniment. "In Her Eyes," a short, quiet piece, uses a more traditional flute color, and Gilbert makes the melody blossom contrapuntally at strategic points—a neat touch. For "Sheep Look Up," he switches to delicate choral and reed colorations, and in "Ships That Pass," he uses wind chimes and toy-piano sounds.

Two things stand out in this album. One is the total transparency of the sound. No matter how complicated the texture becomes, the sound is always open and clear. The bass, in particular, is clean, making its agile figurations easy to hear. The other noticeable aspect is the variety and subtlety of the sounds. Gilbert has a good ear for putting the right kinds of sounds together, and his arrangements have a pristine, fresh quality that I like. *Steve Birchall*



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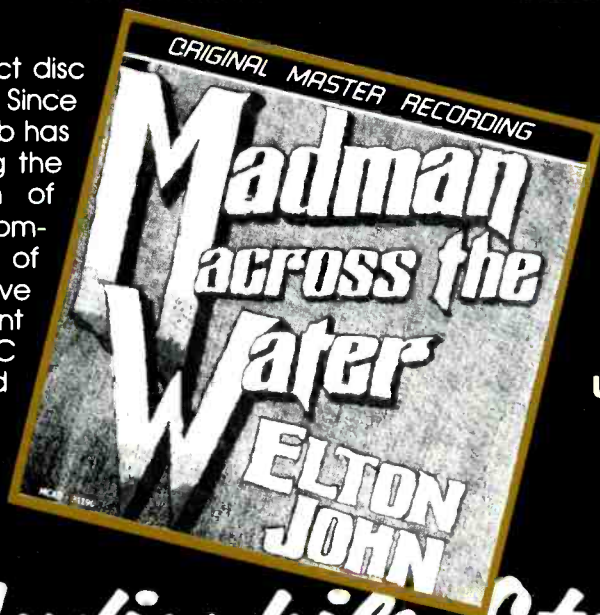
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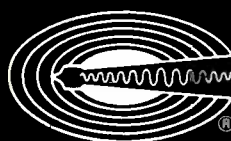


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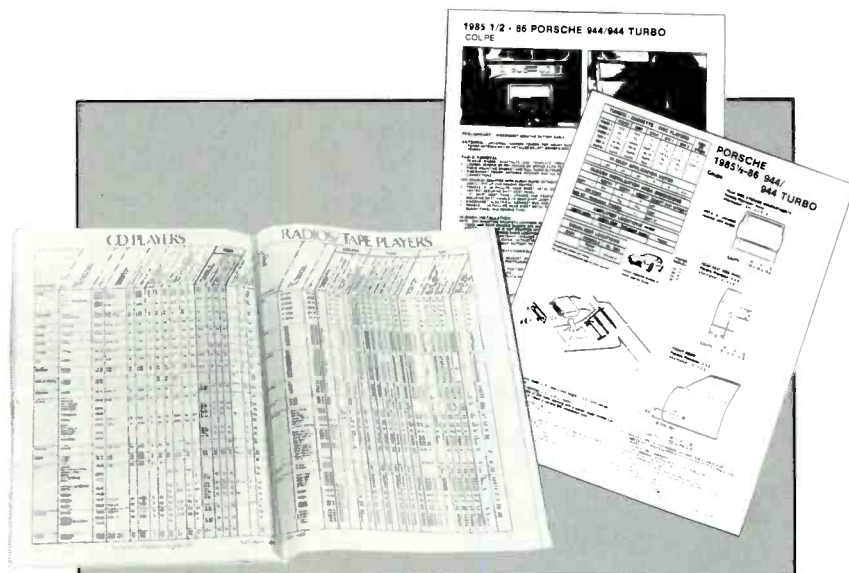
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ANNUAL CAR STEREO DIRECTORY



Wow," I said to myself, "can this be 15 already?" But it is *Audio's* 15th Annual Car Stereo Directory, and it's bigger than ever. The number of models we currently list is more than 25% larger than the number we had last year. The growth has come principally in speakers, with over 300 units added this year. The biggest jump in terms of percentage growth is in the head ends, the tape players/radios, which is about 37% larger. We think that these increases indicate that this area of sound reproduction is getting more popular, rather than that we've gotten better at searching out participant firms. But seriously, I believe that our Car Stereo Directory is, by far, the most complete and the more accurate of any Directory in this field.

Other trends? Digital Audio Tape players are more in evidence this year, but the numbers are still very small. Compact Disc players are more popular, too, but it is hard to tell just how popular; the specs we got from the makers this year show that they are meant to be part of a system incorporating amps and head end. Take special note of the way we've handled the indent spacing in the Directory to indicate this.

And let's hear a round of applause for that wizard of the editorial mark-up pen, Bill Kirkpatrick, without whose services this Directory would not have gotten to the printer nor been as accurate. Bill has again won our fake glasses, nose, and mustache award.—**E.P.**

Photograph: ©1989, Bill Ashe

DAT PLAYERS

MANUFACTURER	Model	Price, \$	Frequency Response, Hz to kHz, ±dB	Dynamic Range, dB	THD at 1 kHz, %	Filtration: Analog Only (A), Digital + Analog (D)	AUX Input?	Repeat Functions: Tape (A), Track (B), Entire Program (C)	Audible Fast Search?	Automatic Rewind?	Controls: Volume (V), Balance (B), Fader (F), Tone (T)	Program Search?	Intro Scan?	Direct-Access Numeric Keypad?	FM Sensitivity dBμV (for 30-300 Chirping)	Alternate-Channel Selectivity	FM Mono S/N Ratio, -dB	TUNER			
																		Total Number of Station Presets	Ther. Protection: Full-Out (F), Secret Code (S)	RCA Out Jacks?	
ALPINE	5700	1540.00	5-22 ±1	90	0.005	D	Yes	A/B/C	No	Yes	V/B/F/T	Yes	Yes						Yes		
BLAUPUNKT	DTP 08	1799.95	5-20 ±1	90	0.005	D	No	A/B/C	Yes	Yes	V/B/F/T	Yes	Yes	Yes					No		
CLARION	DAC 2000 Audia 8100	1749.95	20-20 30-15	92	0.005	D	Yes	A/B/C A/B/C	Yes No	Yes Yes	V/B V/B/F/T	Yes Yes	Yes No	Yes	12	70	92	12			
ECLIPSE	EST-240	1599.95	10-20 ±3	90	0.006	D	No	B	Yes	Yes	V/B/F/T	Yes	Yes	No				No	Yes		
JVC	KSD1	1999.00	5-20	90	0.01	O		A/B	No	Yes	V/B/F/T	Yes	Yes	Yes					Yes		
KENWOOD	KDT-99R	2000.00	10-20 ±1	92	0.005	A	Yes	A/B	No	No	V/B/F/T	Yes	Yes	No	15.2@ 50 dB	80	75	20	No	No	
MITSUBISHI	DT-10	1650.00	20-20	85	0.01		Yes	A/B/C	No	Yes	V/B/F/T	Yes	Yes	No					No		

AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Preamp (P)	Amp (A)	Equalizer (E)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB, A-Weighted	Watts Channel into 4 Ohms, per EIA-490	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % per EIA-490	Input Levels, Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes
A.D.S.	PSS	280.00	A				105	40	20-20	0.05	P			Yes	7 7/8 x 1 3/4 x 5 1/8	Bridges to 90 watts.	
	PQ8	160.00	A				105	20 x 4	20-20	0.3	P		No	No	9 3/4 x 1 7/8 x 5 7/8	35 watts x 4 into 2 ohms.	
	PQ10	530.00	A				105	†	20-20	0.05	P		Yes	No	11 3/4 x 2 x 6 1/8	†Two-channel mode, 80 watts x 2; three-channel, 80 watts x 1 and 40 watts x 2; four-channel, 40 watts x 4.	
	PQ20	790.00	A				105	†	20-20	0.05	P		Yes	No	14 x 2 3/8 x 8 1/4	†Two-channel mode, 200 watts x 2; three-channel, 200 watts x 1 and 80 watts x 2; four-channel, 80 watts x 4.	
	PH12	240.00	A				105	20 x 6	20-20	0.3	P		No	No	9 3/4 x 1 7/8 x 7 3/4	35 watts x 6 into 2 ohms.	
	PH15	690.00	A				105	†	20-20	0.05	P		No	No	14 x 2 3/8 x 8 1/4	†Three-channel mode, 100 watts x 3; four-channel, 100 watts x 2 and 50 watts x 2; five-channel, 100 watts x 1 and 50 watts x 4; six-channel, 50 watts x 6.	
	EQ1	200.00	E	16	†		110			0.05	P		No	No	9 x 1 1/4 x 6 1/4	†Fixed boost/cut via plug-in modules. Parametric EQ.	
642CSi	230.00	P				110			0.05	P/S	Yes	Yes	Yes	9 x 1 1/4 x 6 1/4	For two-, four-, or six-channel systems; six-channel crossover.		
AIWA	MA-3000	220.00	A				94	35	10-50	0.01	P†	No	No	Yes	8 3/4 x 6 5/8 x 2 3/4	†Variable, 300 mV to 2 V. Bridgeable.	
	MA-6000	300.00	A				98	65	10-60	0.01	P	No	No	Yes	9 7/8 x 6 5/8 x 2 3/4		
ALPHASONIK	A-2018III	69.00	A				75	18	20-20	1.0	P/S	No	No	Yes	1 1/4 x 4 x 4 3/4		
	PMA-2030	150.00	A				95	30	5-30	0.05	P/S	No	No	Yes	2 1/8 x 7 1/8 x 5 7/8	Bridgeable.	
	PMA-2035	225.00	A				95	35	5-30	0.01	P/S	No	No	Yes	2 1/8 x 7 1/8 x 7 1/2	As above; Class A.	
	PMA-2050	250.00	A				95	50	5-30	0.05	P/S	No	No	Yes	2 1/8 x 7 1/8 x 7 1/2	Bridgeable.	
	PMA-2075	325.00	A				95	75	5-30	0.05	P/S	No	No	Yes	2 1/8 x 7 1/8 x 10	As above.	
	PMA-2100	450.00	A				98	100	5-30	0.01	P/S	No	No	Yes	2 1/8 x 7 1/8 x 11 1/4	As above; Class A.	
	PMA-2175	590.00	A				98	175	5-30	0.01	P	No	No	Yes	2 1/2 x 8 x 14 1/8	As above.	
	PMA-2300	1200.00	A				98	300	5-30	0.01	P	No	No	Yes	2 1/2 x 8 x 16 5/8	Bridgeable.	
PAS-1060	180.00	A/E	1	+12		90	60 x 1	15-150 Hz	0.05	P/S	No	Yes	Yes	2 x 6 5/8 x 8	Mono subwoofer amp.		
PAS-1100	280.00	A/E	1	+12		90	100 x 1	15-160 Hz	0.05	P/S	No	Yes	Yes	2 x 6 5/8 x 8	As above.		
PEQ-7B	110.00	P/E	7	18		95			0.02	P/S	Yes	No	Yes	1 x 7 x 4 7/8	Half DIN size.		
ALPINE	3545	1400.00	A				110	250	20-20	0.08	P/S	No	No	Yes	17 3/8 x 2 7/8 x 9 1/8	Bridges to 700 watts.	
	3539	710.00	A				110	150	20-20	0.08	P/S	No	No	Yes	11 7/8 x 2 1/8 x 7 7/8	Bridges to 400 watts.	
	3543	550.00	A				110	100	20-20	0.08	P/S	No	No	Yes	11 7/8 x 2 1/8 x 10 3/8	Bridges to 300 watts.	
	3525	290.00	A				105	60	20-20	0.08	P/S	No	No	Yes	10 1/8 x 2 1/8 x 6 1/2	Bridges to 160 watts.	
	3523	240.00	A				105	40	20-20	0.08	P/S	No	No	Yes	10 1/8 x 2 1/8 x 5 1/2	Bridges to 100 watts.	
	3522		A				100	30	20-20	0.08	P/S	No	No	Yes	8 1/4 x 1 7/8 x 5 1/8	Bridges to 80 watts.	
	3554	480.00	A				105	†	20-20	0.08	P/S	No	Yes	Yes	11 7/8 x 2 1/8 x 10 3/8	†Two-channel mode, 150 watts x 2; three-channel, 50 watts x 2 and 150 watts x 1; four-channel, 50 watts x 4.	
	3552	370.00	A				105	†	20-20	0.08	P/S	No	Yes	Yes	10 5/8 x 2 1/8 x 10 3/8	†Two-channel mode, 85 watts x 2; three-channel, 30 watts x 2 and 85 watts x 1; four-channel, 30 watts x 4.	
	3501	80.00	A				90	13	20-20	0.8	P/S	No	No	Yes	5 7/8 x 1 1/4 x 2 3/4	†Six-way, four-channel crossover. Trunk-mount.	
	3656	350.00	P				100				P	No	†	Yes	9 1/2 x 1 1/2 x 6 1/4	†Two-way, four-channel crossover.	
	3653	120.00	P/E				100				P	No	†	Yes	6 1/4 x 1 5/8 x 4 3/4	Four-channel parametric EQ; trunk-mount.	
3401	485.00	P/E	7	15		100				P	No	Yes	Yes	9 1/2 x 1 1/2 x 6 1/4	Half DIN size; subwoofer level control.		
3321	250.00	P/E	11	12		100				P	Yes	Yes	Yes	7 x 1 x 4 1/2	Half DIN size.		
3308	130.00	P/E	7	12		95				P	Yes	No	Yes	7 x 1 x 4 1/2	As above.		
3216	130.00	A/E	7	12		13		20-20	0.8	P/S	Yes	No	Yes	7 x 1 x 5 1/4	As above.		
ALTEC LANSING	ALA 435	500.00	A				95	35 x 4	10-40	0.1	P/S	No	No	Yes	12 3/4 x 8 1/2 x 2 5/8	Bridgeable.	
	ALA 270	400.00	A				95	70	10-40	0.1	P/S	No	No	Yes	12 3/4 x 7 7/8 x 2 5/8	As above.	
	ALA 250	250.00	A				95	50	10-40	0.1	P/S	No	No	Yes	9 7/8 x 6 3/8 x 2 5/8		
AUDIART	A1502	199.00	A				95	25	20-20	0.02	P/S	No	No	Yes	11 5/8 x 6 7/8 x 2 1/4	Bridgeable.	
	A3002	299.00	A				95	55	20-20	0.02	P/S	No	No	Yes	16 5/8 x 6 7/8 x 2 1/4	As above.	
	A3004	399.00	A				95	25 x 4	20-20	0.02	P/S	No	No	Yes	16 5/8 x 6 7/8 x 2 1/4	Two-, three-, or four-channel operation.	
	A6004	599.00	A				95	55 x 4	20-20	0.02	P/S	No	No	Yes	25 1/2 x 6 7/8 x 2 1/4	As above.	
AUDIO CONTRL	EQL	199.00	P/E	12	12		110			0.005	P/S	No	No	Yes	1 1/2 x 9 1/2 x 6 3/4	Input and output level controls.	
	EQX	299.00	P/E	12	12		110			0.005	P/S	No	†	Yes	2 1/4 x 9 1/2 x 6 3/4	†Two-way crossover.	
	EQO	349.00	P/E	12	12		110			0.005	P/S	No	No	Yes	2 3/8 x 9 1/2 x 6 7/8	Four-channel operation.	
	EQT	299.00	P/E	30	12		110			0.005	P/S	No	No	Yes	2 3/8 x 9 1/2 x 6 7/8	Mono.	
AUDOLINK	Powerdriver PD-2	139.95	P				85			0.01	P/S	No	†	Yes	7/8 x 3 7/8 x 2 1/2	†Optional.	
AUDIOVOX	AMP-500	42.50	A				80	20	20-30	10	S	No	No	No	4 1/8 x 1 1/8 x 5		
	AMP-525	100.00	A				85	25	30-40	10	P/S	No	No	Yes	8 x 2 x 6		
	AMP-535	162.50	A				85	50	30-40	10	S	No	No	Yes	8 x 2 1/2 x 8		
	AMP-760	75.00	A/E	7	12		80	15	50-20	10	S	Yes	No	No	6 1/8 x 1 x 4		
	AMP-770	137.50	A/E	7	12		80	18	20-30	10	S	Yes	No	No	7 x 2 1/4 x 6 1/2	CD input jack.	
	AMP-780	162.50	A/E	7	12		80	18	20-30	10	S	Yes	No	No	7 1/8 x 1 1/8 x 7	Includes spectrum analyzer.	
	AMP-785	125.00	A/E	7	12		80	18	20-30	10	S	Yes	No	No	6 1/4 x 1 3/4 x 5 1/2		
	AMP-790	237.50	A/E	7	12		80	30	20-30	10	P/S	Yes	No	Yes	6 1/4 x 2 x 6 1/4	As above.	
	AMP-545	250.00	A				85	60	20-40	1	P/S	No	No	Yes	9 x 2 3/4 x 6 5/8		
	AMP-565	387.50	A				85	80	20-40	1	P/S	No	No	Yes	12 x 2 3/4 x 6 5/8		
AMP-776	100.00	A/E	7	12		80	18	20-30	10	S	Yes	No	No	6 1/4 x 1 1/4 x 4 1/2			

AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, -dB, A-Weighted	Watts Channel into 4 Ohms per IEC-490	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % per IEC-490	Input Levels: Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes
AUTOTEK	7600 BTS	1000.00	A	†	102	300	10-150	0.015	P			Yes	8 x 2½ x 19	†Variable boost (0 to 18 dB at 45 Hz, 0 to 12 dB at 20 kHz) plus subsonic filter at 33 Hz.	
	7300 BTS	750.00	A	†	100	150	10-150	0.015	P			Yes	8 x 2½ x 14	†As above.	
	7150 BTS	500.00	A	†	97	75	10-150	0.015	P			Yes	8 x 2½ x 8¾	†As above.	
	7100 BTS	350.00	A	†	95	50	10-150	0.015	P			Yes	8 x 2½ x 5½	†As above.	
	7050 BTS	250.00	A	†	91	22	10-150	0.015	P			Yes	8 x 2½ x 4¾	†As above.	
	7204 BTS	750.00	A	†	95	50 x 4	10-150	0.015	P			Yes	8 x 2½ x 11¾	†As above but crossover in place of filter.	
	7001P	300.00	E	7	12	82		0.04	P	Yes	Yes	Yes	6¾ x 1½ x 5½		
	7003X	270.00	P			85		0.04	P	Yes	Yes	Yes	6¾ x 1½ x 5½		
	A-232	219.95	A			80	75	20-20	0.05	P/S			Yes	1¾ x 6½ x 8¼	†Two-, three-, and four-way crossover. Bridgeable.
	A-182	189.95	A			80	50	20-20	0.05	P/S			Yes	1¾ x 6½ x 7	As above.
	A-161	79.95	A			75	18	20-20	0.5	P/S			Yes	1¼ x 4½ x 5½	
XOU-1	129.95	P			79		0.05	P		†		Yes	1¼ x 4½ x 5½	†Two-way crossover.	
BLACK KNIGHT	SR-101	99.00	A			90	25	20-20	0.15	P	No	No	Yes	1½ x 3½ x 4	
	SR-150B	199.00	A			93	75	20-20	0.05	P	No	No	Yes	2¾ x 7 x 11	Bridgeable.
	SR-300X	299.00	A			93	120	20-20	0.05	P	No	No	Yes	2¾ x 7 x 12	As above.
BLAUPUNKT	BPA 2120B	479.95	A			92	100	20-20	0.2	P/S		Yes	11 x 2½ x 9	Bridgeable.	
	BPA 430	299.95	A			90	30 x 4	10-30	0.1	P/S		Yes	7½ x 2¾ x 10½		
	BPA 230B	219.95	A			90	30	10-30	0.1	P/S		Yes	6 x 2½ x 9¾	As above.	
	BPA 420	129.95	A			89	20 x 4	10-30	0.1	P/S		Yes	4¾ x 1½ x 7¼		
	PSA 106	199.95	A/E	†	15	90	25 x 4	20-20	0.25	P/S		Yes	8½ x 6½ x 2½	†Three front EQ bands, three rear. Parametric EQ programmable by car-specific modules. All as above. Four EQ presets. Mounted on flexible stalk.	
	PSA 168	399.95	A/E	†	22	90	40 x 4	3-100	0.05	P/S	No	No	No	11 x 9 x 2½	
	BEQ 08E	349.95	E	†	12	80		0.03	P/S	Yes	Yes	Yes	7 x 1 x 5½		
	BEQ 65	229.95	E	5	12	80		0.03	P/S	Yes	No	Yes	2½ x 6¾ x 7½		
	BEA 108E	299.95	A/E	7	12	80	25 x 4	15-30	0.03	P/S	Yes	Yes	Yes	5½ x 1¾ x 5½	
	BEA 80	209.95	A/E	7	12	80	20 x 4	15-40	0.03	P/S	Yes	No	Yes	5½ x 1¾ x 5½	
	BSA 58MS	99.95	A			90	20	20-30	0.1	P/S		No	Yes	4 x 1¾ x 4	
	BSA 280B	549.95	A			110	80	5-100	0.05	P	No	†	Yes	9 x 12 x 2¼	†Subwoofer crossover. Bridgeable. All as above.
	BSA 2150B	749.95	A			110	150	5-100	0.05	P	No	†	Yes	12½ x 12 x 2¼	†Three-channel mode, 150 watts x 1 and 100 watts x 2; five-channel, 150 watts x 1 and 50 watts x 4. ††Separate front, rear, and subwoofer crossovers. Three gain adjustments.
BMA 5350B	849.95	A			110	†	5-100	0.05	P	No	††	Yes	12½ x 12 x 2¼		
CANTON	M 50	300.00	A			94	50 x 1	20-20	0.1	P/S		Yes	6¾ x 3¼ x 1¾	Mono amp module for Model MF 3 or MF 5 mainframe. Model MF 3, holds three amp modules, 11¾ x 6¾ x ¾ inches, \$225.00; Model MF 5, holds five modules, 18½ x 6¾ x ¾ inches, \$325.00.	
	S 30	275.00	A			94	15	20-20	0.1	P/S		Yes	6¾ x 3¼ x 1¾	Amp module, fits mainframes as above.	
	M 100	350.00	A			94	100 x 1	20-200 Hz	0.1	P/S		Yes	6¾ x 3¼ x 1¾	Mono subwoofer amp module, fits mainframes as above.	
CLARION	711EQ	299.00	E	7	12	85			P	Yes	Yes	Yes	7½ x 5½ x 1		
	71EQ	159.95	E	7	12	85			P	Yes	Yes	Yes	7½ x 1 x 5½		
	51EQ	99.95	E	5	12	85			P/S	Yes	Yes	Yes	7½ x 1 x 5½		
	3200A	799.95	A				80 x 4		0.1	P		Yes	13½ x 2¾ x 12½		
	1610A	499.95	A				40 x 4		0.1	P		Yes	8½ x 2½ x 12½		
	1600A	429.95	A				80		0.1	P		Yes	9¾ x 2½ x 8½		
	720EQ	499.95	E	7	12	85			P	Yes	Yes	Yes	9 x 1 x 6½		
	702EQA	209.95	A/E	7	12	85	13.5	20-20	1.0	P/S	Yes	Yes	Yes	7½ x 1 x 5½	
	701EQA	169.95	A/E	7	12	85	13.5	20-20	1.0	P/S	Yes	Yes	Yes	7½ x 1 x 5½	
	501EQA	129.95	A/E	5	12	85	13.5	20-20	1.0	P/S	Yes	Yes	Yes	7½ x 1 x 5½	
	280EQB	239.95	A/E	7	12	85	13.5	20-20	1.0	P/S	Yes	Yes	Yes	6¼ x 1½ x 5½	
	100EQB6	99.95	A/E	5	12	85	13.5	20-20	1.0	S	Yes	No	7½ x 1 x 5½		
	1000A	309.95	A				50		0.1	P		Yes	9¾ x 2½ x 7¼		
	600A	209.95	A				30		0.1	P		Yes	7½ x 1¾ x 8½		
	401A	119.95	A				13.2 x 4		1.0	P/S		Yes	7 x 1 x 5½		
200A	79.95	A				13.2		1.0	P/S		Yes	7 x 1 x 5½			
COMPETITION	COMP 50	269.00	A			100	25	10-50	0.02	P	No	No	Yes	2¼ x 8 x 9	Bridges to 150 watts into 2 ohms; MOS-FET power supply; adjustable gain.
	COMP 100	295.00	A			100	50	10-50	0.02	P	No	No	Yes	2¼ x 8 x 9	Bridgeable; MOS-FET; adjustable gain.
	COMP 150	425.00	A			100	75	10-50	0.02	P	No	No	Yes	2¼ x 8 x 9	As above.
	COMP 200	495.00	A			100	100	10-50	0.02	P	No	No	Yes	2¼ x 8 x 12	As above.
	COMP 300	595.00	A			100	150	10-50	0.02	P	No	No	Yes	2¼ x 8 x 15	As above.
	COMP 450	550.00	A			100	50 x 4	10-50	0.02	P	No	No	Yes	2¼ x 8 x 15	Bridges to 150 watts x 2; MOS-FET; adjustable gain.
	COMP 400	795.00	A			100	200	10-50	0.02	P	No	No	Yes	2¼ x 8 x 20	Dual mono; MOS-FET; adjustable gain.
	COMP 700	995.00	A			100	350	10-50	0.02	P	No	No	Yes	2¼ x 8 x 24	As above.
PAQ-440	400.00	P/E	4	18	105			0.005	P	Yes	No	Yes	1 x 6 x 4½	Parametric EQ; external processor loop; half DIN size.	
APX-432	400.00	P/E	3	10	105			0.005	P	No	Yes	Yes	1 x 6 x 4½	10-dB boost at 45 Hz; two-, three-, or four-way shelving EQ.	
CONCORD	CEQ7+	299.95	E	7	†	90			P	Yes	Yes	Yes	7 x 1 x 5½	†±8 or ±12 dB. Four EQ presets; parametric bass EQ.	
	CA 20.2	99.95	A			90	20		1.0	P/S		Yes	7½ x 6¼ x 1¾		
	CA 50.2	199.95	A			90	50	20-20	0.08	P/S		Yes	10½ x 8¾ x 2¾		
	CA 30.4	349.95	A			100	30 x 4	20-20	0.06	P		Yes	11¾ x 7¾ x 2½	Bridges to two channels.	
	CA 100.2	449.95	A			100	100	20-20	0.06	P		No	Yes	13¾ x 7¾ x 2½	Bridgeable.
	CA 200.2	599.95	A			100	200	20-20	0.06	P		No	Yes	15¾ x 7¾ x 2½	Bridges to 500 watts.

AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Preamp (P)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB, A-Weighted	Watts/Channel into 4 Ohms, per EA-450	Full-power Bandwidth, Hz to kHz	THD at Rated Output, %	Input Level, Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes
COUSTIC	AMP-560	1550.00	A		92	220	20-20	0.05	P			Yes	3 3/8 x 12 x 38	Bridgeable. As above.	
	AMP-380	309.95	A		92	75	20-20	0.05	P/S			Yes	2 3/8 x 7 7/8 x 13 1/2		
	AMP-190	199.95	A		92	35	20-20	0.05	P/S			Yes	2 3/8 x 7 7/8 x 9 1/2	As above.	
	AMP-120	129.95	A		92	30	20-20	0.05	P/S			Yes	2 3/8 x 7 7/8 x 7 1/4		
	AMP-105A	179.95	A		90	25 x 4	20-20	0.9	P/S	Yes	Yes	Yes	1 3/4 x 5 1/2 x 12 1/4	As above.	
	AMP-100A	64.95	A		70	18	30-20	0.9	P/S			Yes	1 3/4 x 5 1/2 x 6 1/8		
	EQ-1100	199.95	P/E	7	12	98			0.02	P	Yes	†	Yes	7 x 1 x 6	†Asymmetrical crossover. Includes pink-noise spectrum analyzer. dbx noise reduction.
	EQ-1030	449.95	P/E	7	12	92			0.02	P	Yes	†	Yes	6 7/8 x 2 1/8 x 8 1/4	
	EQ-1020	229.95	A/E	7	12	65	12 x 2, 18 x 2	30-30	0.9	P/S	Yes		Yes	5 3/4 x 1 3/8 x 6 3/8	
	EQ-1010	179.95	A/E	7	12	65	18	30-30	0.9	P/S	Yes		Yes	5 3/4 x 1 3/8 x 6 3/8	
EQ-1007	144.95	A/E	7	12	65	16	30-30	0.9	P/S	Yes		Yes	5 3/4 x 1 3/8 x 5 3/8	CD/AUX input; under-dash mounting.	
EQ-1000	124.95	P/E	7	12	90			0.05	P/S	Yes		Yes	5 3/4 x 1 3/8 x 5 3/8		
EQ-920	79.95	A/E	7	12	80	20	35-30	0.9	P/S	Yes		Yes	6 3/8 x 1 3/4 x 5		
CRAIG	V506A	44.95	A/E	5	12	70	12	80-15	5.0	S	Yes	Yes	No	3 3/8 x 1 1/4 x 5 1/2	Bridgeable for subwoofer. As above.
	V508	54.95	A/E	7	12	70	12	80-15	5.0	S	Yes	Yes	No	5 x 1 1/8 x 5	
	V509	124.95	A/E	7	12	70	20	50-20	5.0	P/S	Yes	Yes	No	6 3/8 x 2 x 6 3/8	
	V511	69.95	A/E	10	12	70	20	40-20	5.0	P/S	Yes	Yes	No	6 3/8 x 1 1/4 x 5 1/2	
	V510A	179.95	A/E	7	12	70	18 x 4	50-20	5.0	P/S	Yes	Yes	No	7 x 2 x 7 1/4	
	V512	84.95	A/E	7	12	70	14	25-40	5.0	P/S	Yes	Yes	No	7 x 1 x 5 5/8	
	V530	64.95	A			75	20	50-20	5.0	P/S	No	No	No	3 3/4 x 2 x 7	
	V540	99.95	A			75	35	50-20	3.0	P/S	No	No	No	7 x 2 1/4 x 5 1/2	
	V541	169.95	A			75	65	10-20	1.0	P/S	No	No	No	10 1/4 x 2 x 7 1/4	
	V542	239.95	A			75	125	30-20	0.1	P/S	No	No	No	15 3/8 x 2 x 7 1/4	
DELTA/SONIK	D-40	79.00	A		75	18	20-20	1.0	P/S	No	No	Yes	1 1/4 x 4 x 4 3/4	Bridgeable. Two-, three-, or four-channel operation. As above. †Subwoofer crossover.	
	DP-90	170.00	A		95	45	5-30	0.05	P/S	No	No	Yes	2 1/4 x 7 1/4 x 6		
	DP-200	345.00	A		95	100	5-30	0.05	P/S	No	No	Yes	2 1/2 x 10 1/2 x 8 1/2		
	DP-360	595.00	A		95	180	5-30	0.05	P/S	No	No	Yes	2 1/2 x 14 1/2 x 8 1/2		
	PS-7B	220.00	P/E	7	18	95			0.02	P/S	Yes	†	Yes		1 x 5 3/4 x 7
DENON	DCE-2155	200.00	E	7	12	97			P	Yes	†	Yes	7 x 1 x 5 3/8	†Subwoofer crossover. Separate front and rear equalization. †Optional. Interface controller; automatic source selection. †Optional. Interface controller. †Subwoofer crossover. Three- or five-channel operation. Bridges to two channels. Bridgeable.	
	DCE-250	270.00	E	12	12	95			P	No	No	Yes	8 1/2 x 1 7/8 x 4		
	DCL-420	160.00	P			95			P/S	†	No	Yes	8 1/2 x 1 7/8 x 5 1/8		
	DCL-410	100.00	P			95	28 x 4, 60 x 1	20-20	0.05	P/S	†	No	Yes		15 3/4 x 2 1/8 x 8 1/2
	DCA-3500	575.00	A			90	28 x 4	20-20	0.05	P	No	No	Yes		14 3/8 x 2 1/8 x 8 1/2
	DCA-3400	440.00	A			90	40	20-20	0.05	P	No	No	Yes		9 1/2 x 2 1/8 x 8 1/2
	DCA-3280	325.00	A			90	28	20-20	0.05	P	No	No	Yes		9 1/2 x 1 3/4 x 8 1/2
	DCA-3180	220.00	A			90	12 x 4	20-20	0.5	P	No	No	Yes		9 1/4 x 1 3/4 x 6
	DCA-3150	200.00	A			90	12	20-20	0.5	P	No	No	Yes		4 7/8 x 1 3/8 x 3 3/8
	DCA-3120	100.00	A			90	12	20-20	0.5	P	No	No	Yes		4 7/8 x 1 3/8 x 3 3/8
ECLIPSE	EUM-1420	614.95	A		100	100		0.03	P			Yes	16 3/8 x 2 1/2 x 8 1/4	Two- or four-channel operation. As above.	
	EUM-1410	449.95	A		100	50		0.03	P			Yes	11 3/4 x 2 1/2 x 8		
	EUM-1700	174.95	E	7	12	90		0.05	P	Yes	Yes	Yes	7 x 1 x 5 3/8		
FAS	PE-75S	149.95	P/E	7	12	65		0.5	P/S	Yes	Yes	Yes	7 x 1 x 5 1/2	Subwoofer EQ with high- and low-pass crossovers. Includes spectrum analyzer. Four EQ presets.	
	PE-60	114.95	P/E	7	12	65	18 x 4	0.5	P/S	Yes	No	Yes	7 x 1 x 5 1/2		
	EEQ-100	199.95	A/E	7	12	65		0.3	P/S	Yes	No	Yes	6 1/2 x 2 x 7	Includes spectrum analyzer. †Mono operation, 150 watts; stereo, 75 watts x 2; three-channel, 37.5 watts x 2 and 75 watts x 1. †Mono operation, 100 watts; stereo, 50 watts x 2; three-channel, 25 watts x 2 and 50 watts x 1.	
	EA-120	137.95	A/E	9	12	65	14 x 4	±1 20-20	1	P/S	Yes	No	Yes		6 3/8 x 2 x 6 3/8
	EA-65	124.95	A/E	7	12	65	14	±1 20-20	1	P/S	Yes	No	Yes		7 x 1 x 5 1/2
	PA-151	349.95	A			100	†	±1 15-30	0.05	P/S		Yes	Yes		10 x 2 x 8
	PA-101	224.95	A			100	†	±1 15-30	0.08	P/S		Yes	Yes		8 5/8 x 2 3/8 x 8
PA-81	144.95	A			100	30	20-25	0.05	P/S		Yes	Yes	7 x 1 x 6		
PA-25	54.95	A			86	12.5	20-20	1	P/S		Yes	Yes	4 3/4 x 1 x 4 3/4		
FDS/CATE-AUDIO/DMCS	Gavotte Pro Plus	399.00	P/E	1	†	95		0.10	P	No	Yes	Yes	1 3/4 x 11 1/4 x 6	†18-dB boost at 45 Hz. Surround processing circuitry.	
FUJITSU TEN	UM-116	29.95	A		70	9	100-15	5	P	No		Yes	3 x 1 x 2	Includes spectrum analyzer.	
	UM-132	79.95	A		100	25	50-50	0.02	P/S			Yes	6 x 1 1/4 x 5 1/8		
	QM-582	234.95	A		98	70	20-60	0.005	P/S			Yes	5 7/8 x 2 x 6 1/4		
	QM-570XA	264.95	A/E	9		79	25	30-20	1	P		Yes	7 x 1 x 5 1/8		
	UE-116	149.95	E	7		90		0.05	P	Yes	Yes	Yes	7 x 1 x 5 1/8		
FULTRON	15-0739	219.95	P/A/E	7	11.5	60	15 x 4	20-30	5	P/S	Yes	Yes	2 x 7 7/8 x 7	Four EQ presets. Includes spectrum analyzer.	
	15-0734	109.95	P/A/E	7	12	65	13 x 4	20-30	5	P/S	Yes	Yes	1 x 7 7/8 x 5 1/4		
	15-0730	79.95	P/A/E	10	12	65	13 x 4	20-30	5	P/S	Yes	Yes	1 x 7 x 4 1/4	Four EQ presets.	
	15-0770	279.95	P/A			70	75	20-20	1	P/S	No	No	Yes		2 1/4 x 10 3/4 x 9 3/8
	15-0775	339.95	P/A			70	75	20-20	1	P/S	No	No	Yes		2 1/2 x 9 x 8
	15-0735	149.95	P/A/E	7	12	60	15 x 4	20-20	5	P/S	Yes	No	Yes		6 7/8 x 1 3/4 x 5 7/8
	15-0727	59.95	P/A	2	12	15	15	30-20	5	P/S	No	No	Yes		3 3/8 x 1 1/8 x 4 7/8
	MA-1	449.00	A			100	100	10-70	0.01	P	No	No	Yes		12 x 8 x 2 1/2
MA-4	499.00	A			100	40 x 4	20-20	0.05	P	No	No	Yes	2 x 9 x 3 1/2		
MAQ-104	299.00	E	10	12	90				P	No	No	Yes	10 x 8 x 1 1/4		

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AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Preamp (P), Amp (A), Equalizer (E)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, dB, A-Weighted	Watts/Channel, Lineo 4 Ohms, per EA-4gg	Full-power Bandwidth, Hz to kHz	THD at Rated Output, % per EA-4gg	Input Levels: Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, inches	Notes
LINEAR POWER	Runt	130.00	A			16	40-20	0.75	P	No	No	Yes	1 3/8 x 4 x 4 1/2	BTL circuitry. Operates into 2 ohms. As above; bridgeable. As above. As above. As above. As above. As above. †Mono subwoofer out, 20 to 80 Hz; stereo, 80 Hz to 20 kHz. ††Subwoofer crossover. Master and subwoofer gain controls. Front and rear gain controls. Feedback-servo mono subwoofer amp; includes four 8-inch subwoofers (see "Speakers"). Half DIN size; 32-dB gain.	
	652	200.00	A			32.5	20-20	0.12	P	No	No	Yes	2 x 7 3/4 x 5 1/2		
	452i	250.00	A			22.5	20-20	0.01	P	No	No	Yes	2 x 7 3/4 x 5 1/2		
	952	300.00	A			47.5	20-20	0.05	P	No	No	Yes	2 x 7 3/4 x 7 1/2		
	2202	500.00	A			110	20-20	0.09	P	No	No	Yes	3 x 9 1/2 x 9 3/4		
	3002	750.00	A			150	20-20	0.2	P	No	No	Yes	3 x 9 1/2 x 12		
	5002	1000.00	A			250	20-20	0.12	P	No	No	Yes	3 x 9 1/2 x 14 1/2		
	2652	450.00	A			30 x 2, 60 x 1	†	0.04	P	No	††	Yes	2 x 7 3/4 x 9 1/2		
	4302	425.00	A			30 x 4	20-20	0.12	P	No	No	Yes	2 x 7 3/4 x 7 1/2		
	1752S	1500.00	A			175 x 1	20-200 Hz	0.09	P	No	No	Yes	3 x 9 1/2 x 9 3/4		
PA-II	350.00	P/E	4	15	105				P	Yes	No	Yes	7/8 x 6 x 4		
MAJESTIC	MEB670	49.95	A/E	7	12	55	30	20-20	0.10	P/S	Yes	Yes	4 1/8 x 1 x 4 1/8	Half DIN size; floating and common ground. Floating and common ground; CD input jack; includes spectrum analyzer. Floating and common ground; four EQ presets. Floating and common ground. As above. As above; half DIN size. Floating and common ground; four EQ presets. Four EQ presets; CD input jack; includes spectrum analyzer with pink-noise generator and mike. Class A; bridgeable. As above. Bridges to one, two, or three channels. As above. Bridgeable; operates into 2 ohms. As above. As above.	
	MEB1010	79.95	A/E	10	12	65	30	20-20	0.10	P/S	Yes	Yes	4 x 1 x 4 1/4		
	MEB1070S	99.95	A/E	7	12	70	40	20-20	1	P/S	Yes	Yes	7 x 1 x 5 1/2		
	MEB8070CD	119.95	A/E	7	12	65	40 x 4	20-20	1	P/S	No	Yes	6 1/8 x 1 3/4 x 6 1/8		
	MEB7400A	199.95	P/A/E	7	12	65	50 x 4	20-20	1	P/S	Yes	Yes	7 x 2 x 7 1/4		
	MEB7600	169.95	A/E	7	12	60	50 x 4	20-20	1	P/S	Yes	Yes	7 x 2 x 7 1/4		
	MPA7000	69.95	P/E	7	12	65			P	Yes	Yes	5 1/2 x 1 1/8 x 4			
	MPA8000	79.95	P/E	7	12	70			P	Yes	Yes	7 x 1 x 5 1/2			
	MPA9000	129.95	P/E	7	12	80			P	Yes	Yes	6 1/8 x 2 x 6 1/4			
	MPA5000	199.95	P/E	7	12	80			P	Yes	Yes				
	MA60	49.95	A			50	30	50-15	0.9	P/S	No	Yes	4 1/8 x 1 x 5 1/2		
	MA110HD	79.95	A			65	50	20-20	0.7	P/S	No	Yes	8 1/8 x 2 3/8 x 3 3/4		
	MA160HD	119.95	A			65	80	20-20	1	P/S	No	Yes	8 1/8 x 2 3/8 x 5 1/8		
	MA200HD	109.95	A			65	75	20-20	1	P/S	No	Yes	7 3/8 x 2 x 6 1/8		
MA550HD	149.95	A			70	50	20-20	0.1	P/S	Yes	Yes	7 1/8 x 7 7/8 x 2 1/2			
MA770HD	269.95	A			70	70	20-20	0.1	P/S	Yes	Yes	7 3/8 x 8 1/8 x 3 3/8			
MA240HD	139.95	A			70	30 x 2, 75 x 2	20-20	1	P/S	Yes	Yes	7 3/8 x 2 x 6 1/8			
MA460HD	289.95	A			80	50 x 4	20-20	0.1	P/S	Yes	Yes	11 x 2 3/4 x 11 1/4			
MA480HD	399.95	A			80	75 x 4	20-20	0.1	P/S	Yes	Yes	11 x 2 3/4 x 13			
MA9300	199.95	A			80	50	20-20	0.05	P/S	No	Yes	11 x 2 1/2 x 8			
MA9400	249.95	A			80	75	20-20	0.05	P/S	No	Yes	11 x 2 1/2 x 9 1/4			
MA9500	299.95	A			80	100	20-20	0.05	P/S	No	Yes	11 x 2 1/2 x 10			
MARANTZ	750	549.00	A			90	20-20	0.01	P			Yes		Four-piece modular system.	
MEI	EA6100	69.95	A/E	7	12	70	13	20-20	0.8	S	Yes	No	No	CD input jack. Includes spectrum analyzer. Four EQ presets; automatic EQ function. Selectable crossover frequency. Floating- or common-ground speaker input; adjustable gain. As above; bridgeable. As above. As above; two-, three-, or four-channel operation.	
	EA6200	89.95	A/E	7	12	70	12.5	20-20	0.8	P/S	Yes	No	Yes		
	EA6300	119.95	A/E	7	12	70	12.5	20-25	0.8	P/S	Yes	No	Yes		
	EA6350	199.95	A/E	7	12	70	12.5 x 2, 20 x 2	20-25	0.8	P/S	Yes	No	Yes		
	EA6470	239.95	A/E	7	12	70	12.5 x 2, 20 x 2	20-25	0.8	P/S	Yes	No	Yes		
	EP6250	109.95	E	7	12	70			0.8	P	Yes	Yes	Yes		
	DA7225	109.95	A			85	16	20-20	0.8	P/S	No	No	Yes		
	DA7250	209.95	A			95	50	20-20	0.8	P/S	No	No	Yes		
	DA7275	299.95	A			95	75	20-20	0.8	P/S	No	No	Yes		
	DA7450	399.95	A			95	50 x 4	20-20	0.8	P/S	No	No	Yes		
PA705H	39.95	A			60	20	40-20	8	P/S			Yes	4 1/8 x 1 x 5		
MGA	MA-230	79.95	A			86	16	15-20	1	P/S		No	Yes	1 1/2 x 5 1/2 x 7 1/8	Adjustable gain. As above. As above; bridges to two channels.
	MA-250	139.95	A			88	40	15-20	0.2	P		No	Yes	2 3/8 x 7 7/8 x 8 3/4	
	MA-450	219.95	A			88	40 x 4	15-20	0.2	P		No	Yes	2 3/8 x 7 7/8 x 13 3/8	
MGT	CEQ 810	149.95	P/E	7	18	100			P	Yes	Yes	Yes	7 x 1 x 4 1/8	Subwoofer output; CD input jack. Includes spectrum analyzer. Bridgeable; operates into 2 ohms. As above. Bridges to two channels.	
	CEQ 750	99.95	A/E	7	12	65	18	20-20	0.5	P/S	Yes	No	Yes		7 x 1 x 5 1/2
	CEQ 1050	119.95	A/E	10	12	65	18	20-20	0.5	P/S	Yes	No	Yes		6 1/2 x 1 1/4 x 5 3/4
	CPA 40	59.95	A			80	18	20-20	0.5	S	No	No	No		3 1/8 x 1 1/2 x 4 1/8
	CPA 60	139.95	A			65	30	20-20	0.5	P/S	No	No	Yes		9 x 2 3/4 x 6 1/8
	CPA 130	239.95	A			70	65	20-20	0.5	P/S	No	No	Yes		13 x 2 3/4 x 6 1/8
	CPA 300	379.95	A			92	75 x 4	20-20	0.05	P/S	No	No	Yes		17 x 2 1/4 x 9 1/4
MILBERT AMPLIFIERS	BaM-230	1495.00	A			90	30	5-60	2	P/S	No	No	Yes	18 x 6 3/4 x 4 1/2	Tube design.
MONOLITHIC SOUND	Class A Monoblock	599.00	A			100	50 x 1	5-50	0.1	P		Yes		Mono; Class A.	
	PA-5000	1199.00	A				250	20-20	0.05	P	No	Yes	Yes	14 1/2 x 4 x 11	
	PA-2400X	649.00	A				60 x 4	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 11 1/2	
	PA-2400F	599.00	A				60 x 4	20-20	0.05	P	†	No	Yes	6 1/2 x 2 3/4 x 11 1/2	
	PA-2400Q	549.00	A				60 x 4	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 11 1/2	
	PA-2000M	549.00	A				250 x 1	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 9 1/2	
PA-2000	499.00	A				100	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 9 1/2		

AMPS/EQUALIZERS

MANUFACTURER	Model	Price - \$	Preamp (P), Amp (A), Equalizer (E)	Number of EQ Bands	Boost/Cut Range, ±dB	S/N Ratio, -dB, A-Weighted	Watts Channel into 4 Ohms, Per EIA-490	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % per EIA-490	Input Level: Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, Inches	Notes	
MONOLITHIC SOUND (Continued)	PA-700	399.00	A			70	20-20	0.05	P	No	No	Yes	6 1/2 x 2 3/4 x 6 3/4	As above.		
	PA-600	399.00	A			20 x 6	20-20	0.1	P	Yes	Yes	Yes				
	PA-400	239.00	A			20 x 4	20-20	0.1	P	No	No	Yes	4 1/4 x 1 5/8 x 4 3/4			
	PA-200	149.00	A			20	20-20	0.1	P	No	No	Yes	4 1/4 x 1 5/8 x 4 3/4			
	EQ-4	299.00	P/E	4	18			0.05	P	No	No	Yes	1 1/2 x 4 3/4 x 3 1/2	Bi-FET.		
TUNEQ	299.00	E	9	24			0.05	P	Yes	Yes	Yes	7 1/2 x 2 x 5 1/2				
MOREL ACOUSTICS	MV 1	895.00	A			70		0.01	P	No	No	Yes	†	†Two mono blocks, each 5 x 5 x 2 1/2 inches; power supply, 7 1/2 x 5 x 2 3/4 inches. Frequency response, 20 Hz to 20 kHz, ±0.1 dB.		
NAKAMICHI	PA-400M	529.00	A			110	140 x 1	5-50	0.002	P		Yes	12 5/8 x 2 1/8 x 6 3/8	220 watts x 1 into 2 ohms; L + R summing circuit.		
	PA-350	495.00	A			110	35 x 4	5-50	0.005	P		Yes	12 5/8 x 2 1/8 x 6 3/8	Bridgeable with Model BA-50 adaptor.		
	PA-300II	450.00	A			115	75	5-50	0.003	P		Yes	12 5/8 x 2 1/8 x 6 3/8	As above.		
	PA-200	275.00	A			110	30	10-50	0.005	P/S		Yes	7 1/2 x 1 3/4 x 6 3/8	As above.		
	PA-150	235.00	A			100	14 x 4	20-20	0.05	P		Yes	5 7/8 x 1 1/4 x 4 1/2			
	PA-100	139.00	A			100	14	20-20	0.05	P/S		Yes	3 1/4 x 1 1/4 x 4 1/2			
	PA-304		A			†				P		Yes		†Two-channel mode, 80 watts x 2; three-channel, 80 watts x 1 and 40 watts x 2; four-channel, 40 watts x 4.		
ORION	220GX	199.00	A			90	20	20-20	0.03	P	No	Yes	4 x 8 1/2 x 2 1/4	Bridgeable with optional module, Model 400 BDG, \$99.00; operates into 2 ohms.		
	240GX	349.00	A			107	40	20-20	0.03	P	No	Yes	7 1/2 x 8 1/2 x 2 1/4	As above.		
	280GX	499.00	A			110	80	20-20	0.03	P	No	Yes	11 x 8 1/2 x 2 1/4	As above.		
	2150GX	739.00	A			110	150	20-20	0.03	P	No	Yes	17 x 8 1/2 x 2 1/4	As above.		
	4100GX	1049.00	A			110	100 x 4	20-20	0.03	P	No	Yes	22 x 8 1/2 x 2 1/4	Bridges to two channels with optional module.		
	2350GX	1049.00	A			110	350	20-20	0.1	P	No	Yes	22 x 8 1/2 x 2 1/4			
	225 HCCA	559.00	A			112	25	20-20	0.03	P	No	Yes	11 x 8 1/2 x 2 1/4	Bridgeable with optional module; operates into 0.5 ohm.		
	425 HCCA	1049.00	A			112	25 x 4	20-20	0.03	P	No	Yes	22 x 8 1/2 x 2 1/4	Bridges to two channels with optional module; operates into 0.5 ohm.		
	250 HCCA	839.00	A			112	50	20-20	0.03	P	No	Yes	17 x 8 1/2 x 2 1/4	Bridgeable with optional module; operates into 1 ohm.		
	2125SX	689.00	A	†	†	100	125	20-20	0.03	P	No	Yes	14 x 8 1/2 x 2 1/4	†15-dB boost at 40 Hz, 6-dB boost at 10 kHz. Internally bridgeable; simultaneous stereo and mono operation by strapping mono speaker between one left and one right terminal.		
	250SX	469.00	A	†	†	100	50	20-20	0.03	P	No	Yes	10 x 8 1/2 x 2 1/4	All as above.		
	GS-100	840.00	A			107	50	20-20	0.03	P	No	Yes	7 1/2 x 8 1/2 x 2 1/4	Bridgeable with optional module.		
GS-1000	1050.00	A			110	100	20-20	0.03	P	No	Yes	11 x 8 1/2 x 2 1/4	As above.			
300PRQ	209.00	P/E	3	10					P	No	No	Yes	Volume control.			
600EQM	314.00	E	6	12					P	No	No	Yes				
500PMQ	449.00	P/E	5	12					P	No	No	Yes	Parametric EQ.			
PANASONIC	CY-SA50	95.00	A			72	12	20-40	1	P/S		Yes	6 1/8 x 1 3/8 x 3 7/8			
	CY-SA60	190.00	A			100	30	5-100	1	P†		Yes	10 1/8 x 2 1/4 x 4 3/4	†Adjustable.		
	CY-SA100	280.00	A			100	60	5-100	1	P†		Yes	10 1/8 x 2 1/4 x 7 7/8			
	CY-SG55	105.00	A/E	5	12	83	12.5	20-40	0.8	S	Yes	Yes	7 x 1 x 5 1/2			
	CY-SG60	125.00	A/E	7	12	83	12.5	20-40	0.8	S/S	Yes	Yes	7 x 1 x 5 1/2			
PHASE LINEAR	PLA15	100.00	A			85	15	30-20	0.2	P/S		Yes	7 1/4 x 2 x 3			
	PLT150	270.00	A			95	30	20-20	0.05	P/S		Yes	8 3/8 x 2 x 10 1/4	Bridgeable.		
PHILIPS	AP 165	299.95	P/E	7	12	85				P	Yes	No	1 x 7 x 6 1/2	Half DIN size.		
	AP 364	289.95	A/E	7	12	85	20 x 4	20-20		P/S	Yes	No	1 x 7 x 6 1/2	As above.		
	AP 363	224.95	A/E	7	12	85	20	20-20		P/S	Yes	No	2 x 7 x 6 1/2			
	AP 282	119.95	A			85	30	20-20		P/S	No	No	2 x 7 x 6 1/2			
	AP 262	119.95	A			85	20	20-20		P/S	No	No	1 x 7 x 6 1/2	As above.		
	AP 264	159.95	A			85	20 x 4	20-20		P	No	No				
	AP 170	599.95	P/E	9	12	85				P	Yes	No	1 x 7 x 6 1/2	As above; includes spectrum analyzer.		
	AP 210	399.95	A			85	70	20-20		P/S						
	AP 265	329.95	A			85	50	20-20		P/S						
	AP 270	449.95	A			85	100	20-20		P						
	AP 470	249.95	P			85				P		†		†Two-/three-way crossover.		
	PHOENIX GOLD	MQ-450	419.95	A			102	50 x 4	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 12 1/2	Two-, three-, or four-channel operation; operates into 2 ohms.
		MS-250	309.95	A			102	50	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 8 1/2	Bridgeable; operates into 2 ohms; simultaneous stereo and bridged mono output.
MS-2100		479.95	A			102	100	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 15	As above.	
MS-2200		625.00	A			102	200	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 24	As above.	
MPQ-418		249.95	A			102	18 x 4	10-50	0.9	P/S	No	†	Yes	2 3/8 x 1 13/8 x 6	†Defeatable crossover, selectable for four high-pass amp outputs plus low-pass preamp output or two high-pass amp outputs plus two low-pass amp outputs. Operates into 0.5-ohm load.	
MPS-2220		349.95	A			102	22	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 8 1/2	Operates into 0.5-ohm load; simultaneous stereo and bridged mono output.	
MPS-2500		599.95	A			102	50	10-50	0.05	P	No	No	Yes	2 3/8 x 1 13/8 x 24	As above.	
MPH-6300	15,000.	A/E	9	18	102	75 x 6	10-50	0.01	P	No	Yes	Yes	5 x 15 x 48	600 watts x 6 into 1 ohm; 190-ampere alternator supplied.		

If you think custom sound has to be complicated and exorbitant, this will come as a shock to your system.

In the past, if you wanted phenomenal sound tailored to your car, you drove to your local autosound dealership, where you were confronted by such a bewildering array of choices that you briefly considered making do with a Walkman.™

Eventually, of course, you selected your components and left your car with the dealer, who installed over the next several days a battery of amps,

equalizers, networks, switches and other exotic what-nots in your trunk.

The net effect was to reduce your cargo space to a size barely large enough for an attache case. And your bank account by a sum of money that would fill the attache case.

But let's recognize one thing: You drove away with an absolutely sensational sound system.

That was then. This is now.

a/d/s/, the company that pioneered high performance car audio, has created autosound's latest and most refined concept.

Using newly developed a/d/s/ components based on a unique multi-channel architecture, you can now configure a 2, 4 or 6-channel system of superior sound quality more simply, quickly and affordably than you thought possible.

We direct your attention to the a/d/s/ 6-channel, 300-watt, satellite-subwoofer system and its two advanced pieces of electronics. The PH15 Power Plate amplifier has the capacity to drive two front speakers, two rear speakers and two subwoofers. It's the industry's first single-component 6-channel amplifier.

And if the PH15 is the muscle of the system, the 642CSi Electronic Signal Processor is its heart. A 6-channel programmable electronic crossover network, the 642CSi splits music into highs, lows and very lows, then routes the signals left and right to the appropriate amplifier channels. It also features interface circuitry that makes an a/d/s/ system compatible with virtually any head unit, including the AM/FM cassette that comes in the best cars today.

That means the \$750 or so you would have plunked down for a new head unit can be applied instead to the system itself or to the purchase of an additional source—a CD player, say. Either way, you come out ahead.



The a/d/s/ 642CSi defines system architecture. It makes any a/d/s/ system compatible with the head units that come standard in today's cars and those that come off autosound dealers' shelves.



The 6-channel PH15 amplifier is a finely finished dynamo that produces 300 clean watts of power. Whether you choose a 2, 4 or 6-channel a/d/s/ amp, you'll be getting a high-current amp that stands as the state-of-the-art in its class.

For speakers, nothing less than the acknowledged best.

a/d/s/ loudspeakers have long been the speakers of choice in the finest autosound systems. Among the signs of recognition they've garnered are 10 "Product of the Year" Awards from *Audio Video International*.

The a/d/s/ 320i was the first speaker to do for the car what the best home speakers do: project an accurate, stable stereo image.

The a/d/s/ 300i, *Audio Video International* 1988 Speaker of the Year, is an extraordinarily smooth speaker that prompted this from *Car and Driver*:

"... the high end systems made by a/d/s/ have reached the status of modern classics."

And for speakers that reach down to the very fundamentals of music — to notes you feel as well as hear — a/d/s/ offers the long excursion, low distortion S7 subwoofer.

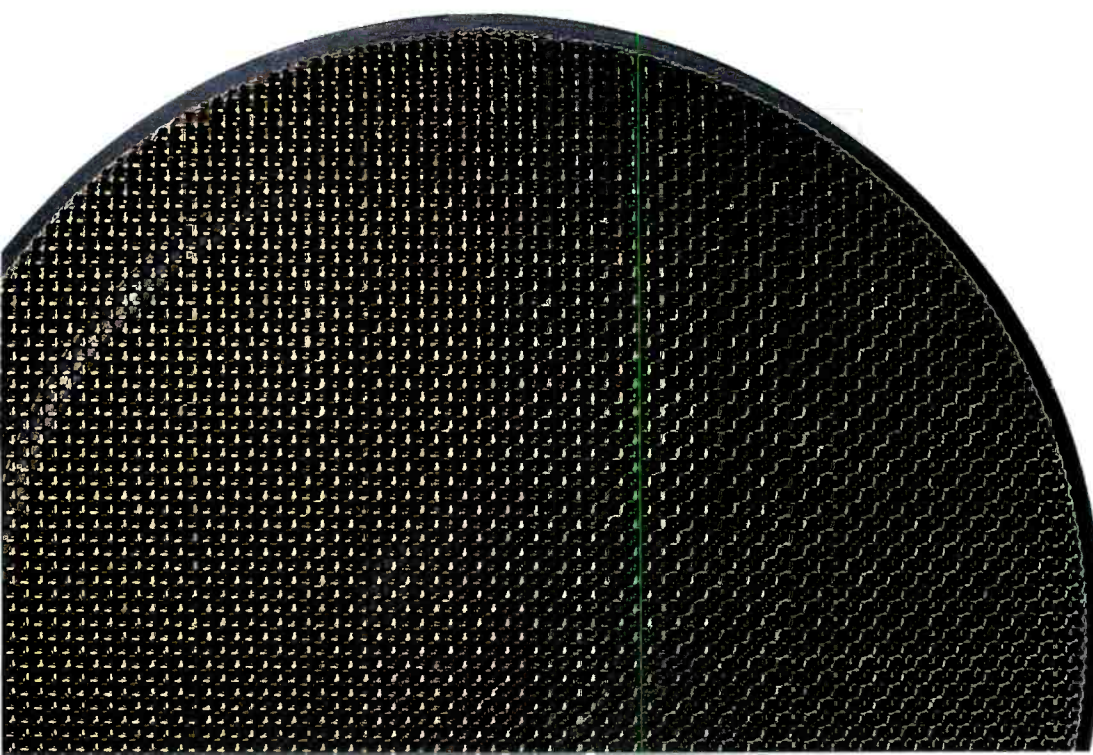
The sound is superb, no matter how many channels you choose.

With 2, 4 and 6-channel amplifiers that deliver unadulterated power, and with a range of speakers capable of noteworthy impact and realism, a/d/s/ can help you create precisely the system your needs define.

Because a/d/s/ systems require fewer components and are simpler to install, the total cost of creating a sound system of convincing accuracy and gut-satisfying power is significantly reduced.

If none of this comes as a shock to your system, why not visit your a/d/s/ dealer for a demonstration.

a/d/s/



The a/d/s/ 320i is universally heralded as the finest automotive loudspeaker ever created. No other car speaker has won more awards for performance and design.

AMPS/EQUALIZERS

MANUFACTURER	Model	Price, \$	Preamp (P)	Amp (A)	Equalizer (E)	Number of EQ Bands	Bobo/Cut Range, ±dB	S/N Ratio, -dB, A-Weighted	Watts Channel into 4 Ohms per EQ-400	Full-Power Bandwidth, Hz to kHz	THD at Rated Output, % per EQ-400	Input Levels: Preamp (P), Speaker (S)	Fader Control?	Includes Active Crossover?	RCA Input Jacks?	Dimensions, inches	Notes
SPARKOMATIC	SBE7	54.99	A/E	7	12	55	20	20-20	5		Yes		No	1 3/8 x 5 1/8 x 5			
	GE50	39.99	A/E	5	12	55	20	20-20	5		Yes		No	1 3/8 x 4 3/4 x 4 3/4			
	LC52	21.99	A			55	20	20-20	5		No		No	1 1/4 x 4 1/4 x 4 1/4			
SPECO	EPB-100	94.95	A/E	7	12	87	30	20-18	0.05	S	No	No	No	5 1/8 x 1 1/8 x 6	Bridgeable. As above. As above.		
	EPB-150	124.95	A/E	10	12	87	27.5	20-18	0.05	S	Yes	No	No	5 1/8 x 1 1/8 x 6 5/8			
	HPA-200	229.95	A			70	100	20-20	0.05	P/S	No	No	No	8 x 2 3/4 x 8			
	HPA-300	349.95	A			70	150	20-20	0.05	P/S	No	No	Yes	11 x 2 3/8 x 8			
	HPA-400	449.95	A			80	100 x 4	20-20	0.05	P/S	No	No	Yes	11 x 3/4 x 11			
TARGA	A-990	499.95	A			92	75 x 4	10-40	0.057	P			Yes	24 x 7 x 2 1/2	Bridges to two channels; operates into 2 ohms. Bridgeable; operates into 2 ohms. As above. Operates into 2 ohms.		
	A-970	249.95	A			92	75	10-40	0.057	P			Yes	11 x 7 x 2 1/2			
	A-950	199.95	A			85	50	10-40	0.04	P			Yes	9 x 7 x 2 1/2			
	A-930	79.95	A			94	25	20-30	0.2	P/S			Yes	5 x 5 1/2 x 1 1/2			
	A-9300	169.95	A			80	75	20-30	10	P/S			Yes	10 3/4 x 2 3/4 x 7 1/4			
	A-9100	119.95	A			80	45	20-30	10	P/S			Yes	10 3/4 x 2 1/8 x 7			
	HT-7102	89.95	A/E	7	12	70	12.5 x 4	20-30		P/S	Yes	No	Yes	1 x 7 x 5 1/2			
	HT-7200	159.95	A/E	7	12	65	50 x 4	20-30		P/S	Yes	No	Yes	1 3/4 x 6 3/8 x 6 1/2			
	E-900	119.95	P/E	7	12	93					P/S	Yes	†	Yes		1 x 7 x 6 1/2	
																	†Subwoofer crossover.
TECHNICS	CY-EQ9	149.95	E	9	12					P	Yes		No	7 x 1 x 5 1/8	†Seven front EQ bands, seven rear. Two-, three-, or four-channel operation.		
	CY-EQ14	239.95	E	14	12					P	Yes	Yes	No	7 x 1 x 5 1/8			
	CY-EQ77	239.95	E	†	12					P	Yes		No	7 x 1 x 5 1/8			
	CY-M50	99.95	A			90	12.5	40-30	0.2	P	No	No	Yes	5 1/2 x 1 3/8 x 4			
	CY-M120	179.95	A			100	20	20-20	0.09	P	No	No	Yes	10 1/8 x 2 1/4 x 4 3/4			
	CY-M200	279.95	A			100	40	20-20	0.09	P	No	No	Yes	10 1/8 x 2 1/4 x 7 1/8			
	CY-M400	549.95	A			100	40 x 4	20-20	0.09	P	No	No	Yes	11 1/8 x 2 7/8 x 9 7/8			
ULTIMATE SOUND	PA1200	219.95	A			93	60	20-25	0.007	P/S	No	No	Yes	4 x 9 3/8 x 9 1/2	Bridgeable. As above. As above.		
	PA2000	289.95	A			93	100	20-30	0.007	P/S	No	No	Yes	4 x 11 x 9 1/2			
	PA2500	389.95	A			93	125	20-30	0.007	P/S	No	No	Yes	4 x 14 7/8 x 9 1/2			
	PA5000	799.95	A			93	250	20-30	0.007	P/S	No	No	Yes	4 x 29 3/4 x 9 1/2			
YAMAHA	YPA-1000	529.00	A			115	†	10-100	0.1	P/S		Yes	Yes	17 3/4 x 2 1/2 x 9	†Two-channel mode, 120 watts x 2; three-channel, 55 watts x 2 and 120 watts x 1; four-channel, 55 watts x 4. Preamp output jack for additional amps. †Two-channel mode, 70 watts x 2; three-channel, 35 watts x 2 and 70 watts x 1; four-channel, 35 watts x 4. Bridges to 150 watts; selectable stereo, mono, or summed mono input. Bridges to 90 watts. Bridges to two channels. †Subwoofer crossover. AUX input. Six crossover frequencies.		
	YPA-700	369.00	A			105	†	10-100	0.1	P/S		No	Yes	11 7/8 x 2 x 8 1/2			
	YPA-600	299.00	A			90	50	30-20	0.01	P/S		Yes	Yes	8 3/8 x 3 x 9 5/8			
	YPA-300	219.00	A			105	40	10-100	0.1	P/S		No	Yes	11 3/4 x 2 x 5 1/8			
	YPA-200	139.00	A			100	18	30-30	0.1	P/S		No	Yes	8 1/4 x 1 5/8 x 6 1/2			
	YPA-240	159.00	A			100	18 x 4	20-20	1.0	P/S	No	No	Yes	10 x 1 1/2 x 4 3/4			
	YPA-100	89.00	A			100	12	20-20	1.0	P/S		No	Yes	7 x 1 1/4 x 3 3/4			
	YGE-420	219.00	P/E	7	12	100			0.02	P/S	Yes	†	Yes	7 x 1 x 5 1/2			
	YGE-400	179.00	P/E	7	12	100			0.02	P/S	Yes	†	Yes	6 1/2 x 1 1/2 x 5 3/4			
	YEC-400	129.00	P			115			0.01	P	Yes	Yes	Yes	8 1/4 x 1 5/8 x 6 1/2			
ZAPCO	Z220	782.00	A			110	110	10-100	0.01	P	No	No	Yes	12 x 8 1/2 x 3	Bridges to 275 watts. †Amp, 5 1/4 x 5 7/8 x 3 1/4; power supply, 7 x 3 3/8 x 2 1/8; ESM (Energy Storage Module), 5 1/2 x 3 x 1 1/2. Bridges to 225 watts. †Parametric EQ, 7 x 5 x 2; power supply, 5 1/2 x 3 1/2 x 1 1/4. †108 dB re: 7 V rms. †Nine bands with separate controls for left and right channels. ††92 dB re: 2.5 V. Operates into 2 ohms. Mono subwoofer amp. As above. †108 dB re: 7 V rms.		
	System 200A	759.00	A			110	100	10-100	0.02	P	No	No	Yes	†			
	PX	632.00	E	4	20	105			0.004	P	No	Yes	Yes	†			
	AXI	210.00	P			†			0.005	P	No	Yes	Yes	5 1/2 x 3 1/2 x 1 1/4			
	PEQ	425.00	E	†	18	††			0.05	P	No	No	No	8 3/4 x 4 1/4 x 1 1/4			
	S80	368.00	A			105	40	10-100	0.03	P	No	No	Yes	8 3/8 x 6 1/4 x 2			
	M80 +	345.00	A			108	80 x 1	10-500 Hz	0.03	P	No	Yes	Yes	8 3/8 x 6 1/4 x 2			
	M80	280.00	A			108	80 x 1	10-100 Hz	0.03	P	No	Yes	Yes	7 1/2 x 6 1/4 x 2			
	AFI	180.00	P			†			0.005	P	Yes	No	Yes	4 1/2 x 4 x 2 1/4			
	MDI	145.00	P							P	No	Yes	Yes	5 1/2 x 3 1/2 x 1 1/4			
AGM-V	90.00	P			95			0.005	P	No	No	Yes	5 1/2 x 3 1/2 x 1 1/4				

CD PLAYERS

MANUFACTURER	Model (RI) = Remote Included, (RO) = Remote Optional	Price, \$	Frequency Response, Hz to kHz, ±dB	Dynamic Range, dB	THD, % at 1 kHz	Filtering: Analog Only (A), Digital + Analog (D)	Multi-Disc?	AUX Input?	Repeat Functions: Entire Disc (D), Track (T), Entire Program (E)	Audible Fast Search?	Auto Scan: Disc (D), Tuner (T)	FM Sensitivity, dB (For 50-dB Quieting)				TUNER				Built-in Amp Power: Watts Channel (if applicable)	Theft Protection: Full-out (P), Secret Code (S)	RCA In/Out Jacks?			
												FM Mono S/N Ratio, -dB	Total Number of Station Presets	Alternate-Channel Selectivity, dB	FM Mono S/N Ratio, -dB	FM Mono S/N Ratio, -dB	FM Mono S/N Ratio, -dB	FM Mono S/N Ratio, -dB	FM Mono S/N Ratio, -dB				FM Mono S/N Ratio, -dB	FM Mono S/N Ratio, -dB	
ALPINE	5903	500.00	5-20 ± 1	95	0.03	D	No	Yes	D/T	Yes	D											P	Yes		
	5952 Changer	600.00	5-20 ± 1	95	0.03	D	No	Yes	D/T/E	Yes	D											P	Yes		
	5953 Controller	250.00																				P	Yes		
	7903 7909 with Remote Changer Control	650.00 1200.00	5-20 ± 1 5-20 ± 1	95 95	0.03 0.03	D D	No No	Yes No	D/T D/T	Yes Yes	D D	16.3 16.3	80 80	60 60	18 24								P P P P	Yes Yes Yes Yes	
BLAUPUNKT	New York SCD 08	899.95	20-20 ± 0.3	90	0.005	D	No	No	D/T/E	Yes	D/T	13	85	75	36							P	S	Dut	
	CDP 01	549.95	20-20 ± 0.3	90	0.005	D	No	No	D/T/E	Yes	D											P		Dut	
	Chicago SCD 08	799.95	5-20 ± 0.15	90	0.003	D	No	No	D/T	No	D/T	13	75	70	20							P		Yes	
CLARION	Audia 6000 Changer	1649.95	20-20 ± 3	90	0.007	D	12	No	D/T/E	Yes	D/T														
	Audia 5000	849.95	20-20 ± 3	90	0.003	D	No	Yes	D/T/E	Yes	D/T	12	70										S	Yes	
	5630CD	849.95	5-20	87		D	No	Yes	D/T/E	Yes	D/T	12	70										S	Yes	
	Audia 6100/6110 Changer					D	6	Yes	D/T/E	No	D														
CONCORD	CD1(RI) Changer	999.95	5-20 ± 1	90	0.005	A	12	Yes	E		D													Yes	
DENON	DCC-8920	925.00	5-20 ± 1	90	0.005	D	No	Yes	D	Yes	T	14.8	70	60	24							P		Dut	
DIGATEC	505		20-20 ± 0.1	96	0.003	D	No	Yes	D/T/E	Yes	D/T	12.8	65	68	60	20 x 4						S		No	
ECLIPSE	ESD-230	749.95	5-20 ± 3	90	0.007	D	No	No	T	Yes	D													Yes	
	ECD-110	1199.95	7-20 ± 3	90	0.007	D	No	No	T	Yes	D/T	11.2	90		27									Yes	
HITACHI	PCD-751A	899.95	5-20 ± 1	92	0.03	D	No	No	D/T	Yes	D	12	80	60	18							P		Yes	
JVC	XLMK1200 Changer	729.95	5-20	90	0.005	D	12	No	D/T	No	D														
	XLC4000	749.95	5-20	90	0.005	D	No	No	D/T	No	T	16.3	65	60	20	22 x 4						P		Dut	
KENWOOD	KDC-C100 Changer Tuner for Above Model: KTC-C100	1199.00 249.00	5-20 ± 1	90	0.05	D	10	Yes	E	Yes	D/T													No	
	KDC-90R	999.00	5-20 ± 1	90	0.005	D	No	Yes	D	Yes	D/T	15.2 @ 50 dB	80	75	18	15						P		No	
	KDC-80	749.00	5-20 ± 1	90	0.005	D	No	No	D	Yes	D	15.2 @ 50 dB	80	75	18							P		No	
NAKAMICHI	CD-760 CDC-101 Changer					D	No	No	None	Yes	No													P	Yes
PANASONIC	CQ-E850	750.00	5-20	90	0.008	D	No	No			D/T	15.2 @ 50 dB	75		24									P	Dut
	CQ-E800	699.95	5-20 ± 1	90	0.005	A	No	No	T	No	T	15.2 @ 50 dB	75	70	18							No		Yes	
PHILIPS	DC 789/084/262 (Includes Tape Player)	1297.95	20-20 ± 1	96	0.01	D	No	No	None	Yes	No													No	
	DC 769/084 (Includes Tape Player)	1097.95	20-20 ± 1	96	0.01	D	No	No	None	Yes	No													No	
	DC 085	799.95	20-20 ± 1	96	0.01	D	No	Yes	None	Yes	D													No	
PIONEER	CDX-M100 Changer Controllers for Above Model:	650.00	5-20 ± 1	87	0.008	D	6	No	D/T/E	Yes	D														No
	CD-M1(RI)	120.00								E	Yes														No
	DPX-M200(RI)	330.00								E	Yes													P	Dut
	Head Units for CDX-M100:																								
	KEX-M700(RI)	650.00										17 @ 50 dB	70	70	24									S	Yes
DEX-M300(RI)	450.00										17 @ 50 dB	70	70	24									P	Yes	
DEH-66	800.00	5-20 ± 1	85	0.01	D	No	No	D/T/E	Yes	D/T		70	70		10								S	Yes	
CDX-3	500.00	5-20 ± 1	85	0.01	D	No	No	T	Yes	D		17 @ 50 dB													No
SANSUI	CD-X500	749.95	5-20	90	0.05	D	No																		Yes
	CD-6i	729.95	5-20	90	0.03	D	No																		Yes
SANYO	FT3000	499.99	5-20 ± 3	90	0.05	A	No	No	D/T/E	Yes	D	19.2	65	65	12										Yes
	ECD4000	499.99	5-20 ± 3	90	0.05	A	No	No	D/T/E	Yes	D	19.2	65	65	12										Yes
	ECD6000	699.99	5-20 ± 3	90	0.05	A	No	No	D/T/E	Yes	D/T	14.0	65	65	24	25						P		Yes	
SONY	CDX-A30 Changer	699.95	5-20 ± 1	95	0.05	D	10																		
	Wired Remote/Preamp for Above Model: RM-X2	229.95						Yes	E	Yes														P	Yes
	Tuner for RM-X2: XT-20	179.95						No			T	15 @ 50 dB	75	70	30										
(Continued)	Wired Remote/Preamp for CDX-A30: RM-X1	129.95						No																	Yes

CD PLAYERS

MANUFACTURER	Model (RM) = Remote Included (RO) = Remote Optional	Price, \$	Frequency Response, Hz to kHz, ±dB	Dynamic Range, dB	THD, %, at 1 kHz	Filtering: Analog Only (A), Digital + Analog (D)	Multi-Disc?	AUX Input?	Repeat Functions: Entire Disc (D), Track (T), Entire Program (E)		Audible Fast Search?	Auto Scan: Disc (D), Tuner (T)	TUNER				FM Mono S/N Ratio, -dB	Total Number of Station Presets (if applicable)	Built-in Amp Power: Full-Band (P), Stereo Channel	Their Position: Full-Band (P), Stereo Code (S)	RCA In/Out Jacks?
									FM Sensitivity, dB (For 30-dB Quieting)	Alternate Channel Selectivity, dB			FM Mono S/N Ratio, -dB	Tuner Number or Station Presets							
SDNY (Continued)	Head Units for CDX-A30: XR-7200	649.95						No	D/T/E	No	D/T	15@ 50 dB	70	70	18		P	Yes			
	XR-7300	699.95						Yes	E	No	T	15@ 50 dB	75	70	24	17 x 4	P	Yes			
	XR-7400	649.95							T	Yes	D/T	15@ 50 dB	70	70	24		P	Yes			
	CDX-R77	549.95	5-20 ± 1	85	0.015	D		Yes	D/T	Yes		15@ 50 dB	75	70	24			Yes			
	CDX-R79	649.95	5-20	85	0.015	D		Yes	D/T	Yes		15@ 50 dB	75	70	24		P	Yes			
	CDX-44	449.95	5-20	85	0.015	D		No	D/T	Yes	D		15@ 50 dB						Yes		
	CDX-2001 Changer Wired Remote/Preamp for Above Model: RM-2001 (For use with XT-20 Tuner)	1399.95	5-20 ± 1	110	0.003	D	10		Yes	E	Yes							P	Yes		
TECHNICS	CX-DP10 Changer Tuner for Above Model: CR-TU10	869.95	5-20 ± 1	90	0.005	A	12	Yes	D/T/E	Yes	D								Yes		
		219.95						No			T	17.2@ 50 dB	75	70	15				No		
	CX-DP11 Changer Head Unit for Above Model: CO-R9550	759.95	5-20 ± 1	90	0.005	A	12				T	15.2@ 50 dB	75	70	24	25			Yes		
	649.95																		No		
TOSHIBA	TX948	899.95	5-20 ± 1	90	0.05		No	No	D/T	No	D/T	18		65	12		No	Yes			
YAMAHA	YCDT-1000	749.00	20-20 + 0.3	90	0.05	D	No	No	D	Yes	D/T	16.3	80	70	18			Yes			
	YCD-500	599.00	20-20 + 0.3	90	0.05	D	No	No	D/T	Yes	D							Yes			

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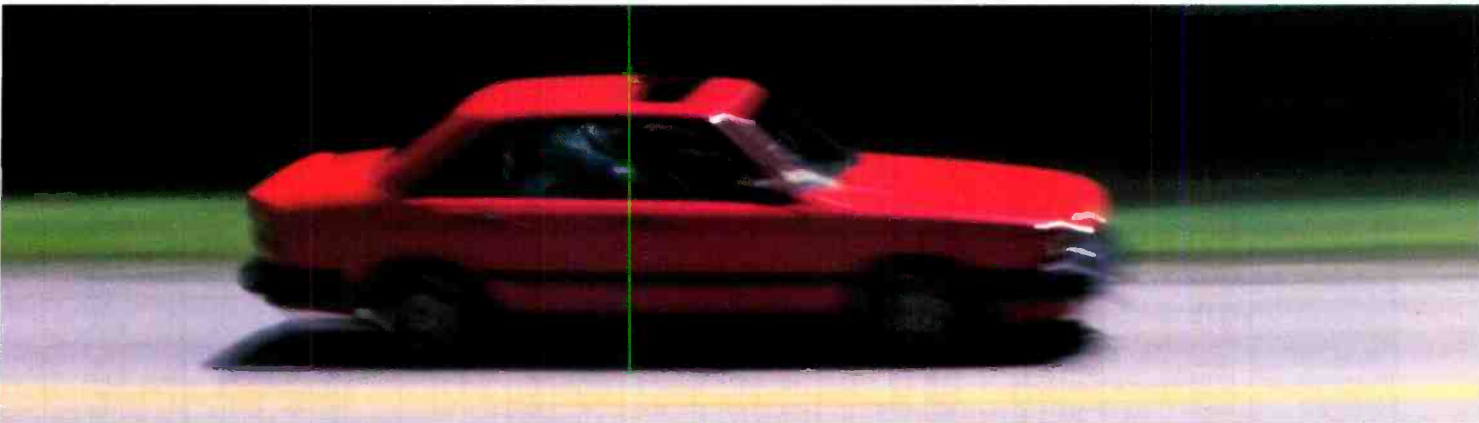
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RADIOS/TAPE PLAYERS

MANUFACTURER	Model (RI) = Remote Included, (RO) = Remote Optional	Price, \$	AMPLIFIER										TUNER										TAPE																																																																																																																																										
			Average Watts Channel, per EIA-490		THD at Rated Output, % per EIA-490		Output Level: Preamp (P), Speaker (S)		Number of Tune or EQ Controls		FM Sensitivity, dB (For 30-dB Quieting)		Alternate-Channel Selectivity, dB		FM Mono S/N Ratio, -dB		Total Number of Station Presets		Tuning: Seek (A), Scan (B), Both (C)		Local Obscure Control: Manual (M), Automatic (A)		AM Stereo Capable?		Frequency Response, Hz to kHz, -dB		Noise-Reduction Circuit? See Code		Tape SN Ratio, -dB A-Weighted		Auto Reverse?		Program Search?		Tape EQ Switch?		In-Chass (I), DIN In-Chass (D), ISO (C) Full-Out (F), Secret Thert Code (S)		RCA In-Out Jacks?																																																																																																																										
			10	1	P/S	2	14.2	65	61	12	A	C	C	M	No	50-15	±3	B	54	Yes	No	Yes	I	D	Out	4	1	P/S	2	12.7	65	63	18	A	C	C	M	No	40-16	±3	B	64	Yes	No	Yes	I	D	Out	10	1	P/S	2	12.7	65	63	18	A	C	C	M	No	40-16	±3	B	64	Yes	No	Yes	I	D	Out	10	1	P/S	2	12.7	65	63	18	A	C	C	M	No	40-16	±3	B	64	Yes	No	Yes	I	D	Out	10	1	P/S	2	12.7	65	63	18	A	C	C	M	No	40-16	±3	B	64	Yes	No	Yes	I	D	Out	8 x 4	1	P/S	2	17.2@50 dB	80	70	24	A	C	C	M	No	30-15	±0.2	B/C	76	Yes	Yes	Auto	P		2 In, 4 Out	650.00	12 x 4	1	P/S	2	17.2@50 dB	80	70	24	A	C	C	M	No	30-15	±0.2	B/C	76	Yes	Yes	Auto
AIWA	CT-S 2300 CT-X 3400 CT-X 3600 CT-X 4500 CT-X 7000 CT-X 8000(RI)	260.00 260.00 340.00 450.00 550.00 650.00	10 4 10 10 8 x 4 12 x 4	1 1 1 1 1 1	P/S P/S P/S P/S P/S P/S	2 2 2 2 2 2	14.2 12.7 12.7 12.7 17.2@50 dB 17.2@50 dB	65 65 65 65 80 80	61 63 63 63 70 70	12 18 18 18 24 24	A C C C M M	M M M M M M	No No No No No No	50-15 40-16 40-16 40-16 30-15 30-15	±3 ±3 ±3 ±3 ±0.2 ±0.2	B B B B B/C B/C	54 64 64 64 76 76	Yes Yes Yes Yes Yes Yes	No No No No Yes Yes	Yes No No No Auto Auto	I D D D P P	D P P P P P	Out Out Out Out 2 In, 4 Out 2 In, 4 Out																																																																																																																																										
ALPINE	7167 7168 7179 7180 7235 7269 7280 7289 7390(RO)	200.00 260.00 330.00 360.00 550.00 320.00 400.00 550.00 600.00	2.2 2.2 2.2 2.2 8.8 8.8 8.8 8.8 8.8	0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	S P/S P/S P/S P/S P/S P/S P/S P	2 2 2 2 2 2 2 2 2	16.3 16.3 16.3 16.3 16.3 16.3 16.3 16.3 15.3	80 80 80 80 80 80 80 80 80	60 60 60 60 60 60 60 60 60	18 18 18 18 18 18 18 18 18	A A A A A A A A A	M/A M/A M/A M/A M/A M/A M/A M/A M/A	No No No No No No No No No	40-18 40-18 40-18 40-18 30-20 40-18 40-18 30-20 20-22	±3 ±3 ±3 ±3 ±3 ±3 ±3 ±3 ±3	No No No No B B B B/C B/C	55 64 55 64 64 64 72 72 72	Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No No No No No	Auto Auto Auto Auto Auto Auto Auto Auto Auto	I I D/P D/P D/P I D/P D/P D/P	No Yes Yes Yes Yes Yes Yes Yes Yes																																																																																																																																											
AUDIOVOX	AV-933 AV-936 AV-939 AV-985 AV-988 AV-215 AV-216 AV-225 AV-226 AV-235 AV-236 AV-934 AV-932 AV-929 AV-686 AV-3050 AV-3000	215.00 312.50 425.00 167.50 275.00 230.00 375.00 387.50 437.50 525.00 600.00 300.00 225.00 225.00 212.50 140.00 115.00	5 10 20 5 15 3 3 5 5 15 15 5 3 5 5 15 5	10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10 10	S S S S S S P/S P/S P/S S S S S S S S	1 1 2 3 5 1 1 2 2 5 5 1 1 1 5 1	15 15 15 16 15 15 15 15 15 15 15 15 15 15 16 16 16	60 65 65 60 65 65 65 65 65 65 65 60 60 60 60 60 60	0 18 18 0 12 12 12 18 18 18 12 12 12 12 12 0 0	B B B B B B C C C C C A A A M M	M M M M M M M M M M M M M M M M M	No No No No No No No No No No No No No No No No No	50-10 50-10 40-12.5 50-10 50-10 50-10 50-10 50-12.5 50-12.5 50-10 50-10 50-10 50-10 50-10 50-10 50-10	B B B B B B B B B B B B B B B B	50 59 50 50 50 50 50 59 59 50 50 50 50 50 50 50	Yes Yes No No No No No Yes Yes Yes No No No No No No	No No No No No No No Yes Yes Yes No No No No No No	No No No No No No No Yes Yes Yes No No No No No No	I I I I I I I D D D D D D D D D D	No No No No No No No Yes Yes Yes No No No No No No																																																																																																																																													
AUTOTEK	70 700 710 720 770	149.00 219.00 249.00 279.00 359.00	5 5 25 25 25	0.5 0.1 0.1 0.1 0.1	P/S P/S P/S P/S P/S	2 2 2 2 2	11.0 11.0 11.0 11.0 11.0	62 62 62 62 62	12 12 12 12 12	C C C C C	M M M M M	No No No No No	50-10.5 ±5 50-10.5 ±5 50-10.5 ±5 50-10.5 ±5 50-10.5 ±5	B B B B B	55 55 55 55 65	Yes Yes Yes Yes Yes	No No No No No	Yes Yes Yes Yes Yes	I I I I D	Yes Yes Yes Yes Yes																																																																																																																																													
BLAUPUNKT	Newport SQR 29 Boston SQR 49 Phoenix SQR 29 San Francisco SQR 28 Los Angeles SQR 48 Lexington SQR 48 Berlin TOR 07 Houston SQR 06(RI) Tucson SQR 06 Aspen SQR 27 Portland SQR 28 Denver SQR 26 San Diego SQR 28 Seattle SQR 27 Dallas SQM 88 (Stalk Mount) Tape Player for Above Model: CCP 08	249.95 299.95 289.95 399.95 479.95 539.95 1599.95 769.95 649.95 389.95 359.95 279.95 239.95 229.95 389.95 279.95	7.5 25 x 2, 7.5 x 4 7.5 7.5 20 x 2, 7.5 x 4 20 x 2, 7.5 x 4 0.1 0.03 7.5 7.5 7.5 7.5 7.5 7.5 20 x 4	0.05 0.05 0.05 0.05 0.05 0.1 0.03 1 1 1 1 1 1 1	P/S P/S P/S P/S P/S P/S P P P/S P/S P/S P/S P/S P/S	2 2 2 2 2 2 2 2 2 2 2 2 2 2	13 13 13 13 13 13 13 13 13 13 13 13 13 13	70 70 75 75 75 75 78 80 80 70 75 65 65 65 65	24 30 24 12 12 12 96 24 24 24 12 12 12 12 20	C C C C C C C C C C C C C	A A A A A A A A A A A A A	No No No No No Yes No No No No No No Yes	40-15 ±0.3 40-15 ±0.3 40-15 ±0.3 30-16 ±0.3 30-16 ±0.3 30-16 ±0.3 35-18 ±3 30-20 ±3 30-20 ±3 30-16 ±3 30-16 ±3 30-14 ±3 30-14 ±3 30-16 ±3	D B D D B/C/D B/C A/B/C/D B/C/D D D D B	60 63 60 63 63 73 67 67 67 62 60 60 53 53	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	No No No No No Yes Yes Yes No No No No No	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	I/S I/S D/P/S D/P/S D/P/S D/S D D D/P D/P/S D D D/P	Out Out Out Out Out Out Out Out Out Out Out Out Yes																																																																																																																																													
CLARION	Audia 3000 9971RT 9770RT 9730RT 9700RT 8730RT 8702RT 8671RT 8530RT 8402RT 2001RT 2002RT 5510/5511RP	499.95 349.95 319.95 319.95 299.95 299.95 309.95 259.95 239.95 239.95 319.95 389.95	25 x 2, 6 x 4 25 x 2, 6 x 4 25 x 2, 6 x 4 25 x 2, 6 x 4 25 x 2, 6 x 4 12 12 12 12 12 12 25 x 2, 6 x 4 25	1 1 1 1 1 1 1 1 1 1 1 1	P P/S P/S P/S P/S P/S P/S P/S P/S P/S P/S P/S	12 12 12 17 17 17 17 17 17 17 17 17	70 70 70 70 70 70 70 70 70 70 70 70	74 74 66 66 66 66 56 56 56 56 56 66 56	18 12 12 12 12 12 12 12 12 12 12 12	C C C C C C C C C C C C	A A A A A A A A A A A A	No No No No No No No No No No No No	30-18 30-18 30-18 30-15 ±3 30-15 ±3 30-18 30-16 30-16 30-16 30-16 30-16 30-16 30-14	B B B B B B B B B B B B	70 70 66 66 66 66 56 56 56 56 56 66	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Auto Auto Auto Auto Auto Auto Auto Auto Auto Auto Auto Auto	D D/P D I I D D/P D D D D	Out Out Out Out Out Out Out Out Out Out Out Out																																																																																																																																													

Hours of sonic perfection without skipping a beat.



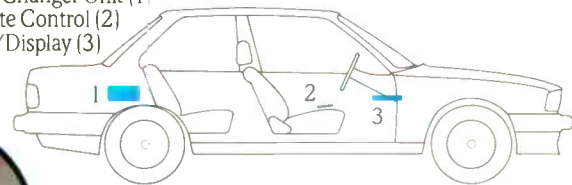
The in-dash *Controller/Display* shows track and disc information and makes it easy to use the CD1 with any existing sound system.



The *Wireless Remote Control* provides convenient access to the CD1's remarkable programming and control features.



Trunk Mounted Changer Unit (1)
Wireless Remote Control (2)
In-dash Controller/Display (3)



The *CD1 Changer Unit* mounts conveniently out of the way in the trunk of your car. Simply load a Disc Module, close the cover, and enjoy 12 hours of music.



The *CDM12 Disc Module* holds 12 CDs. Each can be played with the push of a button. Additional disc modules are available for extensive disc collections.



That long, lonesome road just met its match. The CD1 Compact Disc Changer lets you enjoy up to 12 hours of sonic perfection without repeating a song or touching a disc. And thanks to its double-isolation suspension, the Concord CD1 turns the worst road into a comfortable front row seat. You can program your favorite 35 songs. Listen to random selections from 12 discs. Preview each song. Or play just the one you want. All with the convenience of wireless remote control. Cruise away with a CD1 today. Call or write Concord Autosound, 25 Hale Street, Newburyport, MA 01950, (508) 462-1000. Driving conditions will improve dramatically.

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ON A CAR, THE
PRICE SHOULDN'T
BE THE ONLY THING
THAT SOUNDS
INCREDIBLE.**

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Even though it doesn't take up more space than conventional car stereos, it's got plenty more to offer.

This remarkable sound system is one of the most impressive convertibles on the road today. It has almost no knobs or switches. Instead, it has the most revolutionary control panel ever to come down the pike. Three convertible faces, all in one panel. Each with a different function and a different color. What's more, the

only time you may lay a finger on it is when you turn it on. Because it comes with a wireless remote.

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Martin. But in the meantime you can drive something that sounds as good.



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TOSHIBA

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SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS										Notes
								Subwoofer Only (S), Woofer Only (W), Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Applied Tweeter(s) = A, P	Separately Mounted Drivers?	Flare Mount (F), Surface Mount (S), Convertible (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
BOSE	121 Mobile Monitor	259.00	100	89	4			6 x 9					S		Yes			
BOSTON ACOUSTICS	C700 Series II	199.95	100	87	4	58-20 ± 3	S	5 1/4	2		No	P	1 1/2	Yes				
	710LF	179.95	200	92	4	35-120 Hz ± 3		10				F	4	Yes				
	790LF	159.95	100	87	4	36-120 Hz ± 3	S	6 x 9				F	2 7/8	Yes	Includes crossovers.			
	780LF Series II	149.95	200	91	4	40-120 Hz ± 3	S	8				F	3 3/8	Yes				
	760LF	109.95	100	87	4	45-120 Hz ± 3	S	6 1/2				F	2 1/2	Yes	As above.			
	797	199.95	80	89	4	36-20 ± 4		6 x 9	3		No	F	2 7/8	Yes				
	793	349.95	100	87	4	36-20 ± 3		6 x 9	3	A/P	Yes	C	3 3/8	Yes				
	763	299.95	100	87	4	45-20 ± 3		6 1/2	3	A/P	Yes	C	2 1/2	Yes	2-inch mounting depth with optional spacer.			
	761	239.95	100	87	4	48-20 ± 3		6 1/2	2	A/P	Yes	C	2 1/2	Yes	As above.			
	751	229.95	80	87	4	58-20 ± 3		5 1/4	2	A/P	Yes	C	2	Yes	As above but 1 1/2 inches.			
	741	219.95	40	87	4	85-20 ± 3		4	2	A/P	Yes	C	1 3/4	Yes	As above but 1 1/4 inches.			
	767	139.95	50	89	4	60-20 ± 4		6 1/2	2		No	F	2 1/2	Yes	As above but 1 1/4 inches.			
	757	119.95	50	87	4	58-20 ± 4		5 1/4	2		No	F	1 3/4	Yes	With metric frame for European cars, Model 707e, \$59.95 per pair.			
	707	59.95	15	90	4	70-14 ± 3		4 x 6	W			F	1 5/8	Yes	1 1/4-inch mounting depth with optional spacer.			
705	79.95	40	90	4	58-17 ± 3		5 1/4	W			F	1 3/4	Yes	As above.				
704	79.95	25	90	4	90-17 ± 3		4	W			F	1 3/4	Yes	As above.				
703	49.95	15	90	4	100-12 ± 3		3 1/2	W			F	1 1/2	Yes					
701	99.95	80	90	8	4k-20k ± 3	T			A/P		C	1/2	Yes	Includes crossovers.				
BRAVO SPEAKERS	BS-1526	120.00	150	93	4/8	15-1.5	S	15						Yes	Requires 2 to 3-cubic-foot box enclosure.			
	BS-1526D	128.95	150	93	4/8	15-1.5	S	15						Yes	As above; dual voice-coils.			
	BS-1538	150.00	150	93	4/8	15-1.5	S	15						Yes	Enclosure as above.			
	BS-1538D	158.95	150	93	4/8	15-1.5	S	15						Yes	As above; dual voice-coils.			
	BS-1226	99.00	125	91	4/8	20-2	W	12						Yes	Enclosure as above but 1.2 to 2 cubic feet.			
	BS-1226D	109.95	125	91	4/8		W	12						Yes	As above; dual voice-coils.			
	BS-1238	119.00	125	91	4/8		W	12						Yes	Enclosure as above.			
	BS-1238D	125.00	125	91	4/8		W	12						Yes	As above; dual voice-coils.			
	BS-1020-1.5	80.00	100	90	4/8	25-2.5	W	10						Yes	Enclosure as above but 0.7 to 1.2 cubic feet.			
	BS-1026-1.5	84.00	100	90	4/8	25-2.5	W	10						Yes	As above.			
	BS-1026D-1.5	87.00	100	90	4/8	25-2.5	W	10						Yes	As above; dual voice-coils.			
	BS-1026-2	79.00	100	90	4/8	25-2.5	W	10						Yes	Enclosure as above.			
	BS-1026D-2	87.00	100	90	4/8	25-2.5	W	10						Yes	As above; dual voice-coils.			
	BS-820-1.25	27.95	80	88	4/8	40-3	W	8						Yes	Enclosure as above but 0.3 to 1 cubic foot.			
	BS-820-1.5	64.00	80	88	4/8	40-3	W	8						Yes	As above.			
	BS-826-1.5	70.00	80	88	4/8	40-3	W	8						Yes	As above.			
	BS-826D-1.5	75.00	80	88	4/8	40-3	W	8						Yes	As above; dual voice-coils.			
	BS-826-2	80.00	80	88	4/8	40-3	W	8						Yes	Enclosure as above.			
	BS-6920-1.5	67.00	75	88	4/8	43-3.5	W	6 x 9						Yes	As above.			
	BS-6926-1.5	72.00	75	89	4/8	43-3.5	W	6 x 9						Yes	As above.			
	BS-620-1.5	57.00	75	87	4/8	50-3.5	M							Yes	As above but 0.15 to 0.5 cubic foot.			
	BS-510	34.00	50	87	4/8	75-6	M							Yes	Requires box enclosure.			
	BS-510	20.00	50	87	4/8	75-6	M							Yes	As above.			
	JP-1210		369.00	150	93	4	33-2	S	12			S		No	Box enclosure.			
	BJ-150		285.00	80	92	4	54-24		6 1/2	2		S		No	As above.			
	BJ-5100		269.00	80	90	4	54-3	S	6 1/2			S		No	As above.			
	RB-250		320.00	100	93	4	40-24		8	2		S		No	As above.			
	RB-1050		360.00	125	94	4	35-24		10	2		S		No	As above.			
	RB-1250		400.00	150	95	4	33-24		12	2		S		No	As above.			
	JP-100		269.00	100	90	4	40-3	S	8			S		No	As above.			
JP-1010		319.00	125	91	4	35-2.5	S	10			S		No	As above.				
SR-150		395.00	100	93	4	35-24		8	2		S		No	Vented enclosure.				
SR-1050		439.00	100	94	4	30-24		10	2		S		No	As above.				
BE-100		349.00	100	93	4	40-24		8	3		S		No	Box enclosure.				
BE-1010		369.00	125	94	4	35-24		10	3		S		No	As above.				
BE-1212		429.00	150	95	4	33-24		12	3		S		No	As above.				
B & W	LM1-PM	498.00	40	85	4	95-25 ± 4		5	2		Yes	P	2 3/4	Yes				
	LM1	550.00	40	85	4	95-25 ± 4		5	2		Yes	C	2 1/2	Yes				
	LM50	249.00	40	90	4	45-15 ± 4	†	5 1/4				F		Yes	Cabinet enclosure. †Can be used as woofer or midrange (with external crossover) or as full range (with supplied equalizer). Without grille and spacers, Model LD50, \$199.00 per pair.			
	LT40	249.00	20	90	8	3k-25k ± 2	T			A		S		Yes	External crossover required.			
	LT30	129.00	20	90	8	3k-22k ± 2	T					S		Yes	As above.			
	LXT10	129.00	10	90	8	3k-20k ± 3	T					S		Yes	Includes high-pass filter.			
LS20	279.00	50	89	4	30-2 ± 3	S	8				F	3 5/8	Yes					

SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response Hz to kHz, ±dB	DRIVERS										Notes
								Speaker Qty (S) Midrange Qty (M), Tweeter Qty (T)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Angled Tweeter(s) = A, Pointable Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Pole (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
CANTON	HC100 Pullman	650.00	340.00	35	87.2	4	48-30		4	2		No	S		Yes	Console for rear deck. Tweeter can be surface-mounted. As above. As above. As above. As above. External crossover required. As above. Dual voice-coils; includes crossover.		
	Set 200		340.00	40	89.4	4	45-30		4	3		No	S		Yes			
	Set 300		470.00	60	89.9	4			4	2		Yes	F	1 1/4	Yes			
	Set 400		430.00	50	89.7	4			4	2		Yes	F	2 1/4	Yes			
	Set 500		535.00	70	92.1	4			5	2		Yes	F	3	Yes			
	Set 600		735.00	80	93.4	4			7	3		Yes	F	3	Yes			
	CX 160		400.00	50	91.8	4			7	2		Yes	F	3	Yes			
	TI 25		160.00			4		2.5k-30k	T	5	2		Yes	F	2 3/4		Yes	
	M 120		140.00			4		150-2.5	M					F	1 1/4		Yes	
	W 160		200.00			4			W	6				F	2		Yes	
	W 205		300.00			4			W	8				F	3		Yes	
	W 280			275.00		4			W	10				F	3 1/4		Yes	
	Sub 280		400.00			4			S	10				F	3 1/4		Yes	
GERWIN-VEGA	CMT-5	199.95	100	92	4	40-20 ±3		6 1/2	2		Yes	S		Yes	H.f. overload protected. Carpeted enclosure. As above. As above; includes crossover. H.f. overload protected. As above. Dual voice-coils. As above. As above. As above. As above. As above. As above. As above.			
	SPL8-3	499.00	125	94	8	30-20 ±5		8	3					No				
	FR12-3	399.00	125	95	4	30-20 ±5		12	3	A				No				
	MSE-12	349.00	125	98	4	30-110 Hz ±5	S	12		A				No				
	CS-18A	199.95	150	98	4	40-20 ±3		6 x 9	2		No	F	3 1/8	No				
	CS-17	159.95	100	96	4	50-20 ±4		6 x 9	2		No	F	1 1/8	No				
	LE 8D	104.95	150	92	4	40-800 Hz ±2	S	8				F	3 1/2	No				
	LE 10D	109.95	150	94	4	30-800 Hz ±2	S	10				F	4 1/2	No				
	LE 12D	119.95	250	98	4	20-500 Hz ±2	S	12				F	5 1/2	No				
	LE 15D	199.95	250	101	4	20-400 Hz ±2	S	15				F	6 1/4	No				
	LE 8S	104.95	150	92	4	40-800 Hz ±2	S	8				F	3 1/2	No				
	LE 10S	109.95	150	94	4	30-800 Hz ±2	S	10				F	4 1/2	No				
	LE 12S	119.95	250	98	4	20-500 Hz ±2	S	12				F	5 1/2	No				
LE 15S	199.95	250	101	4	20-400 Hz ±2	S	15				F	6 1/4	No					
LE 18S4	359.95	300	103	4	18-250 Hz ±2	S	18				F	7 1/2	No					
LE 18S8	359.95	300	103	8	18-250 Hz ±2	S	18				F	7 1/2	No					
CLARION	SE8370	479.95	200	90	4	38-40		10	3		Yes	F		Yes	Box enclosure, for hatchbacks. As above but for trucks. Box enclosure.			
	SE6271	269.95	120	92	4	40-21		6 1/2	2			F		Yes				
	SE4280	169.95	60	90	4	60-21			2			S		Yes				
	SE4380	199.95	90	91	4	60-22			3			S		Yes				
	SE320	124.95	45	89	4	70-20			2			S		Yes				
	SE2090	109.95	150	90	4	1.5k-30k	T			A		S		Yes				
	SE2070	74.95	150	89	4	5k-30k	T			A		S		Yes				
	SE971	114.95	75	95	4	60-21		6 x 9	2			F		Yes				
	SE9450	199.95	150	93	4	50-25		6 x 9	4			F		Yes				
	SE9371	189.95	150	93		48-23		6 x 9	3			F		Yes				
	SE9370	419.95	200	92		35-25		6 x 9	3			F		Yes				
	SE9350	159.95	120	93		40-23		6 x 9	3			F		Yes				
	CL930	149.95	120	91.5		70-22		6 x 9	3			F		Yes				
	SE9250	114.95	100	93		45-22		6 x 9	2			F		Yes				
	CL920	104.95	100	91		70-21		6 x 9	2			F		Yes				
	SE6373	159.95	120	90		60-21		6 1/2	3			F		Yes				
	SE6370	389.95	150	92		35-25		6 1/2	3			F		Yes				
	SE632	129.95	90	91		65-22		6 1/2	3			F		Yes				
	SE6270	139.95	100	90		60-21		6 1/2	2			F		Yes				
	SE6262	89.95	60	90		70-21		6 1/2	2			F		Yes				
	SE6261	89.95	60	91		60-22		6 1/2	2			F		Yes				
	CL620	79.95	60	90		90-21		6 1/2	2			F		Yes				
	SE6160	69.95	60	91		55-20		6 1/2	2	W		F		Yes				
	CL610	59.95	60	90		100-20		6 1/2	2	W		F		Yes				
	SE5360	94.95	60	90		70-22		5 1/4	3	W		F		Yes				
	SE5264	89.95	60	91		80-21		5 1/4	2	W		F		Yes				
	SE513	49.95	45	91		60-18		5	2	W		F		Yes				
	SE431	84.95	45	90		60-20		4	3	A		F		Yes				
	SE4271	79.95	60	90		90-21		4	2			F		Yes				
	CL420	69.95	40	88		120-18		4	2			F		Yes				
	SE4170	59.95	60	90		60-20		4	2	W		F		Yes				
	SE4160	59.95	40	90		90-18		4	2	W		F		Yes				
	SE675	59.95	45	90		90-20		4 x 6	2			F		Yes				
SE3251	49.95	40	88		130-20		3 1/2	2			F		Yes					
SE3151	29.95	40	88		130-16		3 1/2	2	W		F		Yes					
SE153	124.95	60	92		50-22		4 x 10	2		A			Yes					
CL821	329.95	150	92		40-20						S		Yes					
CL820	329.95	150	92		40-20						S		Yes					
CL102	399.95	175	93		30-20						S		Yes					
CONCORD	CS141	69.95	40	91	4	70-20		4	2		No	F	1 1/4	Fits 3 1/2- or 4 x 6-inch holes.				
	CS153	79.95	40	98	4	60-20		5 1/4	2		No	F	1 5/8					
	CS261	89.95	50	95	4	40-20		6 1/2	2		No	F	2					
	CS264	119.95	90	96.5	4	40-18		6 x 9	2		No	F	3 1/4					
	CCS1T	99.95	150	90	6	3k-20k ±3	T					F	7/8					
	CCS5M/W	99.95	150	93	4	50-3	M					F	2 1/2					
	CCS8W	89.95	300	93	4	30-3	W	8				F	4 3/8					
	CCS10W	114.95	300	93	4	25-3	W	10				F	5 1/8					
CCS12W	139.95	300	93	4	20-3	W	12				F	5 3/4						

SPEAKERS

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								Speaker Only (S), Midrange Only (M), Woofer Only (W)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Applied Tweeters = A, Polarizable Tweeters (P)	Separately Mounted Drivers?	Flange Mount (F), Convertible (C), Plate (P)	Surface Mount (S), Maximum Required Mounting Depth, Inches	Weatherproofed?			
COUSTIC	HT-615	214.95	400	95	4	25-1 ±3	S	15					F	5 1/2	Yes			
	HT-612	129.95	300	95	4	28-1.5 ±3	S	12					F	5	Yes			
	HT-610	82.95	200	93	4	30-2 ±3	S	10					F	4 1/4	Yes			
	HT-608	54.95	150	92	4	35-3 ±3	S	8					F	3 1/2	Yes			
	HT-606	69.95	60	92	4	55-10 ±3	W	6					F	2 3/8	Yes			
	HT-605	59.95	50	90	4	65-12 ±3	W	5 1/4					F	2 1/2	Yes			
	HT-604	49.95	50	90	4	90-12 ±3	M						F	1 3/4	Yes			
	HT-603	32.95	30	89	4	130-16 ±3	M						F	1 1/4	Yes			
	HT-602	37.95	15	92	4	3k-25k ±3	T			P			S		Yes			
	HT-600	27.95	15	92	4	3k-25k ±3	T						S	5/8	Yes			
	HT-623	64.95	30	89	4	130-25 ±3		4 x 6	2						Yes			
	HS-862	52.95	60	90	4	68-18 ±5		6 1/2	2	A	No							
	HS-860	35.95	60	90	4	87-18 ±5		6 1/2	2	W	No							
	HS-842	35.95	40	88	4	106-18 ±5		4	2	A	No							
	HS-840	27.95	40	88	4	106-18 ±5		4	2	W	No							
	HS-830	16.95	25	86	4	180-15 ±5		3 1/2			No							
	HS-846	42.95	40	89	4	95-18 ±5		4 x 6	2	A	No							
	HS-893	99.95	80	94	4	48-20 ±5		6 x 9	3	A	No		F, S					
	HS-892	79.95	80	93	4	50-19 ±5		6 x 9	2	A	No		F, S	3 3/8				
	HS-890	54.95	80		4			6 x 9	W									
	HS-863	64.95	60	91	4	75-19 ±5		6 1/2	3	A	No							
	HT-620	99.95	60	89	4	60-19 ±2		5 1/4	2		No		C	1 1/2	Yes			
	HT-621	119.95	60	89	4	60-19 ±2		5 1/4	2	P	Yes		C	2	Yes			
	HS-872	79.95	80	93	4	68-18 ±5		4 x 10	2	A	No							
	CS-8866S	119.95	100	90	4	80-20 ±5		4	2	P								
	CS-8822S	94.95	60	90	4	80-20 ±5		4	2	P								
	CRAIG	V442	52.95	50	88	4	80-20 +0, -6		4 x 6	2		No	F	2	Yes			
		V405	42.95	50	88	4	80-16 +0, -6		5	W		No	F	1 3/4	Yes			
V426		64.95	100	90	4	60-20 +0, -6		6 1/2	2		No	F	2 1/8	Yes				
V431		74.95	100	90	4	60-20 +0, -6		6 1/2	3		No	F	2 1/8	Yes				
V481		119.95	100	86	4	60-20 +0, -6		4	4		No	S						
V110		25.95	20	85	4			4	W			F	1 1/2	Yes				
V111		25.95	25	85	4			5	W			F	1	Yes				
V112		29.95	25	85	4			6 1/2	W			F	1 3/4	Yes				
V232		49.95	35	85	4			6 1/2	3			F	2 1/4	Yes				
V244		44.95	25	87	4			6 x 9	2			F	3	Yes				
V254		67.95	50	87	4			6 x 9	3			F	3	Yes				
V306A		24.95	20	85	4			3 1/2	W			F	1 1/2	Yes				
V404		39.95	50	85	4			4	W			F		Yes				
V424		49.95	50	85	4			4	W			F		Yes				
V462		99.95	150	92	4	60-21 +0, -6		6 x 9	2			F	3 1/8	Yes				
V452		109.95	150	92	4	60-21 +0, -6		6 x 9	3			F	3 1/8	Yes				
V479		84.95	50	84	4	80-20 +0, -6		4	3			S						
CUSTOM AUTOSOUND	Kensams 1	34.00	30		4	90-16	M		W			F	1 1/2	No	For 1965-1973 Mustangs. As above. For 1958-1967 Corvettes. For 1967-1969 Camaros and Firebirds. For 1955-1966 Thunderbirds.			
	Kensams 2	44.00	30		4			4	2	P	Yes	F	1 1/2	No				
	SACV-24	44.00	30		4			4	2	P	Yes	F	1 1/2	No				
	SACA-1	54.00	30		4			4	2	P	Yes	F	1 1/2	No				
SATB-13	44.00	30		4			4	2	P	Yes	F	1 1/2	No					
DELTASONIK	DTX-1	25.00	100	96	100	4k-25k ±3	T			A		S		Yes	Includes crossover. As above.			
	MPSGX	26.10	60	96	4	1k-6k ±3	M					F		Yes				
	WP820B	56.70	60	93	4	35-2 ±3	S					F		Yes				
	WP1030B	60.40	160	93	4	30-1.8 ±3	S					F		Yes				
	WP1230B	65.65	160	93	4	20-1 ±3	S					F		Yes				
DENON	DCS-501	120.00	60	91	4	50-21 ±3		5 1/4	2		No	F	2 1/2	Yes	†Top or bottom mount.			
	DCS-461	115.00	60	91	4	55-21 ±3		4 x 6	2		No	F	2	Yes				
	DCS-402	140.00	45	91	4	55-21 ±3		4	2		No	F	2 3/8	Yes				
	DCW-12X		200	93	4	20-2 ±3	S	12				F†	5 1/2	Yes				
	DCW-10X		180	92	4	25-2 ±3	S	10				F†	4 1/4	Yes				
	DCW-8X		125	92	4	30-3 ±3	S	8				F†	3 3/4	Yes				
	DCW-6X		110	90	4	35-5 ±3	S	6				F†	5 1/2	Yes				
ECLIPSE	ESG-1000	134.95	40	91	4	2k-23k	T					F	7/8	Yes				
	ESG-4000	169.95	60	90	4	50-25		4	2		No	F	1 3/4	Yes				
	ESG-5000	99.95	60	89	4	100-10	M					F	1 3/8	Yes				
	ESG-6000	129.95	100	88	4	50-3	W	6				F	2 1/8	Yes				
	ESG-8000	208.95	140	90	4	25-5	S	8				F	3 1/8	Yes				
	ESG-6950	404.95	140	93	4	30-28	S	6 x 9	3		No	F	3 3/8	Yes				
EPI	LS46	79.95	50	91	4	100-20		4 x 6	2		No	F	1 7/8					
	LS50	79.95	40	91	4	110-20		4	2		No	F	1 3/8					
	LS55	99.95	50	91	4	90-20		5 1/4	2		No	F	1 1/2					
	LS60	109.95	50	94	4	90-20		6 1/2	2		No	F	1 1/8					
	LS66	139.95	70	94	4	75-20		6 x 9	3		No	F	3					

Your Car May Not Need A New Stereo. But It Could Sure Use A New Driver.

Our foam surrounds are part of our long excursion, high compliance suspensions. Which allow greater cone travel for deeper bass.

Lurking behind this subwoofer is a die-cast aluminum frame designed for effective heat dissipation and durability. Not to mention a high-energy magnet structure for high sensitivity and power handling.

Our cones are constructed from materials of high rigidity and low mass. Both of which give Cerwin-Vega Subwoofers extremely tight bass.

Judging from this photo, you could say our long excursion voice coils are out of sight. Which is precisely what most people say about our sound.

A Cerwin-Vega subwoofer can help your car achieve its lowest potential.

All the way down to 18Hz.* What's more, our subwoofers are so efficient you can run

one on as little as 5 watts of power. Or as much as 300 "they'll hear you on Jupiter" watts.

Which means you can easily improve your car's performance.

Just change drivers.

 **Cerwin-Vega!**

*An LE-18 can handle bass down to 18Hz. And power up to 300 watts. For product information, please write or call:
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Cerwin-Vega Europe/Grynderupvej 12, P.O. Box 40, DK-9610 Norager, Denmark

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SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power	Sensitivity, dB SPL (1 Watt 1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS										Notes
								Subwoofer Only (S) Midrange Only (M) Tweeter Only (T)	Woofer Size, Inches	Whizzer (W), 2-Way (2) 3-Way (3), 4-Way (4)	Agged Tweeter(s) = A, Pinpoint Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
MAGNADYNE (Continued)	SF550	29.95	40	94	8	500-8 ± 3	M						F	2	Yes			
	LS65HP	59.95	100	90	4	45-8 ± 2	W						F	2 3/4	Yes			
	LS80HP	89.95	150	92	4	40-8 ± 2	W						F	3 1/4	Yes			
	LS80P	79.95	100	94	4	40-5 ± 3	W						F	3 1/4	Yes			
MAGNUM	Mover 6C	199.95	80	91	4	90-20		6 1/2	2		No	S		No		Carpeted box enclosure with removable grille.		
	Mover 8C	229.95	100	91.5	4	75-20		8	2		No	S		No		Carpeted box enclosure.		
	Mover 10C	249.95	100	92	4	70-20		10	2		No	S		No		As above with removable grille.		
MAJESTIC	MCS1250	79.95	250	92	4	18-3	S	12					F	5 1/2				
	MCS1550	89.95	300	92	4	18-2	S	15					F	6 1/2				
	MS265HE	24.95	20	4	4	60-18		6 1/2	2				F	2				
	MS269HE	49.95	25	4	4	60-18		6 x 9	2				F	3 1/8				
	MS530	49.95	100	4	4	80-21		3 1/2	3				S					
	MS540	99.95	120	4	4	80-21		4	3				S					
	MS550	99.95	200	4	4	60-20		4	3				S					
	MS590	149.95	300	4	4	60-24		4	4				S					
MCS1050	69.95	200	92	4	20-3	S	10						4 1/2			Bass reflex enclosure. As above. As above; honeycomb woofer. As above.		
MB QUART ELECTRONICS	QM 19HC	109.00	60	92	4	3.5k-32k	T						C					
	QM 25HC	299.00	100			3k-32k	T						C	1/4				
	QM 100MC	140.00				100-3.5	M						C	1 1/8				
	QM 120K	179.00	80	90	4	40-20		6 1/2	2				C	2 1/2	Yes			
	QM 130K	189.00	60	88	4	50-32		5 1/4	2				C	2	Yes			
	QM 130K/W 124	199.00	60	88	4	50-32		4 1/4	2				C	2 1/4	Yes	For Mercedes-Benz 200 and 300 series.		
	QM 130K/W 124 Heck	229.00		89		48-32			2				C	2 1/4	Yes	For rear deck of Mercedes 200 and 300 series.		
	QM 160K	239.00	80	90	4	40-32		6 1/2	2				C	2 1/4	Yes			
	QM 210K	449.00	100	90	4	35-32		8	2		A			3 1/4	Yes	External crossover supplied.		
	QM 210TC	319.00	100	90	4	33-200 Hz	S	8						2	Yes			
	QM 215CS	279.00	60	90	4	48-32		5 1/4	2			Yes		2	Yes			
	QM 218CS	299.00	80	90	4	40-32		6 1/2	2		Yes			2 1/4	Yes			
	QM 325CS	469.00	60	90	4	48-32		5 1/4	3		Yes			2	Yes			
QM 328CS	499.00	80	90	4	38-32		6 1/2	3		Yes			2 1/4	Yes				
QM 335CS	749.00	90	90	4	30-32		8	3		Yes		F	3 1/4	Yes				
MEI	SK6520	69.95	30	89	4	60-20 ± 3		6 1/2	2		No	F	2	Yes				
	SK6530	74.95	60	90	4	50-20 ± 3		6 1/2	3		No	F	2 1/4	Yes				
	CK8050	119.95	150	90	4	50-2 ± 3		8				F	3 1/2	Yes				
	CK6950	99.95	150	92	4	60-10 ± 3		8				F	3 1/4	Yes				
	CK6550	69.95	120	90	4	60-3 ± 3		6 x 9				F	2 3/4	Yes				
	CK4050	49.95	75	91	4	600-18 ± 3		6 1/2				F	1 3/4	Yes				
	CK3550	49.95	75	90	4	2k-20k ± 3						F	1	Yes				
	SK412F	64.95	30	92	4	60-20 ± 3			2			F	1 3/4	Yes				
	SK691F	44.95	30	90	4	50-16 ± 3		4 x 10	2		No	F	3	No				
	SK693F	64.95	30	90	4	40-16 ± 3		6 x 9	3		No	F	3	No				
	SK696F	109.95	100	91	4	40-20 ± 3		6 x 9	3		No	F	3 1/2	No				
	SK345S	109.95	100	88	4	80-20 ± 3		4	3		No	S	4 1/4	Yes				
	SK525F	49.95	20	90	4	50-18 ± 3		5 1/4	2		No	F	1	No				
	SK601F	29.95	10	88	4	60-12 ± 3		6 1/2	W		No	F	1 3/4	No				
	SK605F	36.95	20	90	4	50-16 ± 3		6 1/2	W		No	F	2 1/8	No				
	SK620F	44.95	30	91	4	55-18 ± 3		6 1/2	2		No	F	2 1/8	No				
	SK655F	59.95	50	91	4	70-20 ± 3		6 1/2	2		No	F	1 1/2	Yes				
	SK325F	29.95	40	88	4	80-16 ± 3		3 1/2	W		No	F	1 1/2	Yes				
	SK426F	44.95	20	90	4	65-20 ± 3		4 x 6	2		No	F	1 1/2	No				
	SK401F	34.95	20	91	4	50-18 ± 3		4	W		No	F	1 3/4	No				
SK405F	36.95	20	91.5	4	50-18 ± 3		4	W		No	F	1 1/2	No					
SK420F	49.95	40	90	4	70-20 ± 3		4	2		No	F	1 1/2	No					
MGA	SC-5260	69.95	60	90	4	45-20		5 1/4	2				C	2 1/4				
	SC-6560	79.95	60	90	4	35-20		6 1/2	2				C	1 5/8				
	ST-6912	119.95	120	92	4	30-20		6 x 9	3				C	3 3/4				
MGT	CSP-6930P	149.95	120	93.5	4	40-20		6 x 9	3		Yes	F	2 7/8	Yes				
	CSP-6530P	139.95	120	92.5	4	50-20		6 1/2	3		Yes	F	2 5/8	Yes				
	CSP-522P	79.95	40	92.5	4	50-20		5 1/4	2		Yes	F	1 5/8	Yes				
	CSP-402P	69.95	40	92.5	4	80-20		4	2		Yes	F	1 1/2	Yes				
	CSP-521PP	69.95	40	92.5	4	45-20		↑	2		Yes	F	1 1/2	Yes				
	P-900	89.95	50	92	4	50-20		6 x 9	3		Yes	F	2 7/8	Yes				
	P-600	79.95	50	92	4	70-20		6 1/2	3		Yes	F	2	Yes				
	P-410	84.95	30	92	4	80-20		4 x 10	3		Yes	F	2 1/2	Yes				
	P-460	59.95	25	92	4	90-20		4 x 6	2		Yes	F	1 3/4	Yes				
	P-500	69.95	40	92	4	70-20		5 1/4	2		Yes	F	2 1/4	Yes				
	P-400	55.95	20	92	4	90-20		4	2		Yes	F	1 3/4	Yes				
	P-300	34.95	20	92	4	100-18		3 1/2	2		Yes	F	1 1/2	Yes				
	PR-100W	49.95	50	92	4	60-20		6 x 9	3		Yes	F	2 3/4	No				
	PR-80W	44.95	30	92	4	65-20		6 1/2	3		Yes	F	2	No				
	CES-104	119.95	120	93	4	35-20		4 x 5	4		Yes	S		Yes				
	CSP-81P	39.95	100	94	4	30-4	S	8					F	3 3/8	Yes			
	CSP-101P	59.95	150	94	4	25-2.5	S	10					F	4 1/4	Yes			
	CSP-121P	74.95	200	94	4	20-3	S	12					F	5	Yes			
	CSP-150S	119.95	250	96	4	20-2	S	15					F					
	CSP-180S	299.95	500	96	4	27-2	S	18					F					
CSP-350D	49.95	60	93	4	2.7k-20k	T							3/4		Removable diaphragm.			
MSP-5220	119.95	40	92	4	50-20		5 1/4	2		Yes	S	1 5/8	Yes					
MSP-5221	124.95	40	92	4	50-20		5 1/4	2		Yes	S		Yes					
CSP-500M	59.95	60	92	4	100-10	M						F	2	Yes	Pin-cushion basket.			



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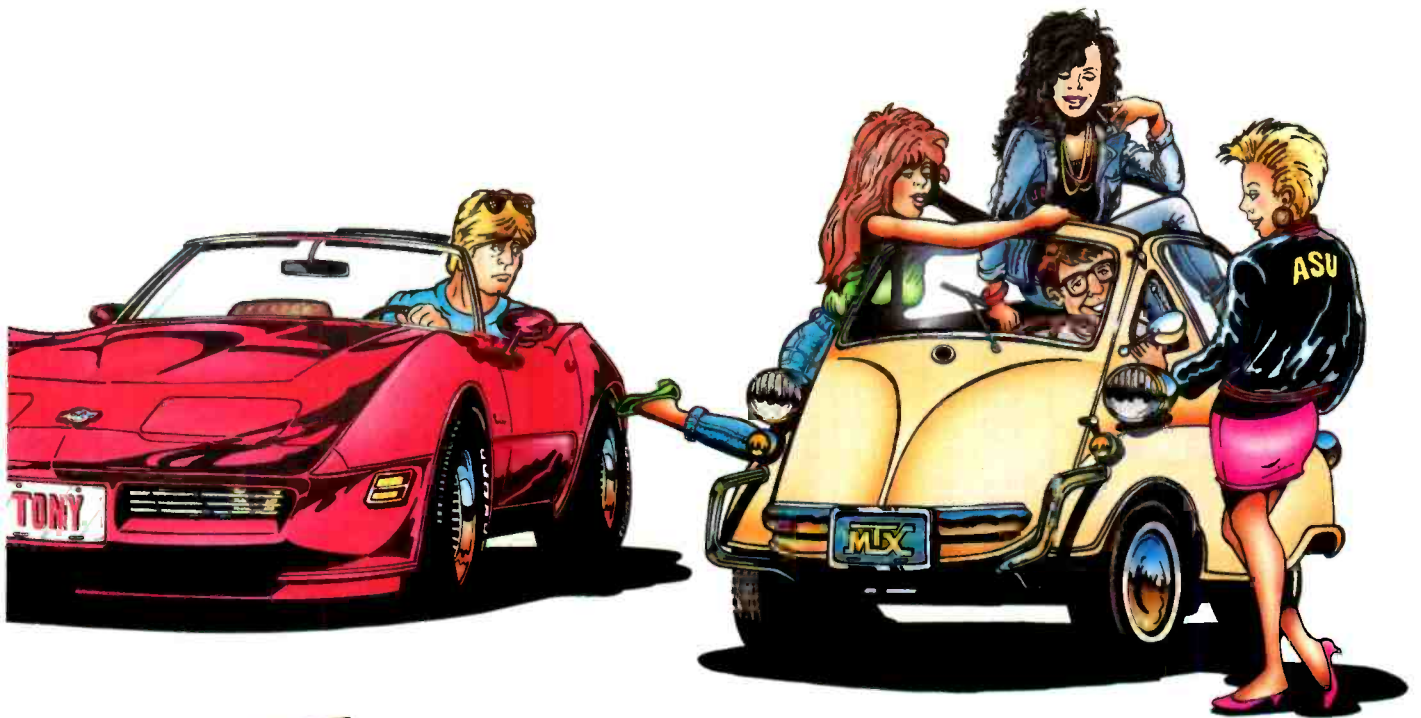


A Harman International Company

SPEAKERS

MANUFACTURER	Model	Price \$ (if sold individually)	Price \$ (if sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS										Notes
								Speaker Qty (S) Woofer Qty (W) Midrange Qty (M) Tweeter Qty (T)	Woofer Size, Inches	Whizzer (W) 2-Way (2) 3-Way (3), 4-Way (4)	Angle Tweeter(s) = A, Pointable Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
MTX (Continued)	MTW 88	79.95	200	87	8	33-2	S	8					F	3/4	No	As above.		
	MTW 108	89.95	250	89.5	8	23-1.8	S	10				F	4 5/8	No	As above.			
	MTW 128	99.95	300	90	8	24-2	S	12				F	5 1/8	No	As above.			
	MTW 158	119.95	300	87	8	26-3	S	15				F	6 1/4	No	As above.			
NAKAMICHI	SP-1010	195.00	325.00	200	90	4	25-4	S	9 7/8				F	4 1/8	Yes	†Optional angle mount, Model MK-1. ††Detachable tweeter.		
	SP-65C			80	86	4	45-22		6 1/2		†	††	F	2 5/8	Yes			
	SP-35	75.00	20	87	4	90-20		3 1/2	W		No	F	1 3/8	Yes	Selectable woofer roll-off frequency. External crossover required.			
	SP-300	425.00	80	86	4	50-22		5 1/8		A/P	No	F	1 3/8	Yes				
	SP-200	275.00	80	86	4	50-20		5 1/8	2		No	P	1 3/8	Yes				
	SP-80	250.00	160	92	4	30-1	S	7 7/8				P	3 7/8	Yes				
	SP-50	149.00	80	87	4	50-6	W	5 1/4				F	1 1/2	Yes				
	SP-40	129.00	40	88	4	75-20		4	W			F	1 7/8	Yes				
	SP-10	195.00	40	86	4	2.5k-22k	T					C		Yes		As above.		
	NIGHT STALKER	NS-MT1	29.00	40	89	8	4k-20k	T					F	3/8		Yes	Dual voice-coils. As above. As above. As above. As above. 4 x 6-inch plate.	
NS-DT1		50.00	50	92	8	3k-20k						F	1 1/8	No				
NS-HT1		60.00	40	96	8	4k-18k	T					F	2 1/4	No				
NS-PDT5		35.00	40	92	8	3k-22k	T					F	1	No				
NS-PDT10		40.00	40	93	8	3k-22k	T					F	1 1/8	No				
NS-XL165		25.00	75	94	4	500-6	M					F	2 1/2	Yes				
NS-DM39		40.00	60	93	8	500-10	M					F	1 1/2	Yes				
NS-DM75		50.00	60	94	8	500-10	M					F	1 1/2	Yes				
NS-PHT26		25.00	70	93	4	2k-40k	S					F	3 1/4	Yes				
NS-1560PSW		200.00	300	98	4	25-1	T	15				F	7 1/4	No				
NS-1260PSW		170.00	300	98	4	28-2	S	12				F	6 1/2	No				
NS-1240PSW		150.00	160	94	4	30-2	S	12				F	5 7/8	No				
NS-830PSW		99.00	120	92	4	32-2	S	8				F	4 3/8	No				
NS-46P		120.00	40	90	4	150-20		3 1/2	2		No	P	2 1/8	Yes				
NS-4PCX		150.00	60	91	4	68-20		4	2	No	No	F	2 1/2	Yes				
NS-5PCX		160.00	60	91	4	25-20		5 1/4	2	No	No	F	2 7/8	Yes				
NS-206PCX		220.00	100	92	4	40-18		6 1/2	2	No	No	F	3 1/4	Yes				
NS-308PCX		225.00	120	92	4	30-18		8	2	No	No	F	4	Yes				
NS-4010P		105.00	150	94	4/8	20-2	S	10				F	5 1/4	No				
NS-308P		90.00	100	92	4/8	30-2	S	8				F	4	No				
NS-206P		70.00	100	94	4/8	40-4	W	6 1/2				F	3 1/4	No				
NS-1052P		45.00	60	92	4/8	70-5	W	5 1/4				F	2 1/2	No				
NS-4.5PM		40.00	60	92	4/8	90-6	M					F	2 1/4	No				
NS-7015P		220.00	250	94	4/8	20-1	S	15				F	7 1/4	No				
NS-6015P		175.00	200	94	4/8	20-1	S	15				F	7 1/4	No				
NS-6012P		150.00	200	94	4/8	22-1	S	12				F	6	No				
NS-7010P		160.00	180	94	4/8	30-2	S	10				F	5 1/2	No				
NS-4012P		140.00	150	93	4/8	22-1	S	12				F	6	No				
NSC-10		395.00	†	100	8	28-3	S	10				F	4 1/2	No	†1600 watts.			
NSC-12		420.00	†	101	8	22-3	S	12				F	6 1/4	No				
NSC-15	450.00	†	98	8	20-3	S	15				F	7 1/8	No					
NSC-18	625.00	†	101	8	20-3	S	18				F	8	No					
ORA ELECTRONICS	Auto Spec	69.95	100	97	4	38-10	W	8				C	2 5/8	No	Biamp capable.			
	ASPO-8W0	49.95	100	97	4	38-10	W	6 x 9	3		No	F	3	No	As above.			
	ASPO-69W0	59.95	100	94	4	35-20		6 x 9	3		No	F	2 3/4	No	As above.			
	ASPO-69D3	47.95	70	94	4	38-22		6 x 9	3		No	F	1 3/4	No	As above.			
	ASPO-69S3	39.95	60	94	4	65-18		6 1/2	3		No	F	1 3/8	No	As above.			
	ASPO-55S3	27.95	50	92	4	60-20		5	3		No	F	1 3/4	No	As above.			
	ASPO-42W	23.95	40	91	4	50-20		4	2		No	F	1 1/2	No	As above.			
	ASPO-0T	21.95	80	96	4	4k-22k	T					C		No	As above.			
ORCA	One	690.00	100	93	4	70-19 ± 2		5 1/4	2	†		P	2 5/8	Yes	†Optional angled base.			
	Two	880.00	100	95	4	55-19 ± 1.5	S	7	2	†		P	2 3/4	Yes				
	Depth	520.00	200	93	4	45-200 Hz ± 3	S	(2)7				P	2 3/4	Yes				
	Great Depth	590.00	200	95	4	35-200 Hz ± 3	S	(2)8				P	3	Yes				
ORION	TR4	30.00	150	110	4/8	5k-20k	T					F	1	No	Square driver. As above.			
	TS4	30.00	150	110	4/8	5k-20k	T					F	1	No				
	ST1	20.00	100	110	4	5k-15k	T					F	1	No				
	GS-124	299.00	500	94	4/8	20-750 Hz	S	12				F	No	No				
	GS-154	349.00	500	96	4/8	28-500 Hz	S	15				F	No	No				
	GS-184	449.00	500	96	4/8	20-500 Hz	S	18				F	No	No				
	SGX-154	160.00	400	96	4/8	21-500 Hz	S	15				F	No	No				
	HC-10	129.00	400	90.8	2	25-1.5	S	10				F	No	No				
	HC-12	159.00	400	91.1	2	20-750 Hz	S	12				F	No	No				
	HC-15	172.00	400	90.7	2	28-500 Hz	S	15				F	No	No				
	SGX-54	49.00	80	91	4/8	200-8	M					F	No	No				
	SGX-64	75.00	200	91	4	50-5	M					F	No	No				
	SGX-84	89.00	200	91	4/8	40-2.5	W	8				F	No	No				
	SGX-104	119.00	250	90.5	4/8	25-1	W	10				F	No	No				
	SGX-124	140.00	400	92.5	4/8	28-500 Hz	S	12				F	No	No				
	OUTRAGEOUS AUDIO	OA-8	179.00	200	95	4	30-27		8	2	A	No	S	Yes		Carpeted enclosure.		
OA-10		219.00	300	96	4	30-33		10	2	A	No	S	Yes	As above.				
OA-M12		329.00	350	96	4	25-29		12	2	A	No	S	Yes	As above.				
OA-10X2		329.00	250	95	4	30-33		10	2	A	No	S	Yes	As above.				
OA-12		329.00	500	98	4	25-29		12	3	A	No	S	Yes	As above.				
OA-12J		329.00	500	98	4	25-29		12	3	A	No	S	Yes	As above.				
OA-15		369.00	600	101	4	23-29		15	3	A	No	S	Yes	As above.				
OA-M15		339.00	500	100	4	23-28		15	2	A	No	S	Yes	As above.				
OA-12X2		249.00	300	98	4	25-30		12	2	A	No	S	Yes	As above.				
OA-8X2		179.00	200	96	4	30-27		8	2	A	No	S	Yes	As above.				
OA-415		649.00	1k	103	4	23-33		15	4	A	No	S	Yes	As above.				

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Things used to be pretty dull for Eugene. That is, until he visited his local MTX dealer. An hour later, Eugene roared away with MTX Thunder in his car. Serious speakers designed for serious sound-pressure-levels. Concussive bass. Crystal clear highs. Clean mid-ranges. And the very best warranty in the auto sound business. Well, it's "Gene" now and things are different. You might say his social life has more "life" now. Sorry Tony. All's fair in Rock and Roll.



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SPEAKERS

MANUFACTURER	Model	Price \$ (If Sold Individually)	Price \$ (If Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to KHz, ±dB	DRIVERS										Notes
								Supower Only (S), Woofer Only (W), Midrange Only (M), Tweeter Only (T)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Angle of Tweeter(s) = A, Polarity (wee) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Conceivable (C), Plate (P)	Maximum Required Mounting Depth, Inches	Weatherproofed?			
OWI	202	159.00	80	92	8	90-20								S		Yes	For vans and trucks. As above. For vans, trucks, and RVs. As above.	
	203	179.00	100	92	8	90-20							S		Yes			
	2300	399.00	60	85	4	50-20							F	1 3/4	Yes			
	2301	299.00	60	90	6	65-20							F	1 3/4	Yes			
PANASONIC	EAB-S33	31.00	40	90	4	100-20		3 1/2	W					F		1 3/8		
	EAB-051	37.00	40	93	4	50-15		5						F		1 3/4		
	EAB-D450	81.50	100	92.5	4	40-22 ±3		4	2	A	No		F		2	Yes		
	EAB-D650	96.50	120	93	4	30-22 ±3		6 1/2		A	No		F		2	Yes		
	EAB-D970	140.00	150	94	4	28-25 ±3		6 x 9	3	A	No		F		4 1/8	Yes		
	EAB-911	35.50	20	93	4	50-15 ±3		5	W		No		F		1 3/4	Yes		
	EAB-T501	47.00	40	89	4	50-16 ±3		5	W		No		F		3 1/8	Yes		
	EAB-T651	76.50	50	92	4	40-22 ±3		6 1/2	2	A	No		F		1 1/2	Yes		
	EAB-466	55.50	50	90	4	60-22 ±3		4 x 6	2		No		F		1 3/8	Yes		
	EAB-4152	93.00	60	92	4	45-22 ±3		4 x 10	2	A	No		F		3 1/8	Yes		
	EAB-S851	58.00	50	92	4	40-22 ±3		6 1/2	2	A	No		F		1 7/8	Yes		
	EAB-0652	76.50	80	92	4	40-22 ±3		6 1/2	2	A	No		F		1 7/8	Yes		
	EAB-S691	76.50	80	92	4	40-22 ±3		6 x 9	2	A	No		F		3 1/4	Yes		
	EAB-6951	90.50	80	94.5	4	30-22 ±3		6 x 9	2	A	No		F		4	Yes		
	EAB-6971	193.00	100	94.5	4	30-25 ±3		6 x 9	3	A	No		F		4	Yes		
	EAB-030	28.50	20	90	4	100-20 ±3		3 1/2	W		No		F		1 3/8	Yes		
	EAB-S412	35.50	40	91	4	50-20 ±3		4	W		No		F		1 3/4	Yes		
EAB-S452	47.00	40	92	4	50-22 ±3		4	2	A	No		F		1 3/4	Yes			
EAB-0552	59.00	60	91	4	40-22 ±3		5 1/4	2	A	No		F		2 1/8	Yes			
EAB-S611	47.00	50	92	4	40-20 ±3		6 1/2	2		No		F		1 3/8	Yes			
PHASE LINEAR	PLC 2525	270.00	120	88	4	40-21 ±3		5 1/4			Yes	F, S		2 1/8	Optional grille kit, Model PL 46AC, \$35.00.			
	PL 1352	50.00	70	88	4	110-22		3 1/2	W	No		F		1 1/2				
	PL 1400	65.00	75	88	4	65-22		4	W	No		F		1 3/4				
	PL 2450	85.00	100	89	4	60-27		4 1/2	2		No		F			1 3/4		
	PL 2460	100.00	90	91	4	65-22		4	2		No		P			1 3/4		
	PL 2650	130.00	160	90	4	55-27		6 1/2	2		No		F			1 7/8		
	PL 3690	200.00	250	92	4	36-27		6 x 9	3		No		F			4 1/8		
	PL S800	100.00	100	91	4	30-5	S	8			No		F			4 1/4		
	PL S1000	150.00	150	92	4	25-3.5	S	10			No		F			4 1/4		
	PL 2690	150.00	70	92	4	38-24		6 x 9	2		No		F			4		
PHILIPS	PRO 8869MKII	229.95	200	90	4	20-20 ±3		6 x 9	3		No		F		Fits 4 x 6-inch cutout. †Flush-mount woofer, surface-mount tweeter.			
	PRO 8810MKII	139.95	200	90	4	20-20 ±3		6 x 9	2		Yes							
	PRO 8890MKII	99.95	80	91	4	40-20 ±3		4 x 6	2		No							
	EN 8846	89.95	60	90		100-20		3 1/2	2		Yes							
	EN 8346	49.95	100	91		2.7k-20k	T											
	EN 8340	49.95	100	91	4	2.7k-20k	T											
	EN 8335	49.95	160	91	4	2.7k-20k	T											
	PRO 200MKII	69.95	80	91	4	3k-20k	T											
	PRO 635MKII	129.95	110	90	4	25-20		6 1/2	3	A	No		S					
	PRO 620MKII	119.95	110	93	4	30-20		6 1/2	3		Yes		†					
	PRO 602MKII	149.95	80	95	4	35-20		6 1/2	2		Yes		†					
	PRO 535MKII	119.95	80	92	4	35-20		5 1/4	3	A	No		F					
	PRO 520MKII	109.95	80	92	4	35-20		5 1/4	2		No							
	PRO 502MKII	129.95	80	93	4	35-20		5 1/4	2	A	Yes		†					
	PRO 420MKII	89.95	80	91	4	40-20		4	2		Yes		S					
	PRO 402MKII	109.95	80	91	4	45-20		4	2		Yes		†					
	SFL 611	59.95	30	91	4	35-20		6 1/2	W	2								
SFL 621	79.95	30	92	4	35-20		6 1/2			No								
SFL 521	69.95	25	91	4	35-20		5 1/4											
SFL 511	49.95	25	90	4	35-20		5 1/4											
PRO 8000	149.95	100	94	4	43-3	W	8											
PRO 1000	79.95	150	91	4	48-2.5	W	10											
PRO 1200	89.95	150	91	4	48-2.5	W	12											
PIONEER	TS-1627	87.00	100	92	4	30-20		6 1/2	2		No		F		1 3/8	For trucks. For marine applications. As above. Honeycomb woofer. As above.		
	TS-U130	180.00	60	88	4	37-30		5 1/4	2		No		S		Yes			
	TS-U160	150.00	100	89	4	30-30		6 1/2	2		No		S		Yes			
	TS-TRX70	400.00	200	90	4	45-24		8	2	A	No		S		Yes			
	TS-MR165	200.00	120	90	4	35-21		6 1/2	2		No		F		4			
	TS-MR163	150.00	100	90	4	38-20		6 1/2	2	W	No		F		3 3/8			
	TS-1001	42.00	40	90	4	50-16		4	W		No		F		1 1/2			
	TS-1065	55.00	40	90	4	50-21		4	W		No		F		1 1/2			
	TS-1002	63.00	40	91	4	50-20		4	2		No		F		1 1/8			
	TS-1085	85.00	40	91	4	50-22		4	2		No		F		1 3/4			
	TS-1606	98.00	150	91	4	30-20		6 1/2	2		No		F		2 1/8			
	TS-1607	130.00	120	91	4	30-20		6 1/2	3		No		F		2 1/2			
	TS-1609	165.00	180	91	4	30-20		6 1/2	3		No		F		2 1/8			
	TS-F202	90.00	60	89	4	48-20		5 x 5	2		No		F		1 1/2			
	TS-1225	78.00	50	91	4	60-20 ±3		5	2		No		F		1 3/4			
	TS-139	85.00	100	90	4	45-20		5 1/4	2		No		F		2 1/8			
	TS-1601	48.00	60	92	4	40-20		6 1/2	W		No		F		1 3/8			
	TS-1602	68.00	60	92	4	40-20		6 1/2	2		No		F		1 3/8			
	TS-1604	87.00	100	91	4	30-20		6 1/2	2		No		F		1 3/8			
	TS-F606	130.00	120	91	4	38-23		6 1/2 x	2		No		F		1 1/2			
	TS-6922	65.00	80	93	4	40-20		6 x 9	W		No		F		2 5/8			
	TS-6933	95.00	100	93	4	35-23		6 x 9	2		No		F		2 1/2			
	TS-6944	135.00	120	93	4	35-26		6 x 9	3		No		F		2 3/4			
	TS-6966	155.00	150	93	4	28-26		6 x 9	3		No		F		3 1/4			
	TS-U697	185.00	100	91	4	28-30		6 x 9	2		No		F		3 1/2			
	TS-6977	210.00	200	93	4	28-30		6 x 9	4		No		F		3 3/8			
	TS-U699	230.00	100	91	4	28-32		6 x 9	3		No		F		3 1/2			
TS-6965	250.00	200	94	4	29-28		6 x 9	3		No		F		3 3/8				
TS-6995	285.00	200	94	4	28-32		6 x 9	4		No		F		3 3/8				

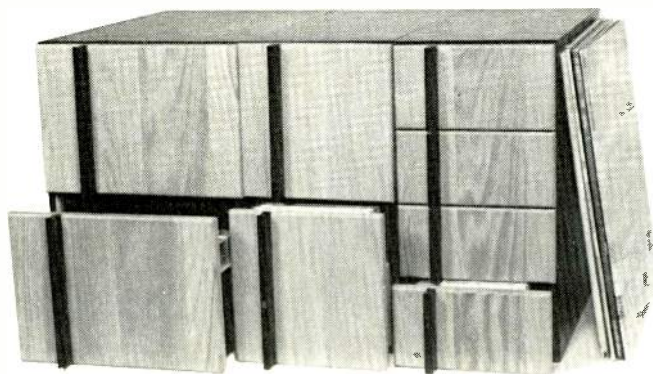
SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to KHz, ± dB	DRIVERS										Notes
								Speaker Qty. (S) Midrange Only (M), Tweeter Only (T)	Woofer Qty. (W) Woofer Only (WO), Tweeter Only (TO)	Woofer Size, Inches	Woofer (W), 2-Way (2), 3-Way (3), 4-Way (4)	Angled Tweeter(s) = A, Foldable Tweeter(s) = P	Separately Mounted Drivers?	Flush Mount (F), Surface Mount (S), Convertible (C), Pole (P)	Maximum Required Mounting Depth, Inches	Weatherproof?		
SONY	XS-33	39.95	35	88	4	70-20		3 1/2	W				F	1 1/2	No	Includes 4 x 6-inch adaptor. For European cars.		
	XS-44	99.95	35	88	4	55-20		4	2				F	1 3/4	Yes			
	XS-4622	99.95	45	89	4	50-20		4 x 6	2				F	1 3/4	No			
	XS-1011	49.95	40	89	4	50-20		4	W				F	1 1/4	Yes			
	XS-3011	54.95	45	90	4	35-20		5 1/4	W				F	1 1/4	Yes			
	XS-6011	59.95	60	91	4	35-20		6 1/2	W				F	2 1/8	Yes			
	XS-6911	69.95	60	92	4	30-20		6 x 9	W				F	2 3/4	Yes			
	XS-1021	79.95	60	89	4	50-20		4	2				F	1 1/4	Yes			
	XS-3021	89.95	75	90	4	35-20		5 1/4	2				F	1 1/4	Yes			
	XS-6021	99.95	100	90	4	35-20		6 1/2	2				F	2 1/8	Yes			
	XS-6921	99.95	100	92	4	30-20		6 x 9	2				F	2 3/8	Yes			
	XS-6931	139.95	100	93	4	30-20		6 x 9	3				F	2 3/4	Yes			
	XS-417	139.95	75	91	4	30-20		4 x 10	3				F	3 1/2	Yes			
	XS-6930	114.95	160	92	4	30-26		6 x 9	3				F	2 3/8	Yes			
	XS-8031	199.95	180	93	4	20-26		8	3				F	3 1/4	Yes			
	XS-6051	169.95	100	88	4	35-22		6 1/2	2				F	2 3/4	Yes			
	XS-6951	209.95	120	90	4	28-22		6 x 9	3				F	2 1/8	Yes			
	XS-616	89.95	60	90	4	40-20		6 1/2	W				F	2 1/8	Yes			
	XS-PL55	249.95	100	88	4	40-22		5 1/4	2	A/P	No	P	C	2	Yes			
	XS-HL55	299.95	100	88	4	40-22		5 1/4	2	A/P	A/P	C	C	2 1/2	Yes			
XS-H5	129.95	100	88	4	6k-22k	T						C	1/2	Yes				
XS-L5	139.95	100	88	4	40-10		5 1/4					F	2 1/2	Yes				
XS-L202	169.95	150	87	4	20-44		8					F	3 3/8	Yes				
XS-L6	149.95	130	87	4	30-7		6 1/2					F	2 3/4	Yes				
SOUNDSTREAM	SS1.0	130.00	80	90	4	2.8k-20k ±3	T				A/P		C	1 1/4	Yes	Includes angled mounting kit.		
	SS5.0	140.00	80	90	4	55-2.8 ±3	W	5 1/4					C	2 1/8	Yes			
	SS510	319.00	80	90	4	55-20 ±3		5 1/4					C	2 1/8	Yes			
	SS10	220.00	250	93	4	32-1.5 ±3	S	10			A/P	Yes	C	3 3/8	No			
	SS12	280.00	300	93	4	26-1 ±3	S	12					C	4 3/4	No			
	SS15	550.00	1k	98	8	30-1 ±3	S	15					C	7	No			
SPARKOMATIC	ASK3000	89.99	20 Inc.	92	22	80-20 ±3		4	2			No	S		Yes	Biamped.		
	SK6950	79.99	400	92	4	50-20 ±3		6 x 9	4			No	F	4	Yes			
	SK6922	49.99	250	95.6	4	30-17 ±3		6 x 9	3			No	F	3 1/2	Yes			
	SK6920	44.99	150	95.3	4	30-15 ±3		6 x 9	2			No	F	3 3/8	Yes			

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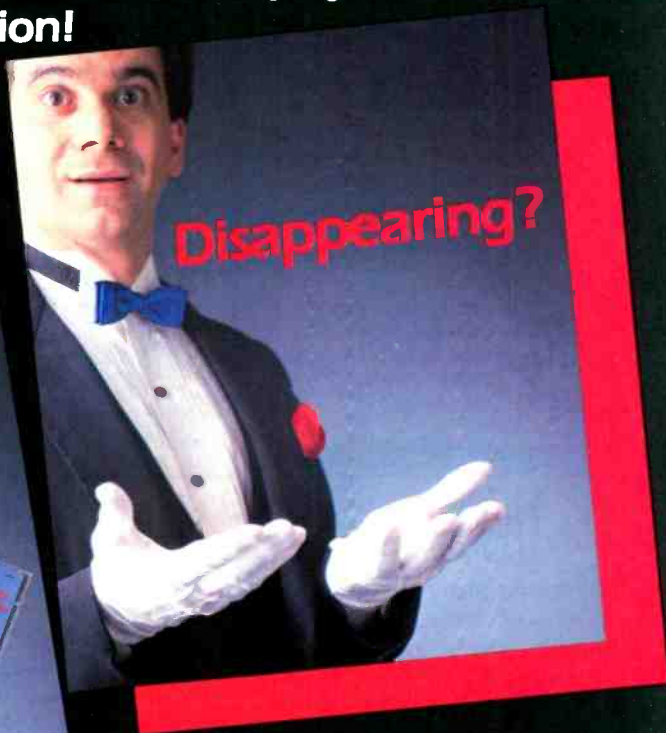
SPEAKERS

MANUFACTURER	Model	Price, \$ (If Sold Individually)	Price, \$ (If Sold in Pairs)	Recommended Maximum Power, Watts	Sensitivity, dB SPL (1 Watt/1 Meter)	Impedance, Ohms	Frequency Response, Hz to kHz, ±dB	DRIVERS						Notes				
								Subwoofer Only (S) Midrange Only (M) Woofer Only (W)	Woofer Size, Inches	Woofer (W) Tweeter (T) 3-Way (3) 4-Way (4)	Angled Tweeters (A) Pointable Tweeters (P)	Separately Mounted Drivers? (S) = Yes, (M) = No	Flush Mount (F) Surface Mount (S) Convertible (C), Plate (P)		Maximum Required Mounting Depth, Inches	Weatherproofed?		
Z-BOX	911-F2		520.00	140	89	4	100-22			2	A	Yes					Biamp capable; for Porsche 911 kick panels.	
	911C-SW		1050.00	125	89	4	20-200 Hz	S	8								Enclosed subwoofer for Porsche 911 rear side panels.	
	911-R3(A)	1590.		390	89	4	20-22		8	3	A	Yes					Triamp capable; satellite and subwoofer system for 1980 to 1983 Porsche 911; Model 911-R3(B), for 1984 to 1989 Porsche 911, \$1690.00 each.	
	911-UDF2		980.00	140	89	4	100-22			2	A	Yes					Biamp capable; replaces door moldings on Porsche 911.	
	911CB-R2		600.00	140	89	4	80-22			2	A	Yes					Biamp capable; for rear side panels of Porsche 911.	
	911-SW-2	1500.		400	89	4	20-200 Hz	S	10								Enclosed subwoofer for under seat of Porsche 911.	
	928-F2		580.00	140	89	4	100-22			2	A	Yes	P				Biamp capable; for upper doors of Porsche 928.	
	928-R2		580.00	140	89	4	100-22			2	A	Yes					Biamp capable; for rear corners of Porsche 928.	
	928-SW	1000.		125	89	4	20-200 Hz	S	8								Enclosed subwoofer; replaces tool panel of Porsche 928.	
	944-F2		560.00	140	89	4	100-22			2	A	Yes	P				Biamp capable; for doors of Porsche 944.	
	944SWL	760.00		125	89	4	20-200 Hz	S	8								Enclosed subwoofer for left cargo well of Porsche 944; for right cargo well, Model 944SWR, \$760.00 each.	
	SL-UDF2		980.00	140	89	4	100-22			2	A	Yes						Biamp capable; for upper doors of Mercedes SL.
	SL-SR2		850.00	140	89	4	80-22			2	A	Yes						Biamp capable; for rear side panels of Mercedes SL.
	SL-SW	800.00		125	89	4	20-200 Hz	S	8									Enclosed subwoofer for rear floor of Mercedes SL.
	300E-R3	1700.		390	89	4	20-22		†	3	A	Yes						One 8-inch or two 6-inch woofers. Triamp capable; satellite and subwoofer system for rear deck of Mercedes 300E.
	190E-R3	1700.		390	89	4	20-22		†	3	A	Yes						All as above but for rear deck of Mercedes 190E.
	635-F2		980.00	140	89	4	100-22			2	A	Yes						Biamp capable; replaces door moldings of BMW 635.
	635-R3	1490.		390	89	4	20-22		8	3	A	Yes						Triamp capable; satellite and subwoofer system for rear deck of BMW 635.
	325-MP2		580.00	140	89	4	100-22			2	A	Yes						Biamp capable; replaces map pockets of BMW 325.
	308-AR2		1190.00		89	4	20-22			2	A	Yes						Biamp capable; replaces door armrests of Ferrari 308.
	308-F2		780.00		89	4	200-22			2	A	Yes						Biamp capable; for lower doors of Ferrari 308.
	308-SW	750.00		125	89	4	20-200 Hz	S	8									Enclosed subwoofer; mounts under footwell plate of Ferrari 308.
	328-F2		780.00	140	89	4	100-22			2	A	Yes						Biamp capable; for upper doors of Ferrari 328.
	328-SW	1050.		125	89	4	20-200 Hz	S	8									Subwoofer for Ferrari 328 console; mounts under dash.
	MON-F2		1120.00	140	89	4	100-22			2	A	Yes						Biamp capable; replaces door moldings of Ferrari Mondial.
	MON-SW	1200.		125	89	4	20-200 Hz	S	8									Subwoofer for Ferrari Mondial console; mounts under dash.
	RR-F2		580.00	140	89	4	100-22			2	A	Yes						Mounts on stock location in Range Rover door.
	RR-R2		580.00	140	89	4	100-22			2	A	Yes						Mounts on sides of Range Rover rear headliner.
	ELOO-F2		980.00	140	89	4	100-22			2	A	Yes						Biamp capable; replaces door moldings of Cadillac Eldorado.
	ELDO-R2		600.00	140	89	4	100-22			2	A	Yes						Biamp capable; replaces rear side panels of Cadillac Eldorado.
VET-F2B		580.00	140	89	4	100-22			2	A	Yes						Biamp capable; for Corvette doors.	
VET-R3B		1100.00	390	89	4	20-22		8	3	A	Yes						Triamp capable; satellite and subwoofer system for rear of Corvette.	
VET-R4	1650.		700	89	4	20-22		(2) 10, 12	4	A	Yes						Quad amp capable; for rear wall area of Corvette.	
TA-F2		740.00	140	89	4	100-22			2	A	Yes						Biamp capable; for doors of Camaro and Firebird.	
614-U		420.00	140	89	4	100-22			2	A	Yes	S					Biamp capable.	
628-U		450.00	140	89	4	100-22			2	A	Yes	P					As above.	
UCSW-12	350.00		200	89	4	20-100 Hz	S	12										
200Hz		460.00	140	89	4	100-22			2	A	Yes	P						
628-SW-1	450.00		125	89	4	20-200 Hz	S	8										
628-SW-2	590.00		250	89	4	20-200 Hz	S	8										Biamp capable; satellite.

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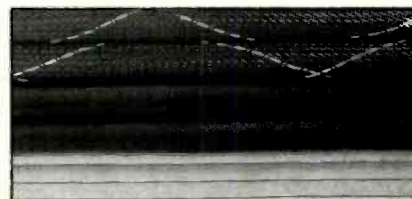
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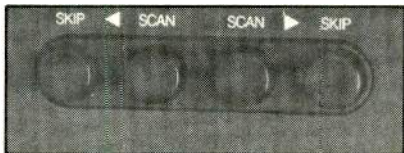
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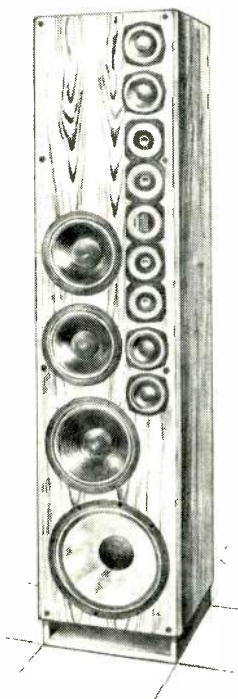


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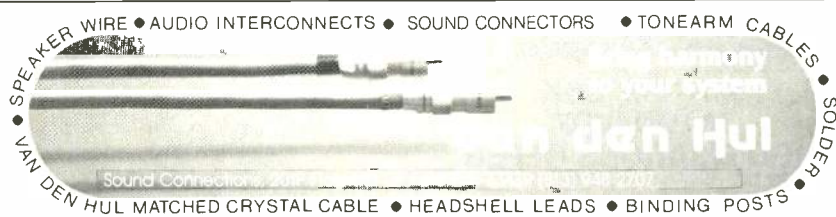
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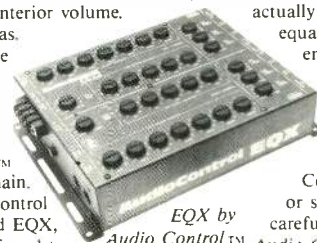
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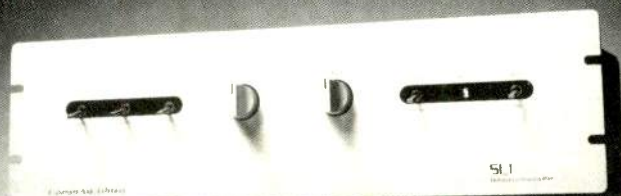
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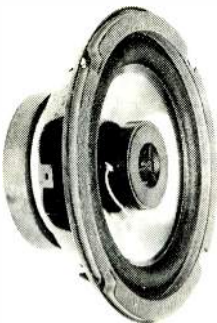
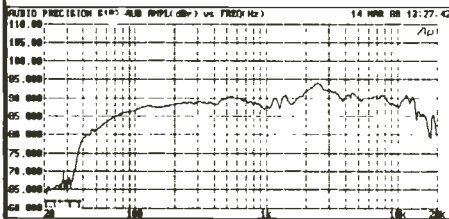
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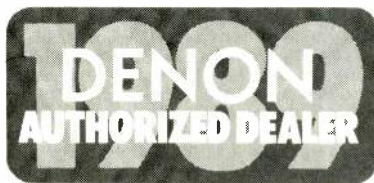
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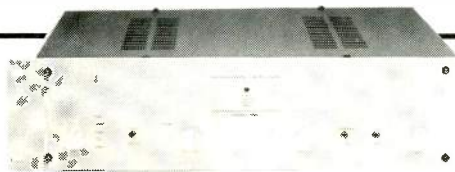
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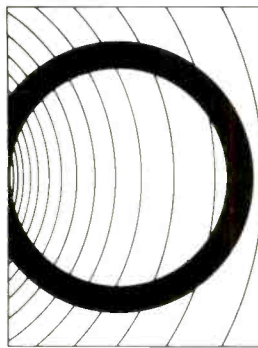


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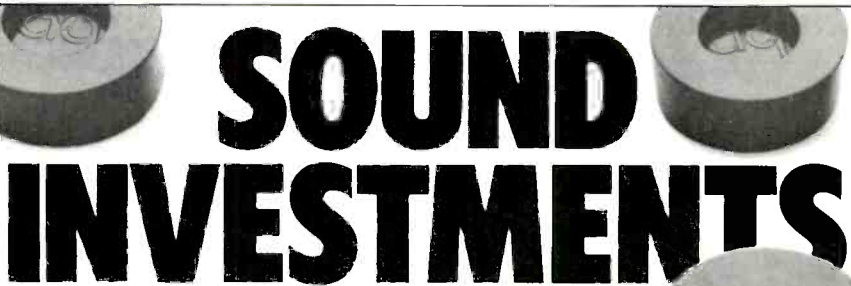
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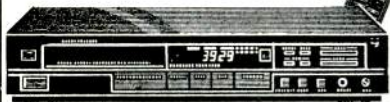
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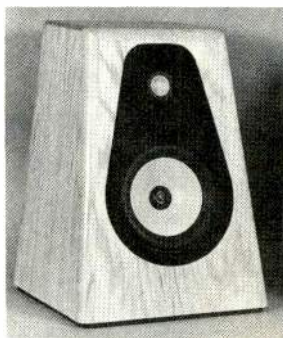
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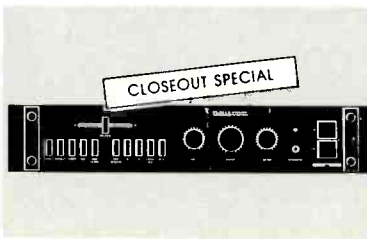
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